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THE NEW REALISM



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THE NEW REALISM

COOPERATIVE STUDIES IN PHILOSOPHY

BY

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PREFACE

On July 21, 1910, we published a brief article entitled 'The Program and First Platform of Six Realists,'[1] in which we indicated the direction philosophical inquiry ought to take. We there asserted that advance would be facilitated by coöperative investigations; and the drafting of the platform was a first attempt to confirm this belief. The present volume continues, on a larger scale, the work there inaugurated; and we hope it will be followed by other collections of studies.

The introductory essay voices our common opinions. The other essays do so only in part. It has seemed best to publish them without laboring for complete unanimity, inasmuch as their agreements quite overshadow their differences. They have been written after prolonged conferences. A few important debatable topics are briefly discussed by dissenting members in the Appendix.

December 31, 1911.

[1] *J. of Phil., Psychol., etc.*, 7, 393. This is reprinted in the Appendix.

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THE NEW REALISM

INTRODUCTION [1]

THE new realism may be said to be at the present moment something between a tendency and a school. So long as it was recognized only by its enemies it was no more than a tendency. But war has developed a class-consciousness, and the time is near at hand, if indeed it is not already here, when one realist may recognize another. This dawning spirit of fellowship, accompanied by a desire for a better understanding and a more effective co-operation, has prompted the present undertaking.

It is perhaps inevitable that the new realism should for a time remain polemical in tone. A new philosophical movement invariably arises as a protest against tradition, and bases its hope of constructive achievement on the correction of established habits of thought. Neo-realism is still in a phase in which this critical motive dominates, and is the chief source of its vigor and unanimity. Before, however, a philosophy can come of age, and play a major part in human thought, it must be a complete philosophy, or must at least show promise of completeness. If it is to assume the rôle, it must undertake to play the whole part. The authors of the present book thus entertain the hope that they may have succeeded not only in amplifying, clarifying, and fortifying the realistic critique, but also in exhibiting that critique as a basis for the solution of special philosophical problems, and for the procedure of the special sciences.

[1] The following introduction expresses opinions common to the several authors of this book; but it has proved convenient to make use of parts of the following articles which have already appeared in print. Montague. The New Realism and the Old. *J. of Phil., Psychol., etc.*, 1912, **9**, 39. Perry. Realism as a Polemic and Program of Reform. *J. of Phil., Psychol., etc.*, 1910, **7**, 337, 365.

I

THE HISTORICAL SIGNIFICANCE OF THE NEW REALISM

THE new realism is not an accident, nor a *tour de force*, nor an isolated and curious speculative eruption. Whatever may be thought of its correctness or power to endure, it must at least be accorded a place in the main current of modern thought. It is a fundamental and typical doctrine — definable in terms of the broad play of intellectual forces, and peculiarly characteristic of their present conjunction.

The historical significance of the new realism appears most clearly in its relations with 'naïve realism,' 'dualism' and 'subjectivism.' The new realism is primarily a doctrine concerning the relation between the knowing process and the thing known; and as such it is the latest phase of a movement of thought which has already passed through the three phases just indicated. Neo-realism, in other words, seeks to deal with the same problem that has given rise to 'naïve realism,' 'dualism' and 'subjectivism'; and to profit by the errors as well as the discoveries for which these doctrines have been responsible.

1. The theory of naïve realism is the most primitive of these theories. It conceives of objects as directly presented to consciousness and being precisely what they appear to be. Nothing intervenes between the knower and the world external to him. Objects are not represented in consciousness by ideas; they are themselves directly presented. This theory makes no distinction between seeming and being; things *are* just what they *seem*. Consciousness is thought of as analogous to a light which shines out through the sense organs, illuminating the world outside the knower. There is in this naïve view a complete disregard of the personal equation and of the elaborate mechanism underlying sense perception. In a world in which there was no such thing as error, this theory of the knowledge relation would remain unchallenged; but with the discovery of error and illusion comes per-

plexity. Dreams are perhaps the earliest phenomena of error to arouse the primitive mind from its dogmatic realism. How can a man lie asleep in his bed and at the same time travel to distant places and converse with those who are dead? How can the events of the dream be reconciled with the events of waking experience? The first method of dealing with this type of error is to divide the real world into two realms, equally objective and equally external, but the one visible, tangible, and regular, the other more or less invisible, mysterious, and capricious. The soul after death, and sometimes during sleep, can enter the second of these realms. The objectified dreamland of the child and the ghostland of the savage are the outcome of the first effort of natural realism to cope with the problem of error. It is easy to see, however, that this doubling up of the world of existing objects will only explain a very limited number of dream experiences, while to the errors of waking experience it is obviously inapplicable. Whenever, for example, the dream is concerned with the same events as those already experienced in waking life, there can be no question of appealing to a shadow world. Unreal events that are in conflict with the experience of one's fellows, and even with one's own more inclusive experience, must be banished completely from the external world. Where, then, shall they be located? What is more natural than to locate them inside the person who experiences them? For it is only upon him that the unreal object produces any effect. The objects of our dreams and our fancies, and of illusions generally, are held to exist only 'in the mind.' They are like feelings and desires in being directly experienced only by a single mind. Thus the soul, already held to be the mysterious principle of life, and endowed with peculiar properties, transcending ordinary physical things, is further enriched by being made the habitat of the multitudinous hosts of non-existent objects. Still further reflection on the phenomena of error leads to the discovery of the element of relativity in all knowledge, and finally to the realization that no external happening can be perceived until after it has ceased to exist. The events we perceive as present are always

past, for in order to perceive anything it must send energy of some kind to our sense organs, and by the time the energy reaches us the phase of existence which gave rise to it has passed away. To this universal and necessary temporal aberration of perceived objects is added an almost equally universal spatial aberration. For all objects that move relatively to the observer are perceived not where they are when perceived, but, at best, where they were when the stimulus issued from them. And in addition to these spatial and temporal aberrations of perception we know that what we perceive will depend not only upon the nature of the object but on the nature of the medium through which its energies have passed on their way to our organism; and also upon the condition of our sense organs and brain. Finally, we have every reason to believe that whenever the brain is stimulated in the same way in which it is normally stimulated by an object we shall experience that object even though it is in no sense existentially present. These many undeniable facts prove that error is no trivial and exceptional phenomenon, but the normal, necessary, and universal taint from which every perceptual experience must suffer.

2. It is such considerations as these that have led to the abandonment of naïve realism in favor of dualism, the second of the aforementioned theories. According to this second theory, which is exemplified in the philosophies of Descartes and Locke, the mind never perceives anything external to itself. It can perceive only its own ideas or states. But as it seems impossible to account for the order in which these ideas occur by appealing to the mind in which they occur, it is held to be permissible and even necessary to infer a world of external objects resembling to a greater or less extent the effects, or ideas, which they produce in us. What we perceive is now held to be only a picture of what really exists. Consciousness is no longer thought of as analogous to a light which directly illumines the extra-organic world, but rather as a painter's canvas or a photographic plate on which objects in themselves imperceptible are represented. The great advantage of the second or picture theory is that it fully accounts for error and illusion;

the disadvantage of it is that it appears to account for nothing else. The only external world is one that we can never experience, the only world that we can have any experience of is the internal world of ideas. When we attempt to justify the situation by appealing to inference as the guarantee of this unexperienceable externality, we are met by the difficulty that the world we infer can only be made of the matter of experience, that is, can only be made up of mental pictures in new combinations. An inferred object is always a perceptible object, one that could be in some sense experienced; and, as we have seen, the only things that according to this view can be experienced are our mental states. Moreover, the world in which all our interests are centered is the world of experienced objects. Even if, *per impossibile*, we could justify the belief in a world beyond that which we could experience, it would be but a barren achievement, for such a world would contain none of the things that we see and feel. Such a so-called real world would be more alien to us and more thoroughly queer than were the ghostland or dreamland which, as we remember, the primitive realist sought to use as a home for certain of the unrealities of life.

3. It seems very natural at such a juncture to try the experiment of leaving out this world of extra-mental objects, and contenting ourselves with a world in which there exist only minds and their states. This is the third theory, the theory of subjectivism. According to it, there can be no object without a subject, no existence without a consciousness of it. To be, is to be perceived. The world of objects capable of existing independently of a knower (the belief in which united the natural realist and the dualistic realist) is now rejected. This third theory agrees with the first theory in being epistemologically monistic, that is, in holding to the presentative rather than to the representative theory of perception; for, according to the first theory, whatever is perceived must exist, and according to the present theory, whatever exists must be perceived. Naïve realism subsumed the perceived as a species under the genus existent. Subjectivism subsumes the existent as a species under the genus perceived. But while the third theory

has these affiliations with the first theory, it agrees with the second theory in regarding all perceived objects as mental states — ideas inhering in the mind that knows them and as inseparable from that mind as any accident is from the substance that owns it.

Subjectivism has many forms, or rather, many degrees. It occurs in its first and most conservative form in the philosophy of Berkeley. Descartes and Locke, and other upholders of the dualistic epistemology, had already gone beyond the requirements of the picture theory in respect to the secondary qualities of objects. Not content with the doctrine that these qualities as they existed in objects could only be inferred, they had denied them even the inferential status which they accorded to primary qualities. The secondary qualities that we perceive are not even copies of what exists externally. They are the cloudy effects produced in the mind by combinations of primary qualities, and they resemble unreal objects in that they are *merely* subjective. The chief ground for this element of subjectivism in the systems of dualistic realism immediately preceding Berkeley, was the belief that relativity to the percipient implied subjectivity. As the secondary qualities showed this relativity, they were condemned as subjective. Now it was the easiest thing in the world for Berkeley to show that an equal or even greater relativity pertained to the primary qualities. The perceived form, size, and solidity of an object depend quite as much upon the relation of the percipient to the object as do its color and temperature. If it be axiomatic that whatever is relative to the perceiver exists only as an idea, why, then, the primary qualities which were all that remained of the physical world could be reduced to mere ideas. But just here Berkeley brought his reasoning to an abrupt stop. He refused to recognize that (1) the *relations between* ideas or the order in which they are given to us, and (2) the *other minds* that are known, are quite as relative to the knower as are the primary and secondary qualities of the physical world. You can know other minds only in so far as you have experience of them, and to infer their independent existence involves just as much and just as little of the process of

objectifying and hypostatizing your own ideas as to infer the independent existence of physical objects. Berkeley avoided this obvious result of his own logic by using the word 'notion' to describe the knowledge of those things that did not depend for their existence on the fact that they were known. If you had an *idea* of a thing — say of your neighbor's body — then that thing existed only as a mental state. But if you had a *notion* of a thing — say of your neighbor's mind — then that thing was quite capable of existing independently of your knowing it. Considering the vigorous eloquence with which Berkeley inveighed against the tendency of philosophers to substitute words for thoughts, it is pathetic that he should himself have furnished such a striking example of that very fallacy. In later times Clifford and Pearson have not hesitated to avail themselves of a quite similar linguistic device for escaping the solipsistic conclusion of a consistent subjectivism. The distinction between the physical *objects* which as 'constructs' exist only in the consciousness of the knower, and *other minds* which as 'ejects' can be known without being in any way dependent on the knower, is essentially the same both in its meaning and in its futility as the Berkeleian distinction of idea and notion. For the issue between realism and subjectivism does not arise from a psychocentric predicament — a difficulty of conceiving of objects apart from any consciousness — but rather from the much more radical 'ego-centric predicament,'[1] the difficulty of conceiving known things to exist independently of my knowing them. And the poignancy of the predicament is quite independent of the nature of the object itself, whether that be a physical thing such as my neighbor's body, or a psychical thing such as my neighbor's mind.

Some part of this difficulty Hume saw and endeavored to meet in his proof that the spiritual substances of Berkeley were themselves mere ideas; but Hume's position is itself subject to two criticisms: First, it succeeds no better than Berkeley's in avoiding a complete relativism or solipsism — for it is as difficult to ex-

[1] Cf. below, 11–12.

plain how one 'bundle of perceptions' can have any knowledge of the other equally real 'bundle of perceptions' as to explain how one 'spirit' can have knowledge of other 'spirits.' Second, the Humean doctrine suffers from an additional difficulty peculiar to itself, in that by destroying the conception of the mind as a 'substance,' it made meaningless the quite correlative conception of perceived objects as mental 'states.' If there is no substance there cannot be any states or accidents, and there ceases to be any sense in regarding the things that are known as dependent upon or inseparable from a knower.

4. Passing on to that form of subjectivism developed by Kant, we may note three points: (1) A step back toward dualism, in that he dallies with, even if he does not actually embrace, the dualistic notion of a *ding-an-sich*, a reality outside and beyond the realm of experienced objects which serves as their cause or ground. (2) A step in advance of the subjectivism of Berkeley and Hume, in that Kant reduces to the subjective status not merely the *facts* of nature but also her *laws*, so far, at least, as they are based upon the forms of space and time and upon the categories. (3) There appears in the Kantian system a wholly new feature which is destined to figure prominently in later systems. This is the dualistic conception of the knower, as himself a twofold being, transcendental and empirical. It is the transcendental or noumenal self that gives laws to nature, and that owns the experienced objects as its states. The empirical or phenomenal self, on the other hand, is simply one object among others, and enjoys no special primacy in its relation to the world of which it is a part.

The post-Kantian philosophies deal with the three points just mentioned in the following ways: (1) The retrograde feature of Kant's doctrine — the belief in the *ding-an-sich* — is abandoned. (2) The step in advance — the legislative power conferred by Kant upon the self as knower — is accepted and enlarged to the point of viewing consciousness as the source not only of the *a priori* forms of relation, but of all relations whatsoever. (3) The doctrine of the dual self is extended to the point of identifying in one absolute

self the plurality of transcendental selves held to by Kant, with the result that our various empirical selves and the objects of their experience are all regarded as the manifestations or fragments of a single, perfect, all-inclusive, and eternal self. But it is not hard to see that this new dualism of the finite and the absolute selves involves the same difficulties as those which we found in the Cartesian dualism of conscious state and physical object. For either the experience of the fragment embraces the experiences of the absolute or it does not. If the former, then the absolute becomes knowable, to be sure, but only at the cost of losing its absoluteness and being reduced to a mere 'state' of the alleged fragment. The existence of the absolute will then depend upon the fact that it is known by its own fragments, and each fragmentary self will have to assume that its own experience constitutes the entire universe — which is solipsism. If the other horn of the dilemma be chosen and the independent reality of the absolute be insisted upon, then it is at the cost of making the absolute unknowable, of reducing it to the status of the unexperienceable external world of the dualistic realist. The dilemma itself is the inevitable consequence of making knowledge an internal relation and hence constitutive of its objects. Indeed, a large part of the philosophical discussion of recent years has been concerned with the endeavor of the absolutists to defend their doctrine from the attacks of empiricists of the Berkeleian and Humean tradition in such a way as to avoid equally the Scylla of epistemological dualism and the Charybdis of solipsism. But, as we have seen, the more empirical subjectivists of the older and strictly British school are open to the same criticism as that which they urge upon the absolutists; for it is as difficult for the Berkeleian to justify his belief in the existence of other spirits, or the phenomenalistic follower of Hume his belief in bundles or streams of experience other than his own, as for the absolutist to justify those features of the absolute experience which lie beyond the experience of the finite fragments.

5. And now enter upon this troubled scene the new realists,

offering to absolutists and phenomenalists impartially their new theory of the relation of knower to known.

From the standpoint of this new theory all subjectivists suffer from a common complaint. The ontological differences that separate such writers as Fichte and Berkeley, Mr. Bradley and Professor Karl Pearson, are, for a realist, overshadowed by the epistemological error that unites them. The escape from subjectivism and the formulation of an alternative that shall be both remedial and positively fruitful, constitutes the central preëminent issue for any realistic protagonist. It is prior to all other philosophical issues, such as monism and pluralism, eternalism and temporalism, materialism and spiritualism, or even pragmatism and intellectualism. This does not mean that the new realism shall not lead to a solution of these problems, but only that as a basis for their clear discussion it is first of all essential to get rid of subjectivism.

The new realists' relational theory is in essentials very old. To understand its meaning it is necessary to go back beyond Kant, beyond Berkeley, beyond even Locke and Descartes — far back to that primordial common sense which believes in a world that exists independently of the knowing of it, but believes also that that same independent world can be directly presented in consciousness and not merely represented or copied by 'ideas.' In short, the new realism is, broadly speaking, a return to that naïve or natural realism which was the first of our three typical theories of the knowledge relation; and as such, it should be sharply distinguished from the dualistic or inferential realism of the Cartesians. But the cause of the abandonment of naïve realism in favor of the dualistic or picture theory was the apparently hopeless disagreement of the world as presented in immediate experience with the true or corrected system of objects in whose reality we believe. So the first and most urgent problem for the new realists is to amend the realism of common sense in such wise as to make it compatible with the facts of relativity.

For this reason especial attention has been given in the present

volume [1] to a discussion of those special phenomena, such as illusion and error, which are supposed to discredit natural realism, and set going a train of thought that cannot be stopped short of subjectivism. It is necessary to inquire closely into the mechanism of perception, and into the logic of contradiction and falsity. And it is necessary to obtain a definition of the central thesis of realism, the thesis of independence, that shall not be so loose as to violate the facts, nor so vague and formal as to disregard them.[2]

II

THE REALISTIC POLEMIC

INASMUCH as subjectivism, renewed and fortified under the name of 'idealism,' is the dominant philosophy of the day, it affords the chief resistance which an innovating philosophy such as realism has to overcome. The realistic polemic is therefore primarily a polemic against subjectivism; but the errors of which realism finds subjectivistic philosophies to be guilty, are not necessarily confined to such philosophies. They may be generalized; and in so far as they are generalized their discovery is of greater moment. The following are some of the traditional errors which neo-realism has thus far succeeded in generalizing.

1. *The fallacy of argument from the ego-centric predicament.* — The 'ego-centric predicament' consists in the impossibility of finding anything that is not known.[3] This is a predicament rather than a discovery, because it refers to a difficulty of procedure, rather than to a character of things. It is impossible to eliminate the knower without interrupting observation; hence the peculiar difficulty of discovering what characters, if any, things possess when not known. When this situation is formulated as a proposition concerning things, the result is either the redundant inference that all known things are known, or the false inference that all

[1] Cf. below, Nos. IV, V, VI. [2] Cf. below, No. II.

[3] In this connection, 'known' means 'given as an object of thought.'

things are known. The former is, on account of its redundancy, not a proposition at all; and its use results only in confusing it with the second proposition, which involves a *petitio principii*. The falsity of the inference, in the case of the latter proposition, lies in its being a use of the method of agreement unsupported by the method of difference. It is impossible to argue from the fact that everything one finds is known, to the conclusion that knowing is a universal condition of being, because it is impossible to find non-things which are not known. The use of the method of agreement without negative cases is a fallacy. It should be added that at best the method of agreement is a preliminary aid to exact thought, and can throw no light whatsoever on what can be meant by saying that knowing is a condition of being. Yet this method, misapplied, is the main proof, perhaps the only proof, that has been offered of the cardinal principle of idealistic philosophies — the definition of being in terms of consciousness. It is difficult, on account of their very lack of logical form, to obtain pure cases of philosophical fallacies. Then, too, this particular fallacy has so far become a commonplace as to be regarded as a self-evident truth. The step in which it is employed is omitted or obscured in many idealistic treatises. In others it is spread so thin, is so pervasive and insidious, that while it lends whatever support is offered for the cardinal idealistic principle, it is nowhere explicitly formulated. But the following will serve as a typical illustration. "Things exist," says Renouvier, "and all things have a common character, that of being represented, of appearing; for if there were no representation of things, how should I speak of them?" [1] It is clear that no more is proved by this argument than that things must be 'represented' if one is to 'speak of them.' That all things have the common character of being 'spoken of,' which is the fundamental thesis restated in a new form, is left without any proof whatsoever.

2. *The fallacy of pseudo-simplicity.* — There is a disposition in philosophy as well as in common sense to assume the simplicity

[1] Renouvier. Mind, 1877, 2, 378.

of that which is only familiar or stereotyped. This error has conspired with the error just examined to lend a certain plausibility to subjectivism. For one would scarcely assert with so much gravity that the world was his idea, or that the 'I think' must accompany every judgment, unless he supposed that the first personal pronoun referred to something that did not require further elucidation. Self-consciousness could never have figured in idealistic philosophies as the immediate and primary certainty if it were understood to be a complex and problematic conception. Yet such it must be admitted to be, once its practical simplicity, based on habits of thought and speech, is discounted. Similarly the common dogma, to the effect that consciousness can be known only introspectively, is based on the assumption that it *is* known introspectively, and that thus approached it is a simple datum. Traditional spiritistic conceptions of will, activity, immediacy, and life, rest on the same fundamental misapprehension as does the materialistic acceptance of body as an irreducible entity. Thus what is really at stake here is nothing less than the method of analysis itself. In exact procedure it is not permitted to assert the simplicity of any concept until *after* analysis. That the concepts enumerated above are not analytically simple, is proved by the fact that when they are treated as simple, it is necessary to give them a complex existence also in order to account for what is known about them. It is customary to say that this is a 'manifestation' or 'transformation' of the simple and more fundamental reality; but this is to reverse the order which is proper to thought as the deliberate and systematic attempt to know. It is equivalent to asserting that the more pains we take to know, the less real is the object of our knowledge; a proposition which is never asserted without being contradicted, since it expresses the final critical analysis of the thinker who asserts it. The following is a characteristic example of the error of 'pseudo-simplicity,' as applied to the conception of activity.

"Every man," says Professor Ward, "knows the difference between feeling and doing, between idle reverie and intense thought,

between impotent and aimless drifting and unswerving tenacity of purpose, being the slave of every passion or the master of himself. . . . It must surely ever remain futile, nay, even foolish, to attempt to explain either receptivity or activity; for what is there in experience more fundamental? And being thus fundamental, the prime staple of all experience, it is absurd to seek to prove them real, since in the first and foremost sense of reality the real and they are one." [1] Nevertheless, activity and passivity *are* capable of being analyzed in a variety of ways, logical, physical, and psychological; [2] and their nature can be regarded as a simple datum only in so far as such analysis is deliberately avoided. They are simples only in so far as they are *not yet analyzed.*

3. *The fallacy of exclusive particularity.* — It is ordinarily assumed that a particular term of any system belongs to such system *exclusively.* That this is a false assumption is proved empirically. The point *b* of the class of points that constitutes the straight line *abc* may belong also to the class of points that constitutes the intersecting straight line *xby.* The man John Doe who belongs to the class *Republican Party* may belong also to the intersecting class *captains of industry.* Unless this multiple classification of terms were possible, discourse would break down utterly. All the terms of discourse are general in the sense that they belong to several contexts. It is this fact that accounts for the origin and the usefulness of language. Without this generality of terms the world would possess no structure, not even motion or similarity; for there could be no motion if the same could not be in different places at different times, and there could be no similarity if the same could not appear in different qualitative groupings. It is little wonder, then, that the virtual rejection of this principle by philosophy has led to a fundamental and perpetual difficulty. To this error may perhaps be traced the untenability of Platonic universalism, recognized apparently by Plato himself, and the

[1] Ward, J. Naturalism and Agnosticism, 2, 52, 53.

[2] Cf. *e.g.* James, W. The Experience of Activity, in Essays in Radical Empiricism, VI.

untenability of modern particularism, attested by the desperate efforts which almost every modern philosopher has made to save himself from it.

The most familiar variety of particularism is found in naturalism. This may be traced to the naïve bias for the space-time order, or that historical series of bodily changes which constitutes the course of nature. Naturalism asserts that this is the only system, and that its terms, the several bodily events, belong to it exclusively. That this theory is untenable is evident at once, since in order that bodily events shall possess the structure and connections necessary to them, being must contain other terms, such as places, times, numbers, etc., that are not bodily events. But historically, naturalism has been discredited mainly by its failure to provide for the system of ideas, a system without which the bodily system itself could not be known; and it is the exclusive particularity of the terms of this latter that has figured most prominently in philosophical discussions.

In dualism of the Cartesian type the terms of nature and the terms of knowledge are regarded as exclusive, but in order that knowledge shall mean anything at all, it is assumed that there is some sort of representative relation between them. Spinoza and Leibniz endeavored to bring them together through a third and neutral term. Among the English philosophers the impossibility of showing how the mind can know nature if each mind is a closed circle, possessing its content wholly within itself, leads finally to the abolition of nature as an independent system. Thus the pendulum swings from naturalism to subjectivism; and in the whole course of this dialectic the mistaken principle of exclusive particularity is assumed.

4. *The fallacy of definition by initial predication.* — This form of error is a natural sequel to the last. A subject of discourse is viewed initially under one of its aspects, or is taken initially as a term in some specific complex or relational manifold. Then, owing to the error of exclusive particularity, it is assumed that this subject of discourse can have no other aspect, or belong to no other

relational manifold. Thus the initial characterization becomes definitive and final.

Subjectivism, again, affords the most notable instances of the error. Any subject of discourse may be construed *as such;* that is, as a thing talked about or 'taken account of,' as an object of experience or knowledge. The vogue of the psychological, introspective, or reflective method in modern thought has given rise to the custom of construing things first according to their place in the context of consciousness. Similarly, the habit of self-consciousness among philosophers has emphasized the relation of things to self; and the prominence of epistemology in modern philosophy has tended to an initial characterization of things according to their places in the process of knowledge, just as the prominence of religious issues led early Christian ascetics to name things first after their part in the drama of the soul's salvation.

Thus, idealism, quite unconscious of having prejudged the main question from the outset, "seeks to interpret the universe after the analogy of conscious life, and regards experience as for us the great reality." [1] Or, as another writer expressed it, "we must *start* . . . from the whole of experience as such." [2] But all such initial characterizations must be regarded as accidental. Allowance must be duly made for alternative and complementary characterizations; and the question of the priority of the characterization to which any subject of discourse submits must be discussed quite independently of the order which is determined by habit or bias. In short, the very general disposition at the present time to begin with a psychological or epistemological version of things must not be allowed in the least to prejudice the question as to whether that version is definitive or important.

5. *The speculative dogma.* — By the 'speculative dogma' is meant the assumption for philosophical purposes that there is an all-sufficient, all-general principle, a single fundamental propo-

[1] Lindsay, J. Studies in European Philosophy, 207.

[2] Baillie, J. B. Idealistic Construction of Experience, 105.

sition that adequately determines or explains everything. This assumption has commonly taken one or the other of two forms. By many it has been assumed that such a principle constitutes the proper content or subject matter of philosophy. Thus Plato said: "And when I speak of the other division of the intelligible you will understand me to speak of that other sort of knowledge which reason herself attains by the power of dialectic, using the hypotheses not as first principles, but only as hypotheses — that is to say, as steps and points of departure into a region which is above hypotheses, in order that she may soar beyond them to the first principle of the whole; and clinging to this and then to that which depends on this, by successive steps she descends again without the aid of any sensible object, beginning and ending in ideas." [1] And Caird makes the same assumption when he says that "Philosophy professes to seek and to find the principle of unity which underlies all the manifold particular truths of the separate sciences." [2] But such an assumption is dogmatic, because it ignores the prior question as to whether there is such a principle or not. So far as the general task of philosophy is concerned, this must be treated as an open question. Philosophy does aim, it is true, to generalize as widely and comprehend as adequately as possible; but a loosely aggregated world, abounding in unmitigated variety, is a philosophical hypothesis. The discovery of a highly coherent system under which all the wealth of experience could be subsumed would be the most magnificent of philosophical achievements; but if there is no such system, philosophy must be satisfied with something less — with whatever, in fact, there happens to be. By others, in the second place, it has been assumed that the idea of such a principle or system is the property of every thoughtful person, the existence of an object corresponding to it being alone doubtful. This assumption gave rise to the ontological proof of God, which carried conviction only so long as man did not question the definiteness and meaning of the idea; for the assumption

[1] Plato. (Jowett, trans.) Republic, 511, B.

[2] Caird, E. The Social Philosophy and Religion of Comte, xiii.

obscured a problem, the problem, namely, as to whether there is any idea corresponding to the words *ens realissimum*. The possibility of defining, on general logical grounds, a maximum of being or truth, is, to say the least, highly questionable; and it is certain that this problem must properly precede any inferences from such a maximal idea.

The speculative dogma has been the most prolific cause of the verbal abuses which abound in philosophy, and which are to be considered separately. It is through this dogma that various words have been invested with a certain hyperbole and equivocation, in consequence of the attempt to stretch their meaning to fit the speculative demand. A further evil arising from the speculative dogma is the unjust and confusing disparagement of positive knowledge through invidious comparison with this Unknown God to which the philosopher has erected his altar.

6. *The error of verbal suggestion.* — Words which do not possess a clear and unambiguous meaning, but which nevertheless have a rhetorical effect owing to their associations, lend themselves to a specious discourse, having no cognitive value in itself, and standing in the way of the attainment of genuine knowledge. This is Bacon's famous idol of the forum. In philosophy this reliance on the suggestive, rather than the proper denotative or connotative function of words, is due not only to man's general and ineradicable tendency to verbalism, but also to the wide vogue of doctrines that are fundamentally inarticulate. We have already examined two errors which lead philosophers to accept such doctrines. The error of pseudo-simplicity involves a reference to topics that cannot be analytically expressed; they cannot be identified and assigned an unequivocal name. The speculative dogma has, as we have seen, led to the use of words which shall somehow convey a sense of finality, or of limitless and exhaustive application, where no specific object or exact concept possessing such characters is offered for inspection. This is what Berkeley calls the "method of growing in expression, and dwindling in notion." Ordinarily the words so used have a precise meaning also, and there results a

double evil. On the one hand, the exact meaning of such terms as 'force,' 'matter,' 'consciousness,' 'will,' etc., is blurred and vitiated; and on the other hand, their speculative meaning borrows a content to which it is not entitled. The desire of philosophers to satisfy the religious demand for an object of worship or faith, doubtless one of the fundamental motives of the speculative dogma, leads to yet another variety of verbal suggestion, in which a technical philosophical conception is given a name that possesses eloquence and power of edification. Thus philosophers commonly prefer the term 'eternal' to the term 'non-temporal,' and 'infinite' to 'series with no last term,' or 'class, a part of which can be put in one-to-one correspondence with the whole.' Such terms as 'significance,' 'supreme,' 'highest,' 'unity,' have a similar value. Or the same end may be achieved by decorating almost any word with a capital letter, as is exemplified by the emotional difference between truth and Truth, or absolute and Absolute.

Finally, there is a verbal abuse which is worse, even, than equivocation; for it is possible to invent utterly fictitious concepts simply by combining words. In such cases, the constituent concepts, if the words happen to signify any, are not united. They may be positively repugnant, or simply irrelevant. At any rate, they have not been tested for consistency, and whether they do or do not constitute a true system or complex concept remains wholly problematic. Such, for example, is the case with Eucken's "total activity, which by its own movement develops into an independent reality and at the same time comprehends the opposition of subject and object, subjectivity and objectivity."[1] Such procedure is the principal source of the fallacy of *obscurum per obscurius* and affords an almost unlimited opportunity for error.

7. *The fallacy of illicit importance.* — This is one of the most insidious errors which has ever been foisted upon mankind, and it is the idealist who has popularized it. It consists in inferring that, because a proposition is self-evident or unchallengeable, there-

[1] Eucken. (Pogson, trans.) Life of the Spirit, 329.

fore it is important. There is a healthy animal instinct behind the fallacy. Men have early learned that the certain affords, on the whole, a safer basis for conduct than the uncertain. The merchant who is sure of his market grows rich faster than his ignorant competitor. The statesman who is sure of his constituents acts with directness and decision. So it is throughout all practical life. Now, the practical man never reflects upon his own mental processes, and thus he fails to note that the certainty he feels toward things is not an attribute of them, but only a certain precision in his attitude toward them. But the fact that the relations are unequivocal and clear is no proof that they happen to be of much significance. *A* may surely be *C*, and yet its being *C* may be the most trivial circumstance. A man, for instance, may be absolutely sure he likes cucumbers; but this does not prove that cucumbers are the true foundation of dietetics, nor that his liking of them reveals either his own nature or the nature of cucumbers.

Undeterred by such obvious cases, however, the idealist is wont to reason that all philosophy and all science must be built upon the one fact that nobody can make any unchallengeable assertion about anything except his having an immediate experience.

One might ask the idealist whether he is any more certain of being aware than he is of the presented object; whether, for example, in addition to saying: "I am certain that I am experiencing" — he cannot say with equal assurance: "There certainly is a tree of some sort over yonder." But to take up this debate is to pass beyond the fallacy which he has committed. And no solution of the question alters the fact that he has erred logically in holding that, because *A* is undeniably *B*, therefore *B* is an important characteristic of *A*. There is no sure connection between the axiomatic and the significant. To think there is, is vicious intellectualism. The fallacy is curable only by the use of strict logic, but by this very easily. If one person is certain that a distant object is a tree, while his companion is equally certain that the same object is an automobile, is it not obvious that certainty

is a negligible factor in the problem of deciding what the object really is?

III

THE REALISTIC PROGRAM OF REFORM

PHILOSOPHY has repeatedly thrown off its bad habits, and aroused itself to critical vigilance. Furthermore, there is good ground for asserting that there has never before been so great an opportunity of reform. Logic and mathematics, the traditional models of procedure, are themselves being submitted to a searching revision that has already thrown a new light on the general principles of exact thinking; and there is promise of more light to come, for science has for all time become reflectively conscious of its own method. The era of quarrelsome misunderstanding between criticism and positive knowledge is giving way to an era of united and complementary endeavor. It must not be forgotten that philosophy is peculiarly dependent on logic. Natural science in its empirical and experimental phases can safely be guided by instinct, because it operates in the field of objects defined by common sense. But the very objects of philosophy are the fruit of analysis. Its task is the correction of the categories of common sense, and all hope of a profitable and valid result must be based on an expert critical judgment. The present situation, then, affords philosophy an opportunity of adopting a more rigorous procedure and assuming a more systematic form. It is with reference to this opportunity that it is worth while here to repeat the advice which is our common inheritance from the great philosophical reformers. None of these canons is original, but all are pertinent and timely.

1. *The scrupulous use of words.* — This is a moral rather than a logical canon. There is need in philosophy of a greater fastidiousness and nicety in the use of words. A regard for words is, in philosophy, the surest proof of a sensitive scientific conscience; for words are the instruments of philosophical procedure, and

deserve the same care as the lancet of the surgeon or the balance of the chemist. A complacent and superior disregard of words is as fatuous as it is offensive. It is a healthier intellectual symptom to feel as MacIan felt in Chesterton's 'Ball and the Cross.' "Why shouldn't we quarrel about a word? What is the good of words if they aren't important enough to quarrel over? Why do we choose one word more than another if there isn't any difference between them? If you called a woman a chimpanzee instead of an angel, wouldn't there be a quarrel about a word? If you're not going to argue about words, what are you going to argue about? Are you going to convey your meaning to me by moving your ears? The church and the heresies always used to fight about words, because they are the only things worth fighting about." [1]

2. *Definition.* — "The light of human minds," says Hobbes, "is perspicuous words, but by exact definitions first snuffed and purged from all ambiguities." Words are properly signs. They are serviceable in proportion as they are self-effacing. A skillful word will introduce the hearer or reader to his object, and then retire; only the awkward word will call attention to itself. It follows, then, that the only means of escaping quarrels about words is to use words with discrimination, with careful reference to their objective purport, or usefulness as means of access to ideas. Furthermore, a word is essentially a social instrument, whether used for record or communication, and requires that its relation to an object or idea shall be agreed on and conventionalized. This is the only means of bringing several minds together in a common topic of discourse. "Syllables," says John Toland, "though never so well put together, if they have not ideas fix'd to them, are but words spoken in the air, and cannot be the ground of a reasonable service." [2]

Philosophy is peculiarly dependent upon a clear definition of the reference of words because, as we have already seen, its objects are not those of common sense. It cannot rely on the ordinary

[1] Chesterton. The Ball and the Cross, 96.

[2] Toland. Christianity not Mysterious (2d ed.), 30.

denotation of words. This fact affords a perennial and abundant source of confusion, from which there is no escape save through the creation of a technical vocabulary. Bacon's observations on this matter are worthy of being quoted in full. "Now words," he says, "being commonly framed and applied according to the capacity of the vulgar, follow those lines of division which are most obvious to the vulgar understanding. And whenever an understanding of greater acuteness or a more diligent observation would alter those lines to suit the true divisions of nature, words stand in the way and resist the change. Whence it comes to pass that the high and formal discussions of learned men end oftentimes in disputes about words and names, with which (according to the use and wisdom of the mathematicians) it would be more prudent to begin, and so by means of definitions reduce them to order." [1]

Definition, then, means, in the first instance, the unequivocal and conventional reference of words. But there is a further question which arises from the use of single words to refer to complex objects. If such a reference is to be unequivocal, it is necessary that there should be a verbal complex mediating between the single word and the complex object. Thus if a circle is defined as 'the class of points equidistant from a given point,' this means that a circle is a complex object whose components are specified by the words in the given phrase. The single word is virtually an abbreviation of the phrase. The clarity of words depends in the end on their possessing a conventional reference to simple objects. But with the progress of analysis and the demonstration of the unsuspected or unexplored complexity of things, the single word which at first denoted the object in its pre-analytical simplicity, comes to stand for several words which denote the components of the object in their post-analytical simplicity. Definition, then, means two things: first, a convention regarding the substitution of a single word for a group of words; second, a convention regarding the reference of words to objects.[2]

[1] Bacon. Novum Organum (edition of Ellis and Spedding), IV, 61.

[2] The definition of things, rather than words, is apparently the same as knowledge in general.

3. *Analysis.* — The term 'analysis' properly refers not to the special method of any branch of knowledge, but to the method of exact knowledge in general, to that method of procedure in which the problematic is discovered to be a complex of simples. Such procedure may lead to the discovery of fine identities in the place of gross differences, or fine differences in the place of gross identities. Analysis in this sense means only the careful, systematic, and exhaustive examination of any topic of discourse. It cannot, then, be proper to assert that such procedure destroys its object. It does, it is true, require that naïveté and innocence of mind shall give place to sophistication; or that ignorance shall give place to some degree of explicitly formulated knowledge. But even the discovery that such psychological or moral values are lost is itself the result of analysis. Nor is there any difficulty in providing a place for such values within the psychological or moral systems to which they belong. In the second place, it cannot be proper to assert that there is anything which necessarily escapes analysis, such as 'real' change or 'real' activity. The method of analysis does not require that change and activity shall be anything other than what any investigation shall discover them to be. Analysis may show either that they are unanalyzable or that they may be further reduced. If they turn out to be unanalyzable, it can only be because they exhibit no complexity of structure, no plurality of necessary factors. If they turn out to be reducible, then they must be identical with the totality of their components. If they appear to differ from such a totality, then they must appear so to differ in some respect, and this respect must at once be added to complete the totality. It is especially important not to forget the combining relations. A toy is not identical with the collection of the fragments into which it has been shattered, but it is identical with these fragments in that particular arrangement which has been destroyed. Similarly dynamics does not reduce motion to the occupancy of positions, but to the occupancy of positions *in a temporal order*. There is a perfectly clear difference between geometry or statics, on the one hand, and dynamics on the other.

It is important also not to confuse analysis and synthesis with the physical operation that often accompanies them. For the purposes of knowledge it is not necessary to put Humpty Dumpty together again, but only to recognize that Humpty Dumpty is not himself unless the pieces are together.

The common prejudice against analysis is due in part to this false supposition that it is an attempt to substitute a *collection* of parts for an *arrangement* of parts. But it is due also to a more or less habitual confusion between things and words. Those who have employed the analytical method have been by no means guiltless in the matter. So soon as any word obtains currency it begins to pose as a thing in its own right, and discourse is constantly tending to take on the form of a logomachy. It has not unnaturally been supposed that analysts intended to verbalize reality, to give to its parts the artificial and stereotyped character of words, and to its processes the formal arrangement of grammar. But, as we have already seen, verbalism cannot be avoided by a deliberate carelessness in the use of words. If words are to be both useful and subordinate, it is necessary that they should be kept in working order, like signposts kept up to date, with their inscriptions legible and their pointing true.

4. *Regard for logical form.* — Logic is at the present time in a state of extraordinary activity, and able both to stimulate and to enrich philosophy. The principal contribution which modern logic is prepared to make to philosophy concerns the form of exact knowledge. This problem is by no means wholly solved, and there is an important work to be done which only philosophers can do. But the mathematical logicians have already broken and fertilized the ground. The theory of relations, the theory of 'logical constants' or indefinables, the theory of infinity and continuity, and the theory of classes and systems, concern everything fundamental in philosophy. No philosopher can ignore these and like theories without playing the part of an amateur. The mathematical logicians may be quite mistaken, or they may have failed to go to the root of things; but in that case they must be over-

taken in their error and corrected on their own grounds, if the field of scientific philosophy is not to be abandoned to them altogether. The present situation is certainly intolerable; for philosophy deals with the same topics as modern logic, but treats popularly and confusedly what modern logic treats with the painstaking thoroughness and exactness of the expert.

There is another respect in which modern logic should be of service to philosophy. In the course of a reconstruction of the foundations of mathematics, certain general canons of good thinking have come to light; and these are directly applicable to philosophical procedure.[1] We refer to such canons as 'consistency' and 'simplicity.' These canons are new in the sense that they are now well enough defined to afford a means of testing any theory. A theory is consistent when its fundamental propositions actually generate terms, or when a class can be found which they define; and a theory satisfies the criterion of simplicity or parsimony when none of its fundamental propositions can be deduced from the rest. It behooves philosophy, then, both to ally itself with logic, in the investigation of the most ultimate concepts, such as relation, class, system, order, indefinable, etc., and also to apply to its own constructive procedure the most refined tests of scientific form. It is one of the major purposes of the new realism to justify and to extend the method of logic and of exact science in general. For this reason one of the essays in this volume [2] is especially devoted to defending the truthfulness of that method and giving it full ontological validity.

5. *Division of the question.* — Although philosophy is especially charged with correcting the results obtained in each special investigation by results obtained from other investigations, it is folly to ignore the necessity, humanly speaking, of dealing with one problem at a time. Not only is the attempt to raise and answer all questions together futile, but it prevents either definiteness of concepts or cogency of reasoning. Exact knowledge must

[1] Cf. Schmidt. Critique of Cognition and its Principles, *J. of Phil., Psychol., etc.*, 1909, 6, 281.

[2] No. III.

be precisely limited in its application. A disposition in philosophy to employ terms in an unlimited sense, and to make unlimited assertions, is the principal reason why philosophy at the present time possesses no common body of theory. And for the same reason philosophy is to-day without any common plan of work to be done. English and American philosophers have been much exercised during the past decade over what is called 'the problem of truth.' It is assumed that the various parties to this discussion are referring to the same thing; but it is doubtful if this would ever be suspected, did they not specifically mention one another's names and writings. These quarrels are perhaps due less to disagreement on the merits of any question, than to an irritable determination to be heard. If a sober and patient attempt were made to reduce the present differences of philosophical opinion to debatable propositions, the first result would be a division of the question at issue. It would certainly appear that the present-day problem of truth is one problem only so long as it is a symbol of factional dispute; discuss it, and it at once proves to be many problems, as independent of one another as any problems can be. If one undertakes to enumerate these problems, one readily finds as many as seven: (1) The problem of non-existence: What disposition is to be made of negated propositions, of non-temporal propositions, and of imaginary propositions? (2) The problem of the one and the many: How may many elements belong to one system? (3) The problem of logical form: What are the ultimate categories? (4) The problem of methodology: How shall one best proceed in order to know? (5) The problem of universality: How can that which is known at a moment transcend that moment? (6) The problem of the values of knowledge: What are the criteria of right believing? (7) The problem of the relation between belief and its object: In what respect does belief directly or indirectly modify its object?

If agreement, or even intelligent disagreement, is to be obtained, philosophical issues must be sharpened. If any steady advance is to be made, special problems must be examined in order, and one

at a time. There is a large group of such special problems that is by general consent assigned to philosophy. In addition to those already enumerated, there are such problems as consciousness, causality, matter, particularity and generality, individuality, teleology, all of them problems whose solution is of the first importance both for the special sciences and for religious belief. These problems are examined by the traditional philosophy; but they are not sufficiently isolated, nor examined with sufficient intensive application. They find their place in most philosophical treatises as applications of a general system, and not as problems to be examined independently on their merits.

6. *Explicit agreement.* — The recent discussion of the desirability and expediency of a 'philosophical platform' has developed a difference of opinion as to whether agreement should be explicit or implicit.[1] Agreement of some sort is conceded to be a desideratum, but there are some who believe that a common tradition or historical background is all that is necessary. Now is it not evident that in theoretical or scientific procedure there *is* no agreement until it is explicitly formulated? The philosophical classics afford no basis for agreement, because they are open to interpretation. The difficulty is merely complicated through the necessity of first agreeing on the meaning of a text. To employ terms and propositions in their historical sense is to adopt precisely the course which is adopted by common sense. It means the introduction into what is supposed to be exact discourse of the indeterminate human values with which tradition is incrusted. In exact discourse the meaning of every term must be reviewed; no stone can be allowed to go into the building that has not been inspected and approved by the builder. Otherwise the individual philosopher is no more than an instrument in the hands of the *welt-geist.* He must be possessed by a fatalistic confidence that the truth will take care of itself if he only repeats the formulas that he has learned in the schools or in the market place. But the most precious and

[1] Cf. Schmidt, Creighton, and Leighton, *J. of Phil., Psychol., etc.*, 1909, 6, 141, 240, 519, 673.

cherished privilege of philosophy is the critical independence of each generation. Every philosophical reformer from the beginning of European thought has been moved by a distrust of tradition, and has proclaimed the need of a perpetual watchfulness lest the prestige of opinion be mistaken for the weight of evidence.

If agreement is to be based on tradition, then tradition, with all its ambiguity, its admixture of irrelevant associations, and its unlawful authority, is made the arbiter of philosophical disputes. That no theoretical difference is ever really judged in this way is abundantly proved from the present situation in philosophy. We sympathize, but we do not agree; we differ, but we do not disagree. It is of more importance in theoretical procedure that two or three should agree, than that all should sympathize. "If the trumpet gives an uncertain sound," says Toland, "who shall prepare himself to the battle?" Agreement and disagreement alike require the explicit formulation of theories in terms freshly defined. It is not to be supposed that those who insist on the necessity of explicit agreement have in mind any general unanimity. The principle would be satisfied if a single philosopher could be found to agree with himself — provided the agreement were explicit. For then it would be possible for others to disagree with him, and to disagree explicitly. We should then have before us a number of carefully formulated propositions, which could be tested and debated in the light of the evidence, propositions which would be the common property of philosophers and the material with which to construct an impersonal system of philosophical knowledge.

The first duty of philosophers, then, is not to agree, but to make their implicit agreements or disagreements explicit. Moreover it is not easy to see how this duty can be escaped without entirely abandoning philosophy's claim to be a theoretical discipline. If we cannot express our meaning in exact terms, in terms that we are willing should stand as final, if like the sophists of old we must make long speeches and employ the arts of rhetoric; then let us at least cultivate literature. At present we are bad scientists and

worse poets. But philosophy is not necessarily ineffable.[1] The difficulties which some philosophies have in meeting the demands of exact discourse are gratuitous, and are due to a habit of mixing theory, on the one hand, with the history of theory, and, on the other hand, with common belief. It is not necessary that philosophy should abandon its interest in either history or common belief, but it is necessary that it should isolate those interests, and not permit them to compromise its direct study of problems.

7. · *The separation of philosophical research from the study of the history of philosophy.* — A problem can be solved only by the attentive examination of that which the problem denotes. But a problem of historical exegesis, and an original philosophical problem, necessarily denote different things and direct the attention to different quarters. Thus the problem of *Hume's conception of causality* directs attention to a text, whereas the problem of *causality* directs attention to types of sequence or dependence exhibited in nature. It is worth while to formulate this commonplace because there is a present-day habit of procedure that obscures it. It is customary to assume that it is the mark of rigorous scholarship in philosophy to confine oneself to commentaries on the classics. To raise the question of the importance of the history of philosophy is not necessary. That it has an indispensable place in human culture and in the discipline of every philosopher is not to be doubted; but that it has a higher dignity than a direct and independent analysis of special problems seems to be nothing more than a superstition. What dignity the history of philosophy possesses it derives from the originality of the individual philosophers whose achievements it records. If philosophy were to consist in the study of the history of philosophy, it would have no history. Doubtless the by-product of originality is charlatanry and sophomoric conceit; but mankind is not less well served by this than by the complacent pedantry which is the by-product of erudition.

But whether the historical form of treatment does or does not

[1] Cf. Sheffer, H. M. Ineffable Philosophies, *J. of Phil., Psychol., etc.*, 1909, **6**, 123.

lend dignity to philosophical discourse, it certainly adds complexity and difficulty. Ferrier, good Hegelian though he was at heart, confided to his readers the hopelessness of undertaking to show whether his conclusion agreed with Hegel's or not. "It is impossible to say to what extent this proposition coincides, or does not coincide, with his opinions; for whatever truth there may be in Hegel, it is certain that his meaning cannot be wrung from him by any amount of mere reading, any more than the whisky which is in bread . . . can be extracted by squeezing the loaf into a tumbler. He requires to be *distilled*, as all philosophers do more or less — but Hegel to an extent which is unparalleled. A much less intellectual effort would be required to find out the truth for oneself than to understand *his* exposition of it."[1] Ferrier does not exaggerate the difficulty of historical exegesis; for it is true not only that the great philosophies require to be distilled, but that they also require to be translated from the terms of their own traditional context to the terms of another. Moreover there must always be a large marginal error in any such interpretation. This being the case, it is not only gratuitous, but suicidal, to add the difficulties of this problem to the difficulties of each special philosophical problem.

IV

REALISM AS A CONSTRUCTIVE PHILOSOPHY

As is almost universally the case with conscious and methodical criticism, realism finds itself committed to certain positive beliefs. The very act of criticism itself cannot but define, however broadly and tentatively, the outline of a general philosophy. Thus, the grounds on which realism rejects subjectivism determine to some extent the superstructure which is to be reared in its place; while the very fact of the rejection of subjectivism excludes one of the leading metaphysical alternatives, and gives heightened emphasis to the alternatives that remain.

[1] Ferrier. Institutes of Metaphysics, 96–97.

1. Perhaps the most notable feature of a realistic philosophy is the emancipation of metaphysics from epistemology.[1] This means that the nature of things is not to be sought primarily in the nature of knowledge. It does not follow that a realist may not be brought in the end to conclude that moral or spiritual principles dominate the existent world, but only that this conclusion is not to be reached by arguing from the priority of knowledge over its objects. Moralism and spiritualism must take their chance among various hypotheses; and the question of their truth is to be determined by the place of such principles among the rest within the world. The general fact that whatever the world be judged to be, it is at any rate so judged, and therefore an object of cognition, is to be ignored; and one is left to decide only whether on empirical grounds one may fairly judge the world to be spiritual or moral in part only, or on the whole. It will be seen at once that the chief ground on which a spiritualistic or ethical metaphysics has latterly been urged is removed. But at the same time the metaphysical significance of life, consciousness, and morality as facts among facts is at once increased; and these may now be employed for the formulation of hypotheses that are at least pragmatic and verifiable.

2. Again, in rejecting anti-intellectualism and espousing the analytical method, realism is committed to the rejection of all mystical philosophies. This holds of all philosophies that rely on immediacy for a knowledge of complexness; of all philosophies that regard the many in one as a mystery that can be resolved only by an ineffable insight. A neo-realist recognizes no ultimate immediacies nor non-relational nor indefinable entities, except the simples in which analysis terminates. The ultimate terms of knowledge are the terms that survive an analysis that has been carried as far as it is possible to carry it; and not the terms which possess simplicity only because analysis has not been applied to them. Such a course of procedure is fatal, not only to a mystical universalism in which the totality of things is resolved into a moment of ecstasy, but also to those more limited mysticisms in which

[1] Cf. below, No. I.

complexes such as substance, will, activity, life, energy or power, are regarded despite the obvious manifoldness of their characters, as nevertheless fused and inarticulate. It follows that neo-realism rejects all philosophies in which metaphysics is sharply divorced from the special sciences, on the ground that while the latter must analyze, specify, and systematize, the former may enjoy a peculiar illumination of its own, in which the true heart of things is made apparent, and the facts and laws of science are reduced to dead abstractions, or mere instrumental artifacts.

3. For several reasons the new realism tends, at least in the present state of knowledge, to be metaphysically pluralistic rather than monistic. Most metaphysical monisms have been based on one or the other of two grounds. The first of these is the internality of relations; the supposition that the nature of terms contains their relations. It is easy to argue from this premise, that since all things are interrelated, the nature of each contains the nature of all. Realism rejects the premise that all relations are internal, because it is believed that it is contrary to the facts of existence, and to the facts of logic. The second ground of monism is the universality of cognition. The rejection of this is, as we have seen, the very starting-point of realism. Without one or the other of these grounds it is not possible to construct a monism dialectically or *a priori*. This question also becomes an empirical question, and in lieu of the discovery of a law, or set of postulates that shall explain everything, we must at least remain skeptical. The evidence at present available indicates that while all things may perhaps be related, many of these relations are not constitutive or determinative; that is, do not enter into the explanation of the nature or existence of their terms.

4. Again, the primary polemical contention of realism, its rejection of subjectivism, has its constructive implications. If cognition is not the universal condition of being, then cognition must take its place within being, on the same plane as space, or number, or physical nature. Cognition, in other words, has its genesis and its environment. When knowledge takes place, there

is a knower interacting with things. The knower, furthermore, since it cannot legitimately be saved from analysis, and referred to a unique mystical revelation, must take its place in one manifold with the things it knows. The difference between knower and known is like the difference between bodies, or states of consciousness, or societies, or colors, or any grouping of things whatsoever in the respect that they must be brought into one field of study, and observed in their mutual transactions.

In all this it is presupposed that if there is to be knowledge, there must be something there to be known, and something there to know; 'there' meaning the field in which their relation obtains. Their correlation is not a basic and universal dichotomy, but only a special type of correlation, having no greater *prima facie* dignity than the many other correlations which the world exhibits. It is not to be taken in bare formal terms, but is to be observed concretely, and in its native habitat. The realist believes that he thus discovers that the interrelation in question is not responsible for the characters of the thing known. In the first place being known is something that *happens* to a preëxisting thing. The characters of that preëxisting thing determine what happens when it *is* known. Then, in the second place, when the knowing takes place, these characters are at least for the most part undisturbed. If they are disturbed, or modified, then the modification itself has to be explained in terms of certain original characters, as conditions of the modification. So that even if it proved necessary to conclude that illusion and hallucination are due to modifications of the stimulus by the reacting organism, this very conclusion would imply the preëxisting and independent character of the body in which the stimulus originated.

5. In immediate and intimate connection with this doctrine of the independence of things known and the knowing of them, stands another special doctrine — to the effect that the content of knowledge, that which lies in or before the mind when knowledge takes place, is numerically identical with the thing known. Knowledge by intermediaries is not denied, but is made subordi-

nate to direct or presentative knowledge. There is no special class of entities, qualitatively or substantively distinguished from all other entities, as the media of knowledge. In the end all things are known through being themselves brought directly into that relation in which they are said to be witnessed or apprehended. In other words, things when consciousness is had of them become themselves contents of consciousness; and the same things thus figure both in the so-called external world and in the manifold which introspection reveals.

6. Finally, because he regards analysis and conception as means of access to reality, and not as transformations or falsifications of it, and because he asserts the independence of reality in the knowing of it, the neo-realist is also a Platonic realist. He accords full ontological status to the things of thought as well as to the things of sense, to logical entities as well as physical entities, or to subsistents as well as existents.

7. In short, for realists, knowledge plays its part within an independent environment. When that environment is known it is brought into direct relations with some variety of agency or process, which is the knower. The knower however is homogeneous with the environment, belonging to one cosmos with it, as does an attracting mass, or physical organism, and may itself be known as are the things it knows. The world is of an articulate structure that is revealed by analysis, consisting of complexes, like bodies, persons, and societies, as well as of simples. The simple constituents of the world comprise both sensible qualities and logical constants. Both enter into the tissue of fact, and both possess an inherent and inalienable character of their own. There is no safe refuge from this conclusion in any abandonment of intellectual rigor. Hence all speculative versions of the world that require the withholding of analysis, or that depend on the unique and preëminent status of the act of cognition, must be rejected, no matter how eagerly they may be desired for the justification of faith. They must be rejected in favor of such hypotheses as may be formulated in terms of the evident composition of the

known world, and verified by its actual interrelations, history, and trend.

These conclusions in the aggregate can scarcely be said to be negative. It is true that they constitute neither a complete philosophy, nor, even so far as they go, an absolutely systematic philosophy. But that a philosophy should be absolutely systematic in the sense of being deducible from one principle is itself a philosophical doctrine that the realist is by no means prepared to adopt. Moreover that his philosophy should be as yet incomplete is, to the realist at least, a wholesome incentive, rather than a ground for uneasiness. There are endless special philosophical questions to which there is no inevitable realistic answer, such questions as mind and body, teleology, the good, and freedom; and there is as yet no general realistic philosophy of life, no characteristic verdict on the issues of religion. Nevertheless, the foundations and the scaffolding of the realistic universe are already built; and it is even possible for some to live in it and feel at home.

V

REALISM AND THE SPECIAL SCIENCES

1. It is the earnest hope of those who have identified themselves with this movement, that it may afford a basis for a more profitable intercourse with the special sciences than that which has latterly obtained. There are common problems which have been hitherto obscured by a radical difference of method, and an incommensurability of terms. So long as philosophy is simply the exploitation of a unique and supreme insight of its own, it remains either irrelevant to the special sciences or, through its claim of superiority, a source of irritation and an object of suspicion. Such has, to some extent, at least, been the case during the later philosophical régime. Idealists have benevolently assimilated science to a universal consciousness; irrationalists have appealed to revelation for insight that overrules and makes naught of all the hard-

won truths of science. In either case, science is not helped by philosophy, but after being allowed to do the work of truth finding, is graciously assigned to headquarters labeled 'Appearance' or 'Mere Description,' where it may enjoy the patronage of a superior.

Realism advances no all-inclusive conception under which science as a body may be subsumed; it claims no special revelation, and asks no immunity from the pains of observation and analysis. What is thus lost of eminence and authority, may, it is hoped, be made up by a more cordial and profitable association with fellow-workers in a common task. For, after all, the division of the disciplines is less significant than the identity of problems and the singleness of purpose that should animate all rigorous seekers after knowledge. Consciousness, life, infinity, and continuity are genuine and identical topics of investigation, whether they happen to be alluded to by psychologists, biologists, logicians, and mathematicians, or by philosophers. And it is reasonable to hope that the difference of training and aptitude between the special scientist and the philosopher should yield a summation of light, rather than misunderstanding and confusion.

2. Thus psychology, for example, has for its very subject matter the concrete process of consciousness, and is therefore vitally concerned in anything true which philosophy has to say about consciousness in general. But the alleged discovery of subjectivism, that all things are mental, is so untrue to the phenomena on which psychology has to work, that this science has been brought thereby to a peculiar state of embarrassment. In the concrete processes of perception and cognition, the *corpus vile* of psychology, the stimuli, howsoever 'mental' they may be in some last and remote analysis, are assuredly not mental in the sense in which the correlated sensations and ideas are so. Precisely because the psychologist has to accept the direct evidence for the existence of particular minds, he can take no part in the conspiracy to make of mind a universal predicate.

The result is that idealism has meant nothing to the actual psychologist, who has in his laboratory remained a Cartesian dual-

ist. And it is unmistakable that the results of the study of the soul are to-day, and have been through the last three centuries, read off and tabulated in terms of two substances — matter and mind. Sensations and ideas, alleged to be peculiar and private to each percipient, are conceived as invisible pawns which are correlated one-to-one with the 'brain-cells' or other cerebral structures, and are superfluous to the actual processes of the brain in spite of frantic efforts to assign to them some regulative function; and they have none but the most chimerical and unstatable relations to the outer objects which these pawns are said to represent. The supposed need of interpreting the results of empirical psychology, or rather of 'observing' all mental processes in terms of two substances, has thoroughly stultified the science as a whole. The artificial and unsupportable situations to which this course has led are numerous, but one in particular is so preposterous and unendurable that it alone would demand a complete revision of the current 'presuppositions' of psychology. This is the concrete situation when two persons are making a psychological experiment. One is called the experimenter, the other the observer or 'subject,' and between them lie the instruments for giving stimuli and recording results. The experimenter, by hypothesis, has direct and immediate knowledge of these instruments and in particular of the stimuli which he employs. By hypothesis the observer, although similarly a human being with the same gift of cognition, has not a direct or immediate apprehension of these instruments and stimuli, but this observer's knowledge is limited to the field of invisible pawns which 'represent' the stimuli, and which enjoy an otherwise inscrutable status of one-to-oneness with some structures within the observer's skull. So the situation is interpreted, until presently the two experimenters exchange their rolls, whereupon by a process of magic the just-now observer acquires a direct apprehension of the instruments of stimulation, the scales have fallen from his eyes and are adjusted to the other man's, whose conscious field now shrivels and is merely the fitful flux of the intracerebral and invisible pawns.

This is the situation which attends every psychological experiment in which two persons take part. It is absurd, and can be mitigated only by a theory which gives a satisfactory epistemological status to the 'outer objects' which are the terms common to all human experiences. Neither dualism nor idealism provides such a status. This condition of things is sufficient to induce the psychologist to look toward realism; and yet this is merely one of several insupportable results attendant on a dualistic psychology. In general, it may be said that any argument which makes dualism indefensible in philosophy makes it concretely intolerable in psychology. Psychology has not yet found the right fundamental categories, and will not find them as long as dualism continues to hold sway. Meanwhile its particular findings lie accumulated in incoördinated heaps and investigators are beginning to sense an *impasse*, and are somewhat inconsequently turning away to various forms of an 'applied' science.

3. A similar state of things exists in biology; for here a realistic philosophical basis is even more clearly presupposed. Indeed, the realistic point of view and all its fundamental propositions may be served on the biologist as a *mandamus;* for to him are assigned such problems as the origins of life, the origins of species, the manners of growth, of variation, and of adaptation. Now each and every one of these problems presents a situation wherein there is an environment independent of a given creature which is being affected by that environment and is, in turn, manipulating itself and parts of the environment. Such a world is realistic; it is no piece of human imagery, and its texture is made of other stuff than mere thoughts. It is full of minds which it has somehow made and which it, by a mere invisible lesion, can destroy.

As with the world, so with the organisms in it. They are not the products of the minds they bear. Although these minds do not even suspect the form and flux of their sustaining organs, yet the latter operate, day and night, indifferent to that ignorance. They are as independent of the mind as is the wind which sighs around the house while the mind sleeps.

It is true that many biologists look with favor upon idealistic doctrines, which, if accepted, would lead to absurdities. They have applied them only half-heartedly though and thereby befuddled many questions, notably that of vitalism *versus* mechanism. So far have some of them gone with the doctrine that things are 'mental constructs,' that they have projected conscious intelligence the whole organic process. But they cannot doubt that an organism is needed to produce a 'mental state.' Thus Pauly cannot understand how an organism could ever 'grow' eyes, unless the cause of the growth also had eyes. Nothing, he virtually argues, can be done unless the deed is known beforehand in detail; though to know it, the knower behind the organism must in turn have a perceiving mechanism. It is to avoid such bewilderment that realism wishes to join hands with the cautious biologists.

4. If realism can afford assistance and clarification to psychology and biology, this is no less the case with logic and the mathematical sciences. At the present time these latter sciences suffer chiefly from a confusing admixture of psychology. This confusion takes two forms, as illustrated by the case of logic. On the one hand, logic as a science of such entities as terms, propositions, propositional functions, etc., is confused with the study of the art and processes of thought. On the other hand, logic as a science of implication and necessity is confused with the study of the historical genesis of knowledge. Realism frees logic as a study of objective fact from all accounts of the states or operations of mind.

For the realist there are empirical grounds for holding that the object known is independent of and may be dissimilar to the cognitive process. Cognition can be eliminated. It is discovery. Accordingly, the realist is an open-minded empiricist. He stands quite ready to find and to admit that anything may be a fact, that any kind of entity may exist, or subsist. The only limitations are *a posteriori*. For the realist, the study of the knowing process is only one of many fields of investigation. Logic, arithmetic, and mathematics in general are sciences which can be pursued quite

independently of the study of knowing. The entities with which they deal are not physical; nor are they mental. They are subsistents in that they are entities notwithstanding this fact. Thus these sciences investigate neither physical nor mental entities, but have to do with an independent and objective field of their own.

5. It is necessary that philosophy should raise the questions of epistemology, if only in order to assign them a subordinate place. It will not do to ignore the fact of knowledge itself. Sooner or later, the knower must take himself into the account and become conscious of that inward relation to a subjective background which, in the first objective or outward intent of knowledge, is naturally overlooked. Realism is not a naïve or blind neglect of the problem. If realism concludes, as it does, that the knower himself may, in the great majority of cases, be disregarded, and the object be explained in its own terms, it is only after due consideration of the matter. The right so to disregard the subjective conditions of knowledge is an achievement of critical reflection.

And it is an achievement of no small moment; for it at once establishes the full rights of all special branches of knowledge. Philosophy must, it is true, now abandon its supposed privilege of radically transforming all results which have been reached without taking knowledge into account. Philosophy can no longer condemn such results as necessarily and universally false, or replace them with a higher esoteric truth, which is revealed only to the initiated. The disregard of epistemological considerations which is characteristic of special investigations is now justified.

But what philosophy loses in prerogative, it gains in the improvement of its relations with other branches of knowledge. It may now employ the results of the special sciences as they stand. This is true not only of the physical sciences, but of the moral sciences; and not only of scientists in the professional sense, but of all observers and investigators who have anything to report concerning the state of things in this common world. In other words, once subjectivism and mysticism are discredited, the work of philosophy

becomes continuous with that of all who have chosen to limit more narrowly the field of their labors. There will always remain a certain difference of procedure between philosophers and specialists. Philosophers will be looked to for breadth of generalization, for refinement of criticism, and for the solution of such problems as are peculiarly connected with the limits of generalization and criticism. But, even so, the task of philosophy is not *radically* different from that of the special knowledges. It lies on the same plane, or in the same field. It is a difference of degree and not of kind; a difference like that between experimental and theoretical physics, between zoölogy and biology, or between jurisprudence and political science.

Thus, realism proposes that philosophy should abandon for all time that claim to the hereditary exclusive possession of truth which was made in the first days of its youthful arrogance. Though philosophy has until now clung tenaciously to that dualism of knowledge by which Parmenides assigned to philosophy "the unshaken heart of persuasive truth," and left for the less privileged workers in the field of empirical facts only "the opinions of mortals in which is no true belief at all"; it is the conviction of those who have undertaken the present volume that the way of all mortal opinion, in so far as it is honest and attested by evidence, is the way of truth.

THE EMANCIPATION OF METAPHYSICS FROM EPISTEMOLOGY

THE EMANCIPATION OF METAPHYSICS FROM EPISTEMOLOGY

By Walter T. Marvin

I

THE ISSUE BETWEEN DOGMATISM AND CRITICISM

1. The purpose of this essay is to present some arguments in opposition to the belief, held by many philosophers, that the science which investigates the nature, the possibility, and the limits of knowledge is fundamental to all other sciences and to all other scientific procedure, and in particular that this science either is metaphysics or is fundamental to metaphysics.[1] As a preliminary to our discussion we must clearly understand what is meant by "one science being *fundamental* to another." To an inquiry concerning the meaning of the words "one science is fundamental to another," three answers appear to be offered.

First, one science is fundamental to another when it is logically prior; and by logical priority is meant that relation which holds between a proposition and its necessary condition. Thus if A implies B but B does not imply A, then B is the necessary condition of A; for A's truth depends upon B's truth. That is, should B prove to be false, A must be false: and though A be false, still B may prove true; for we are saying merely that A's truth is a sufficient condition of B's truth, and are not maintaining that it is the only condition, or a necessary condition. For example, let us assume it to be true that if the tissues of a man's

[1] Under the term metaphysics I include two subjects: (*a*) the study of the logical foundations of science; (*b*) the theory of reality. Here and throughout this essay I mean by the words, theory of reality, any collection of fundamental existential propositions and of high existential generalizations.

body absorb a certain amount of arsenic, he must die, that there is no preventing cause either known or unknown. Then evidently for it to be true that this man's body has absorbed such an amount of arsenic, it must be true that the man is dead; whereas the mere fact of his death does not prove that many another possible cause is not the actual cause. In short, "the man is dead" is logically prior to the proposition, the tissues of his body have absorbed the required quantity of arsenic. But let us illustrate specifically the logical priority of one science to another. Much of mathematics is logically prior to mechanics and physics, since much of these latter sciences could prove false without thereby indicating any errors in our pure mathematical theories; but should it be found that arithmetic, the calculus, and elementary geometry are false, evidently our mechanical and physical theories, based as they are upon these sciences, and being in great part explicit deductions from them, would fall to the ground. Of course there may be other, as yet totally unknown, ways by which mechanics and physics can be demonstrated; but according to our present knowledge, unless a large part of mathematics is true, mechanics and physics must be false. If then we accept the foregoing as the meaning of the word 'fundamental,' we get as the first answer to our question: In calling the theory of knowledge fundamental, the philosopher means that it is logically prior to all other knowledge.

2. The second answer offered appears to be different, though a closer scrutiny may reveal the presence of the same conviction. "The theory of knowledge is fundamental," means not only that the epistemologist can ascertain through his science the limits of possible knowledge, but especially that he can do so without studying the various special sciences or the history of science and of scientific discovery, or without in any way going for information beyond the territory of his own science. In other words, it is maintained that there is a science of the possibility of knowledge which is not an induction from men's scientific experience during the centuries of civilization nor from the sciences as they

are now known, but which is a direct, independent, and final study of the nature and limits of knowledge. Indeed, it is held that unless we have proven in this way the possibility of any special science, such a science is mere dogmatism; and therefore that he only is a critical scientist who does not attempt to investigate until he proves to himself by the theory of knowledge that what he hopes to discover and to explain is a possible object of knowledge.

Of course the writer has in mind especially Kant and his 'Critique of Pure Reason.' He it was who taught, as no other man has taught, that dogmatism and criticism are forever irreconcilable, that one science, the science of the possibility of knowledge, can ascertain what are and what are not problems which the human mind can solve. He thought that the older metaphysicians, who were either ignorant or careless of these matters, were led hopelessly into error precisely because they undertook to solve their problems before they wrote or studied a critique of pure reason.

Moreover, note well; this critique of pure reason is not a history of the successes and failures of scientists, nor is it a summary of what in the course of human history have proved solvable and insolvable problems. Rather it is a direct study of the nature of knowledge in the abstract and of the behavior of the human intellect; and its conclusions are said to be drawn from this study without the aid of the other sciences. On this account its results are believed to be independent of the special sciences and authoritative over them; whereas if it drew its information from them or were itself a mere induction from human experience, it would be admittedly a vicious circle.

3. The third answer informs us that in calling the theory of knowledge fundamental the philosopher asserts that this science can enable us to ascertain the validity of the special sciences and of their methods, and in certain respects at least can enable us even to correct their results. For example, if a science offers us a solution of some problem which we know to be insolvable,

or asserts what is beyond the possibility of human knowledge, we can infer at once that this part of such a science must be invalid. But this is by no means all that is referred to in the third meaning of the word, 'fundamental.' Rather we are given to understand that the theory of knowledge offers us information regarding reality, and that this information is of great value in two respects; it is more certainly true than are the results of the special sciences, and it is a means of refuting, correcting, and limiting these results. For example, if a study of the nature of knowledge shows that the universe must be an organic unity; it can be inferred that should the sciences indicate the opposite, they are at the best only relatively or partly true. Again, if a study of knowledge shows that only mental contents can be known, that an object to be known must be part of the mind's experience; then it can be inferred directly without further evidence from science that reality as far as it is knowable must be the experience of some mind. Then if in addition the theory of knowledge shows that whatever is essentially unknowable cannot be real; we reach the conclusion, reality as such is the experience of one or more minds, and only that. Hence, should popular opinion and scientific inference assert in opposition to this that things exist which cannot be experienced or which belong to no one's experience, such doctrines would be subject to correction by our fundamental science.

Still again, if it be true, as some epistemologists have taught, that the mind in knowing gives a form to the objects known and consequently that whatever is known must have this form or structure; then their science can lay down for all time to come the main outlines of the world as the possible object of scientific research. Should the physicist or any other scientist ever quarrel with this outline furnished by our philosopher, it will be our duty to inquire whether or not he is a student of the theory of knowledge and has made a discovery in that field. Should it prove that he is not an epistemologist, but just a physicist, mathematician, or chemist; our philosopher will tell him that he is not

competent to talk about ultimate reality, for his science may indeed give useful information, but cannot give any independent and fundamental insight into what is and what is not ultimately real. For example, it has been claimed by one epistemologist or another that the world as an object of knowledge must be a three-dimensional spatial system, a temporal system, a causal system, a system of sense impressions, a society of minds, an organic unity, an infinite and perfect personal mind, a divine language by which God sends us messages, a battlefield created by the mind wherein the will may fight for the moral ideals, the dreary, hopeless outcome of the struggles of an impersonal, blind and restless will, an evolution of an absolute mind. Negatively it has been held by one philosopher or another as the result of his study of the nature of knowledge, that matter does not truly exist, that colors and sounds, heat and cold, do not exist outside the mind, that scientific laws are not truly parts of nature, that the real world cannot be known.

4. Let us sum up briefly these three meanings of the statement, "the theory of knowledge is fundamental," in the following propositions: First, the theory of knowledge is logically prior to all other knowledge; secondly, one can by a direct study of the knowing process infer the limits of possible knowledge; and thirdly, the student of epistemology can give us, independently of all other sciences, a theory of reality. By no means do I claim that these three propositions cannot be and should not be further analyzed and reduced to one, namely to the first; rather, I believe precisely this: but for the purpose of the present argument it is better to leave them as they stand.

5. In opposition to these beliefs in the fundamental character of the theory of knowledge, this essay will support directly or indirectly the truth of the following propositions: (*a*) first, that the theory of knowledge is not logically fundamental, that on the contrary its logical position is posterior to many of the special sciences, such as physics and biology; (*b*) secondly, that the theory of knowledge does not enable us to show, except inductively and em-

pirically, either what knowledge is possible or how it is possible, or again, what are the limits of human knowledge; (*c*) thirdly, that no light is thrown by the theory of knowledge upon the nature of the existent world or upon the fundamental postulates and generalizations of science, except in as far as the knowledge of one natural event or object enables us sometimes to draw inferences regarding certain others; (*d*) fourthly, that epistemology does not give us a theory of reality, on the contrary, it assumes one; (*e*) finally, that it neither solves metaphysical problems nor is it the chief source of such problems. One may express all of this affirmatively as follows. I shall try to show three things: (*a*) first, that the theory of knowledge is one of the special sciences, that it studies knowledge as a natural event and in virtually the same way and by the same methods as biology studies life or physics light; (*b*) secondly, that as such a science, it assumes the formulæ of logic and the results of several special sciences, such as physics and biology; (*c*) and finally, that logic, metaphysics, and some existential sciences are logically prior to the theory of knowledge.

6. In short, the general conclusion which I shall draw is that metaphysics is logically prior to the theory of knowledge and that it is not peculiarly indebted to this science either for its problems or for their solution. If this conclusion is true, then metaphysics should be completely emancipated from epistemology; for the sway that this science has held over metaphysics from the days of Locke to our own time is a thoroughly unconstitutional assumption of authority. Thus in a certain respect I am urging a return to the old days of the seventeenth century, to the days of Descartes, Spinoza, and Leibniz, to the method that Kant condemned as dogmatism. Indeed, let us for the sake of brevity accept throughout this essay Kant's terms to indicate the two opposing tendencies. In a narrow and technical meaning of the words, the one tendency is dogmatic and its doctrines are dogmatism,[1]

[1] It should be distinctly understood by the reader that the word dogmatism is used throughout this essay in the narrow and precise sense above defined. The

whereas the teachings of the opposed tendency are criticism and their defenders are criticists.

II

THE THEORY OF KNOWLEDGE IS NOT LOGICALLY FUNDAMENTAL

1. THE first and most prominent tenet of the criticist may be stated thus: Inasmuch as all sciences are cases of knowledge, the science which investigates knowledge as such is fundamental and is, both in fact and by right, a critique of all science. Underlying this doctrine the dogmatist finds, or at least suspects,

name is taken from Kant's Critique of Pure Reason where, whatever else it may mean, it denotes the contradictory of what Kant calls criticism. Unfortunately, the word has other associations in Kant's mind and in the mind of the student of Kant; for it sometimes means specifically the *rationalistic* ontology of the Cartesian and Leibnizian philosophers, whereas neo-realism differs radically from this philosophy. For example, many neo-realists have a strong tendency toward an extreme empiricism and toward an abandonment of the substance-attribute notion as a fundamental notion in metaphysics. Again, neo-realism is epistemological monism; whereas the Cartesians were epistemological dualists, holding to a representative rather than a presentative theory of perception. Finally, a modern dogmatism must of necessity differ from that of the earlier centuries just because it has behind it two centuries of experience with criticism. That is, it is consciously and deliberately dogmatic, whereas the earlier dogmatism was naïve and was therefore easily misled into idealism and its so-called criticism. But in spite of these unfortunate associations I believe the names dogmatism and criticism not only appropriate but enlightening; for I think the neo-realistic movement to be a reaction against the whole enterprise of Locke, Kant, and their followers to get at a fundamental science and not merely against their idealism. That is, neo-realism is not only a different theory of knowledge but, what is more important for metaphysics, a different doctrine as to the place of epistemology in the hierarchy of the sciences. As the names realism and idealism do not point out this difference clearly; I prefer the names dogmatism and criticism, which, if taken in their generic meanings as given by Kant, certainly indicate precisely this difference. Indeed, I would go further; for many contemporary realists are criticists, and it is at least conceivable, no matter how remarkable, that some dogmatists may be idealists. My points may be summed up briefly in the following two sentences. Dogmatism is the contradictory of criticism and defines neo-realism negatively or by exclusion. Chiefly and perhaps only in this respect is neo-realism a return to seventeenth century philosophy.

two errors, on the one hand the assumption of a false theory regarding the nature of logic, and on the other a failure to distinguish between two uses of the word 'knowledge,' that which denotes the act of knowing and that which refers to the truths or propositions known.

2. To many philosophers logic still seems to be a science of the knowing process, or more precisely, a science of the laws of thought, that is, of the rules dictated by the mind's own nature and obeyed by us whenever we think correctly; whereas logic is nothing of the sort. The formulæ of logic are no more laws of thought than is the undulatory theory of light, the Mendelian law of heredity, or for that matter a recipe for cake or even an adding machine. Logic gives us no information in particular regarding the mind or the thinking process; and the logician's views on such subjects might be quite erroneous without leading him astray within his proper field.

3. What then is logic? And I mean by logic not only the results of recent study, which the reader may or may not value highly, but also the ancient doctrines to be found in the writings of Aristotle and in the textbooks of past centuries. The logician offers us, as does any other scientist, information regarding certain terms and their relations. Some of these terms are classes, and some of these relations are the relations obtaining between classes and their members or between one class and other classes. Further, some terms studied in logic are propositions, and propositions are found to be related in a way called implication. Therefore the logician tries to learn the ways in which one proposition can be related by implication to another. Finally, logic deals with a number of fundamentally different sorts of relation. As the logician puts it, some are transitive, some intransitive, some symmetrical, some asymmetrical, and so on.

4. Now in all of this logic is studying something non-mental in the same sense as does mathematics or chemistry. There are in the world about us classes and these classes are related. There are such things as truths and falsehoods and these as such are

related to one another. Moreover, they are so related quite apart from any question of human existence or human thought. "Two plus two equals fourteen," was false fifty million years ago; and the fact that it was false, made the world of that day a very different world from what it would otherwise have been. Thus to the best of our knowledge, the fact that one proposition implies another is not merely a pleasant and playful thought of this man or that, but it is a downright serious matter. It seems to determine what happens in this world about us, it seems to determine whether a man shall die or live, shall be born or not be born, shall be happy or utterly wretched. It seems to determine even whether a solar system shall go along peacefully and evolve habitable planets, or shall go to smash and end in chaos. There may be some sense in which all of these things are mental; that is, some sense in which astronomy, physics, chemistry, biology, geology, and what not other science is a study of human knowledge and of the knowing process. All well and good; if such be the case, no doubt logic is so too; but if in other respects they are not such a study, then neither is logic. The nature of the physical universe depends upon whether or not logic is true as genuinely as it does upon the truth of this or that physical theory. Therefore the logician has a right to say: "When I study classes and their relations, or propositions and their relations, I am studying aspects of the world about me as truly as does the physicist when he studies the nature of light, heat, gravity, and electricity."

5. "But," you ask, "is not logic the science or art of correct reasoning? And is not reasoning a mental process?" No, logic is not. Of course there is such a study or art, and of course there is excellent authority for the use of the word logic as the name of this art. But the art called logic, when examined critically from the point of view of the pure sciences, is a conglomerate of many sciences applied to solving one type of practical problem. In short, it is the application of information from many scientific sources. It draws on pure logic, it draws on psychology, it

draws on mathematics; indeed, I decline to mention the pure science upon which it should not draw.

6. Yet it may be protested, "In all our reasoning we use logic, therefore logic is the science of reasoning." Such an argument is fallacious, and what is more, its conclusion is false. To make a long story short, we must define what is meant in this argument by the word 'use,' and we must decline from the start to reckon *by percentage of use* whether or not this or that science or part of a science is a study of the knowing process. Do we in our reasoning *use* logic in a different way from that in which we use mathematics, physics, chemistry, or astronomy? Now if we do not, and if the only difference is that we use *some parts* of logic every time we reason, why should we then draw the line at one hundred per cent (really a lesser per cent for parts of logic may be used quite infrequently and we should take the average) and not at forty-five per cent? Evidently the man who believes logic to be a science of reasoning is not thinking of percentage of use. Rather he holds that the *use* our reasoning makes of logic is different from the use our minds make of mathematics or chemistry. It is then all a question of the meaning of the word *use*.

How do we use logic in our reasoning? I reply, in the same way in which we use physics. How is that? We make use of the laws or propositions of physics as *premises* or as *formulæ for whose variables we substitute constants*. Let me illustrate. I want to know how far a projectile will go if it leaves the ground at a given angle and at a given velocity. Physics gives me formulæ from which, if I use as premises along with the given conditions also used as premises, I can infer the proposition which I wish to know. Again, mathematics tells me $(a + b)^2 = a^2 + 2ab + b^2$. I want to know the square of 27. How then do I use (*in my reasoning*) this information? We substitute, let us say, for a 20 and for b 7; that is, we substitute constants for the variables in the equation. Thus $(20 + 7)^2 = 400 + 280 + 49 = 729$. Hence *to use* physics or any other exact or natural science *in our reasoning* is to adopt its propositions as premises. Now is the same thing

true when we *use* logic *in our reasoning?* It is. The results or truths of logic are assertions, as we have said, regarding the relations of classes and propositions. Further, these results of logic are usually formulæ, that is, propositions whose terms are variables. Thus, roughly stated, if *any* class a is contained in another class b, and if this class b in turn is contained in a third class c, then the first class a is contained in the third class c; or more precisely stated, $[(a < b)(b < c)]$ implies $(a < c)$, where a, b, c, represent any class. Here is a logical formula taken from the logic of classes. How do we use it in our reasoning? Assuming it as true, we substitute constants for its variables. For example, if this formula is true, and if the class men is included in the class mortals, and if Socrates is a member of the class men, then Socrates is a member of the class mortals. Every student will agree that logic is not concerned with Socrates or man but with something more general. But notice what this means: Logic is concerned with *variables.* It gives us *formulæ.* If so, and if we use logic always in our reasoning, we shall find, no matter what instance of reasoning we may take instead of the trite example aforegiven, that some formula is presupposed by it. That a formula is presupposed means that it is assumed as a premise which we have used by substituting constants in place of its variables. In short, to use logic means to substitute in a formula constants for the variables of the formula and then to assert one of the resulting propositions, namely, the one found in that part of the formula called the conclusion. But this, we know, is precisely what we do when we use physical formulæ in our reasoning.

7. The mere fact that logical formulæ are used so widely, the mere fact that physics itself presupposes parts of logic, does not alter the essential nature of the use. It would be perhaps a more serious matter to have logic false than to have the undulatory theory of light false; but of what true proposition can we not say something similar? Practical importance then does not determine whether or not a science is actually a study of beasts, rocks, stars, or ocean currents; for that depends upon the terms to be

found in the propositions constituting the science. So too in the case of logic, whether or not logic is a study of the knowing process depends upon what terms are found in its propositions. Now these terms are as non-mental as are rocks and ocean currents.[1] Hence, one must draw the general conclusion: Logic is not a science of the knowing process. Its principles and formulæ are not laws of thought. Its terms and relations are as clearly distinct from those of thought as are the terms and relations of physics.

8. It has been stated above that a second error also is believed by the dogmatist to underly the criticist's assertion that the science which investigates knowledge as such is fundamental, to wit, the criticist fails to distinguish between two uses of the word 'knowledge': first, that which denotes the act of knowing, the natural event called knowing, or 'knowing in the making'; and secondly, that which refers to the truths or propositions known, the systems of propositions called, for example, the sciences. As a consequence of this neglect, the dogmatist believes, the criticist ascribes to sciences, for instance to mathematics, that which is true only of the *student* of mathematics, as such a student learns, thinks, or makes discoveries in the course of his mathematical research.

Hundreds of things may be true of this or that mathematician at work studying his science, which are not true of mathematics. He may be dependent upon visual pictures in his geometrical research. He may make an important discovery by mere accident or a happy and brilliant intuition. He may be more successful studying while he smokes than when he is not smoking. He may be more inventive and mentally acute mornings and

[1] Of course any such discussion can be a dispute about mere words, but we deny that this is true of the foregoing. Logic is an ancient science, and it is possible, without any idle disputation, to ascertain what its nature is. Now, as is the case in the human history of almost every science, the student has not always seen clearly what the nature of his science is. Thus we are far better able to-day to define logic than was Aristotle in his time, precisely as we are better able to define geometry than was Euclid. If to this the reply is made, "Any attempt to define a science is either a purely verbal matter or an idle matter," I can but reply, it seems to me just the opposite. To be able to define a science rigorously and correctly is to pass a most important and significant milestone in the course of human history.

nights than he is afternoons. In short, health, fatigue, fresh air, digestion, season of the year, time of day, inborn mental and physical traits, previous training, praise and fame, example and competition, ideals and curiosity, and what not else may all be factors in determining what he learns, what he discovers, and the rigor of his demonstration. But what has all this to do with mathematics? Is it part of mathematics? Would any sane man put into a rigorous mathematical demonstration memoranda regarding his health, the time of day, and the state of the weather, his ambitions, and his mental imagery? Yet why not? Clearly because such information is not mathematics. True, he might state in a book on geometry the date when a proposition was discovered and first proved, and who the discoverer was: but if he did so, it would not add one whit to the mathematical information he was giving the reader; and if he failed to do so, it would not lessen either the accuracy of the geometrical doctrine or the rigor of its demonstration.

9. In other words, propositions, and they alone constitute a science, are not events in time. They do not come into being or get created by the student who first learns that they are true. They are discovered and not made, as truly as was the American continent discovered and not made by the explorers of the fifteenth and sixteenth centuries. Thus mathematics as a system of true propositions has been in part discovered by man; but this discovery or that failure to discover did not add or subtract anything to or from mathematics, did not make any of its propositions either true or false, did not alter it in any way. Two plus two equaled four, and the sum of the angles of a plane triangle in Euclidian space equaled two right angles when the earth was a molten mass, as truly as they do to-day. Mathematics and any other science is what it is for only two reasons: because certain propositions are true and others false, and because one proposition implies certain propositions and does not imply certain others. Thus if a physicist is asked why it is true that the cables of a suspension bridge in hanging from tower to tower

formed a catenary before the rest of the bridge was constructed, and now when the bridge is completed form a parabola, he will not talk in reply about the knowing process, but he will show that these propositions are true because other propositions are true (that is, certain propositions in elementary mathematics and mechanics) and because these propositions imply the state of affairs mentioned (that is, the propositions asserted) in the question.[1]

At this the nominalistic reader may rise in scorn and protest: "You are confusing mere abstractions with real things. You are taking the words of men and treating them as timeless supernatural entities, dwelling in a Platonic world of pure thought. Apart from the thoughts of men, mathematics, or any other science, has no more existence than has the man in the moon." To this I reply: I have no desire either to refute or to support nominalism in what I have said; but I do wish the nominalist to understand me, and I fear that up to this point he may not have done so. He certainly has not if the words which I have just put in his mouth are truly there. Of course mathematics as a timeless system of true propositions does not exist in the sense that the Rocky Mountains or the Atlantic Ocean exists; but on the other hand, when man discovers a mathematical truth, he truly discovers it as he truly discovers and does not create the distant islands of the South Seas. Hence, whatever may be the full sense of the statement, mathematics has its being apart from man's thought, it will include or imply two propositions at least: first, mathematics

[1] All this does not mean that the word 'science' has not the same ambiguity as has the word 'knowledge.' Quite the contrary, the word 'science' means two distinct things: on the one hand, a part of human achievement, a thing that has had a growth and a history, a thing that can prosper or perish, a thing that depends upon man for its existence; on the other hand, a collection of propositions that do not exist in time, that are discovered by man but in no way are made or altered by this discovery, that would subsist and would be true or false even had man never existed. Such is usage, and it would be in vain as well as unnecessary to attempt to avoid this custom. Hence throughout this essay I shall use the word 'science' in both senses, speaking for example of the history and growth of science as well as of the propositions of science. Which is the intended meaning in each case the context should always make quite clear.

does not depend *for its truth* upon our minds any more or in any other sense than does the existence of the North Pole; and secondly, the historical origin of man's knowledge of mathematics is in no sense mathematical, nor does mathematics presuppose logically any propositions regarding man, his knowing process, or in general any proposition constituting a theory of knowledge. If mathematics is true, it is so for the same reason that any other proposition in all reality is true, which seems to mean the truism, it is true because reality is just what reality is.[1] Again, if mathematics is true to-day, it always was true and always will be true, because we mean by truth something in no way a function of the time at which it is asserted by the knower. Mathematics, then, or any other science, does indeed not exist; but it is, has being, subsists, and as such it is a timeless system of propositions.[2]

[1] That is, the question why a proposition is true can mean one of two things, the first of which admits of an answer and the second does not. A proposition is true because some other proposition is true and implies it. But why is that other proposition true, why ultimately is anything true that is true? Well, the question is as absurd as the question, Why is red red? The question asks us to go beyond the ultimate, and its absurdity shows us that truth is ultimate and as such is only to be discovered, and is not to be ascertained by any device which would make it explicable.

[2] I hope that the pragmatist reader also will not misunderstand the foregoing statements. Of course, knowing is a natural event and as such its nature is to be ascertained by a frank, unprejudiced study of fact and not by any dialectic. Or, as I should prefer to put it, logic throws no light upon the nature of the knowing process except in the sense in which it is true that logic throws light also upon the nature of the rocks, the ocean currents, or anything else that exists or takes place. Therefore, in as far as the pragmatist is against that type of epistemology which is chiefly dialectic, I am heartily in sympathy with him. But as he is liable to suspect anything which sounds like dialectic, he will no doubt think the foregoing statements at best disguised error. If so, I believe either he fails to understand me or he mistakes quite the nature of logic. If he rightly permits the mathematician to go ahead with his mathematics undisturbed, why should he interfere with the formal logician? The whole preceding problem is strictly and solely one of logical analysis. Formal logic defines the relation logical priority, and holding to that definition I have urged that the theory of knowledge is not logically prior to logic or to physics. Questions of fact are in no way involved. If they were, of course the foregoing argument begs the question. If the problem is solely one of logical analysis, as I claim it to be, then either there is no such rightful procedure as logical analysis, or I must

10. If then logic is not a science of the knowing process, and if most of the sciences do not presuppose any information regarding the knowing process, what is the place of the science of knowledge relatively to that of other sciences? This question will be answered more fully later on; but for the present it suffices to say, the knowing process, the act of discovery, man's reasoning and the conditions of this reasoning, are *natural events*. They take place at definable moments; and in all essential respects they are like other natural events which lend themselves to our study and research. As a consequence, the science of knowledge instead of being *sui generis*, and instead of occupying an exceptional position relatively to the other sciences, is simply one of the special sciences. Its implications may or may not be wide reaching, a matter to be ascertained only by a study of the facts and certainly not by any *a priori* consideration of the field of the science.

III

THE LOGICAL POSITION, RELATIVELY TO THE OTHER SCIENCES OF THE THEORY OF KNOWLEDGE AND, IN PARTICULAR, OF THE PROBLEM OF THE POSSIBILITY OF KNOWLEDGE

1. AGAINST all of the foregoing statements some criticists will immediately urge: "Logic, as any other science, has to assume the possibility of knowing and, in particular, the possibility of knowing matters logical. Hence, there must be a science prior to all others, even to logic, which shows the possibility of knowing. Or if logic is indeed fundamental and therefore has to be excepted from this axiomatic statement, then it alone is prior to the science of the possibility of knowledge, but all other sciences are subsequent and dependent."

be permitted to pursue my enterprise undisturbed as long as I am not surreptitiously introducing information unattainable by logical analysis, and as long as I keep to information so commonplace and so much a matter of course that to prove it true by a fresh investigation of fact would be needless.

Let us examine the extreme position first, "even logic presupposes the conclusions of this ultimate science, the science whose subject matter is the possibility of knowledge." How is the criticist to avoid here a vicious circle? It will be his business to show that knowledge is possible and to show the conditions that make knowledge possible, yet in doing this he too will have to use premises and among these will be one asserting that his investigation as an instance of knowing is possible. Now if it is permissible for the criticist to make this assumption in the pursuit of *his* research, why may it not be permissible for the logician to do the same in his study, and similarly any other scientist? In other words, if it is the business of Kant in his 'Critique of Pure Reason' to show how mathematics is possible, whose business is it to show how the 'Critique of Pure Reason' itself is possible? Moreover, if there were such an ultimate science, it would presuppose parts of logic in the course of its demonstrations, and therefore the criticist would be in the uncomfortable position of assuming the possibility of logic in order to prove the possibility of logic.

2. The extreme position then involves a vicious circle and is untenable; but is not the other position also untenable? That is, if the logician and the criticist may rightly assume the possibility of discovering and demonstrating the propositions of their sciences, for what possible reason do they forbid the mathematician, the physicist, the biologist, the historian, or any one else from doing likewise in other branches of scientific or popular research? Do they do so by showing that it is less difficult to read and understand Kant's 'Critique' than to learn how to light a fire or to shoot an arrow? If so, our savage ancestors must have had remarkable intellects. Do they do so by showing that the mathematician and the astronomer had to wait until the eighteenth century of our era to get their doctrines well established? If so, history proves the contrary. Do they do so by showing that the premises upon which logic and criticism rest are self-evident, and that their doctrine is infallible? Even Kant admits the infallibility, nay, *explicitly bases* his views upon the *assumed* in-

fallibility, of mathematics and mechanics. Do they do so by showing that the science of the possibility of knowledge presupposes only the results of logical research and not the results of any other science? That is, do they show that they are not guilty of a similar vicious circle here in respect to some of the other sciences, as they were shown to be in respect to logic; for perhaps they presuppose the possibility of certain sciences in order to prove the possibility of these same sciences? Indeed, I shall give reasons later for thinking that they do precisely this. Finally, if none of these implied objections be true; do they show that we are so much better able to observe directly and accurately the facts involved in knowing that there is no need to have a science of the possibility of knowing how we know and how we can know, whereas it is necessary to have such a science to show that we can know the trees, the birds, the rocks, the earth, and the stars? Some criticists no doubt would try to show this; but in the sequel I shall endeavor to prove that their theory also assumes the possibility of observing precisely these out-of-door things and so make evident that they also assume the possibility of such knowledge in order to demonstrate its possibility.

3. To put it affirmatively, I am convinced that either the possibility of knowledge is not the premise of any science, or it is the premise of all sciences and the conclusion of none; and of these alternatives I believe that the former alone is true. I argue thus: The word 'possibility' contains the ambiguity previously referred to; that is, either it means the possibility of man's discovering and demonstrating science, or it means logical possibility. The former, which seems to be the meaning in the mind of the criticist, lies, as we have seen, entirely without the various sciences, and has nothing to do either with their content or with their validity. Mathematics certainly has no premise, "mathematics is possible knowledge." On the other hand, if logical possibility be meant, it can refer only to the question, whether or not the premises from which the results of a given science follow are true. In other words, *what a science assumes is not the possibility*

of its being known, but the truth of its premises; and, this is even more to the point, what you and I assume in *believing* this or that doctrine to be true, for example, in believing that light is due to an undulating motion in the ether, *is not the possibility of knowing such matters but again the truth of the premises upon which our particular demonstration rests.* Hence the statement, "it is impossible for us to know such propositions," could mean only, "we cannot know them to be true"; but if we cannot know them to be true, this must be because we cannot know that the premises are true, from which they follow. In short, in believing the sciences we assume their premises to be true, and this is our only assumption.

4. But, you retort, "Ought we not to ascertain whether or not these premises are true?" Yes, by all means; but to assume the possibility or even to know the possibility of our doing so, will not help us actually to get the information: for either we can get it or we cannot; and if we can, we do, and if we cannot, we do not. "Yes, but there is a further question which remains entirely unanswered," you may reply. "In accepting these premises are we not able to state which ones are merely assumed to be true and which ones are true? If so, then we must know when we are merely assuming and when we really know. But how can we tell the difference unless there be some ultimate science which gives us infallible criteria by which ignorance can be distinguished from knowledge and by which the field of possible knowledge is marked off forever from that of impossible knowledge? Of course you can take the position that we always assume and never genuinely know;[1] but, if you do, why do you believe some things and not others? Why do you not believe everything? Is your choice purely whim? If it is not, there must be some infallible criterion to guide you at least in making assumptions; even the pragmatist seems to have that much."

Well, some dogmatists admit the force of this argument, but they

[1] I confess that some dogmatists seem to take this position; and if they do, I believe that in their case the criticist has the better of the argument.

draw a quite different conclusion. Let us grant that a thorough logical analysis of any man's knowledge shows the premises of that knowledge to be divided into two classes; first, premises that are merely assumed and therefore are tentative, and, secondly, premises that are not tentative, but are out-and-out fact. Otherwise expressed, let us admit that some premises are *assumed* to be true, and that some are *known* (or *perceived*) to be true.[1] What follows? Does it follow that we cannot know a proposition to be true without assuming the possibility of this knowledge, or, in other words, without assuming that we know that we know it to be true? If so, we have an infinite regress on our hands; and it would be far better frankly to admit that we do not know anything, but assume everything we assert.[2] But this does not follow. If we do indeed perceive, or know some propositions to be true, then this knowledge is ultimate, and no further assumptions, premises, or explanations lie logically behind it. If you still persist in asking how it is possible to perceive a truth, I have to reply, your question is as absurd as the questions: Why is hard, hard? Why is blue, blue? I perceive it, and that ends the matter. Moreover, this must be the criticist's own real position; for either his epistemology, as an ultimate science, is mere assumption, or it is based at least in part upon perceived truth. If the latter, he has either to admit that this calls for further investigation, or to affirm with me that it is ultimate and no investigation can go logically behind it.

Even many realists may think that I go too far in asserting this extreme dogmatism. They may urge: "Unless knowledge is possible, you cannot know, that is, knowing presupposes the possibility of knowing. Again, if as a realist you maintain that we perceive the physical world truly as an extra-mental world, you

[1] Cf. Stout, G. F. Immediacy, Mediacy, and Coherence. *Mind*, 1908, N. S., 17, 20.

[2] As far as I can see, this is the position of those who hold to the organic or monistic theory of truth. Cf. Russell, B. Philosophical Essays, "The Monistic Theory of Truth"; also Stout, *loc. cit.*

thereby presuppose some theory of perception, which, if true, would make such an act possible. In short, unless realism is true, we do not perceive an extra-mental world ; or, our perceiving an extra-mental world presupposes realism." Such opinions seem to me to indicate fallacious reasoning and to be an invalid objection to my 'extreme' dogmatism. Knowing as an *event* has indeed its necessary conditions. Therefore when I assert that *knowing is taking place I do presuppose all the necessary conditions of knowing*, precisely as when I assert that water is boiling I assert implicitly all the necessary conditions of water boiling. Of course, but all of this is beside the issue. The issue is this: when I assert that water is boiling, am I *ipso facto* asserting that *I am knowing* that water is boiling? No, for "water is boiling" and "I perceive that water is boiling" are two different propositions and have different presuppositions. The former proposition has no presuppositions, as far as physical science informs me, regarding the knowing process or its possibility ; whereas the latter proposition has such presuppositions. Now I urge that if this last statement were not true, the science of the possibility of knowing would be an unavoidable vicious circle. As any other science, it too has its presuppositions, and has, I suppose, crucial tests for its various theories. Hence the epistemologist is no better off than is the chemist, for as the chemist he must assume postulates and observe facts in order to discover and to demonstrate his theory of the possibility of knowledge. If in so doing he assumes the possibility of knowing (as he claims the chemist does), then he assumes the possibility of knowing in order to prove that knowing is possible. In short, we have logically to start somewhere, and I maintain that it is a matter verifiable by ordinary empirical study that the scientific investigator does not start with propositions regarding the knowing process. I do indeed believe that we start with postulates and *presuppositions*, but, I add, we start also with *perceived* truths. Now, a perceived truth in no way presupposes a theory of any sort or kind. It is logically ultimate, it is a crucial test of our theories and of *their presuppositions*. Even a theory of the possibility of knowing presupposes its crucial tests ;

whereas if the crucial tests themselves presuppose the theory, they are not crucial tests. To be sure, there is one philosopher for whom this argument is utterly inadequate, namely, the believer in the monistic or organic theory of truth. He really denies that there is any such relation as logical priority ; and I have to confess that I know no way of refuting the theory of a man who rejects formal logic and holds consistently to this rejection. Fortunately, however, the monist is never a consistent monist, *for he argues;* and it is, I believe, possible to reduce his monism to the absurdity pointed out by Mr. Russell in the essay to which I have referred.

Here the realistic reader may again protest: "The dogmatist, no matter where he starts logically, will sooner or later come to the problems of the theory of knowledge; and he must solve these epistemological problems in such a manner that his solution will be consistent with the solution of his logically prior problems. Therefore in his solution of logically prior problems he has already indicated implicitly a part at least of his future epistemological theory. If so, he really starts with an epistemological theory." Yes, but only in the sense in which I can maintain that the chemist starts with a biological theory. His chemistry has no doubt shut out certain conceivable biological hypotheses which presuppose that present-day chemistry is false. So, no doubt, logic, mathematics, physics, and biology shut out certain epistemological theories.[1] Yet notice this is so, *not because they presuppose any theory of knowing, but because our theory of knowing presupposes them.* It is utterly idle to work out a theory of knowing which presupposes that the exact sciences are false, unless we are prepared to go back to intellectual savagedom. In short, we have to start logically somewhere, but this 'somewhere' is not with a theory of knowing ; and in so starting, we do indeed shut out all theories of knowing which contradict whatever constitutes the ultimate crucial tests of our theories. My own conviction is *perception is that ultimate crucial test,* and as such it does not presup-

[1] Personally I believe that they shut out idealism.

pose its own possibility. *It simply is;* and the man who questions it assumes it in order to do the questioning.

5. If all of this be so, what follows? In case our beliefs are entirely built upon assumptions, then our whole question becomes: Are the assumptions of epistemology more nearly fundamental than those of other sciences; in other words, what is the logical position of epistemology among the sciences? Whereas, in case there are perceived truths, then either epistemology has to show that it has a monopoly of these perceived truths and that it is in its assumptions logically independent of the sciences, or it has to admit that other sciences have no need of its good offices. But this again is merely to say, epistemology has to show that it is logically prior to the other sciences. That is, our whole question regarding the science of the possibility of knowledge reduces to the question, What is the logical position of epistemology among the sciences, and, in particular, what is the logical position of that branch of it which deals with the conditions of knowledge? As I have already shown that epistemology presupposes logic, my question may be restated as the two following problems: What is the logical position of the theory of knowledge relatively to the sciences other than logic? and, in particular, What is the logical position of that branch of epistemology which investigates the possibility of knowledge?

6. The answer to the first question asserts: not only is the theory of knowledge subsequent to logic, but it is subsequent also to some of the special sciences, such as physics and biology. The knowing process as a natural event is conditioned by many factors, the mind's physical and social environment on the one hand, and the needs, the structure, and the health of the bodily organism on the other hand. No explanation of knowledge has ever been given that ignored totally what we know regarding these factors.

In opposition to this, no one will claim that an epistemology can be deduced from the principles and formulæ of formal logic alone. Surely more data must be allowed the investigator. But

what data? Would it be sufficient that the epistemologist be furnished in addition with the sciences themselves as systems of propositions in which various doctrines are demonstrated? If so, his task would be to show precisely what are the logical foundations of the sciences. That is to say, he would state rigorously the ultimate premises presupposed in them, he would define the fundamental notions as far as they are definable and point out the ones that he finds himself unable to define. It is true that many an epistemologist, *e.g.* Kant, has attempted to solve some of these problems, which fall strictly within the field above defined; but is this epistemology? It is not, for as we have seen it would exclude a study of the knowing process, of the factors entering into knowledge, and of the growth of knowledge and of many other problems usually accredited to the theory of knowledge.[1]

Well then, would he have sufficient data if he got all his other information by mere introspection, if he became an expert introspective psychologist of the knowing process? As such an investigator he would watch our knowing in the making; and he would describe for us the facts precisely as he directly observes them, for he would not derive them from physiology, physics, or any other science. In this case he could not offer us any explanation of these facts, or give us any hint as to what part they play in man's life, as to what factors influence the knowing process from without, as to what goal human cognition is probably heading toward, as to what limitations are set to the field

[1] Of course if the reader chooses to limit thus his own use of the word, he may have a right to do so; but as the names metaphysics and epistemology are employed in this essay, the problem of the purely logical foundations of the sciences falls entirely within metaphysics and entirely without epistemology. There is indeed danger of idle dispute regarding the proper use of these words; for recent books entitled theory of knowledge and the great classic writings of the past two hundred and fifty years often contain matter that is both metaphysical and epistemological as I define these terms. This difficulty, however, can and ought to be avoided, for the nomenclature lies quite beyond the purpose of my essay; whereas the specific problems and the logical relations of their solutions are all-important. Therefore the conclusion follows, as the word epistemology is here defined, that the investigator in that field must have other or additional data.

of possible knowledge. Indeed, some philosophers would urge that he could not tell us about anybody's knowing process except his own; and other philosophers would maintain that he could do even this only through outside information regarding his own life and its environment. Evidently, the science in which we are interested should not be thus hedged in; for, as we see, the chief problems regarding the knowing process, its nature, its conditions, its growth, its goal, and its limitations would have to be excluded.

If, then, we are to require all this knowledge from the epistemologist, what sources of information must be open to him? Clearly, almost everything that modern knowledge can put at his disposal. He must know all that biology and, in particular, physiology can tell him of the relation between man's body, its functions, and its origin on the one hand, and man's knowledge on the other hand. He must know of the functional relationship between man's environment, both physical and social, and man's knowledge, between our instinctive impulses, needs, and purposes and our knowledge. He must know the history of our knowledge and of our sciences from prehistoric days to our own time, in order to learn the course of scientific evolution and the factors which determine this course. Likewise, he must know the development of knowledge in the individual and the factors which determine it. In short, besides contributions from biology and physiology, he will need all the help psychology, social psychology, physics, political and social history, and the history of science can give him.

Thus, one must answer our question regarding the logical position of epistemology among the sciences somewhat as follows: Epistemology is not logically fundamental; on the contrary, it presupposes logically the results of many of the special sciences. If these results are false, so also, as far as we can tell, is epistemology; and without these results granted as data the epistemologist would be unable to solve most, if not all, the problems belonging properly within the field of his science.

7. Much the same is true of our second problem, the problem we face when within epistemology we try to ascertain what knowledge is possible and how it is possible. Man has never succeeded in getting trustworthy information on this subject except empirically; for in case after case man has been able to discover what scholars in an earlier age pronounced unknowable, or would have pronounced unknowable if the question had so much as entered their minds. This has been true of what man has learned, precisely as a similar truth holds regarding what he has proved himself able to do in spite of an earlier belief that the deed was impossible. We have been able to see the far-distant and the exceeding small where centuries ago such vision would have seemed impossible. We have been able to study the chemistry and the temperature of the stars, we can weigh the planets, we can tell with complete accuracy the area of curved figures whose sides stretch out to infinity. In short, precisely as our wireless telegraph and telephone, our X-ray photographs, and our trolley cars would seem miracles to Galileo, could we suddenly usher him from the seventeenth century into the twentieth; so, too, what has proved possible for man to learn since his day would seem to him miraculous.

It will be objected that all such trite instances and the whole argument which appeals to them are entirely beside the issue. "What within certain large areas will prove possible or impossible can of course be learned only inductively; and Galileo might well have been clever enough to refuse to answer questions regarding such matters. But Galileo was able, and as able as we, to study directly the nature and conditions of knowledge and learn the ultimate boundary within which knowledge must keep. Thus, Galileo could not predict the future of physical and astronomical science nor in any way give the details of what was to prove possible within this general field which as a division of science he knew to be possible; but he could have shown that there are other problems essentially unlike any man has ever solved, and that man lacks totally the kind of mind which could solve these prob-

lems. Take as an illustration a doctrine of Kant. Man has a sensuous intuition only. He lacks an intellectual intuition; and since there are problems which could be solved only by such a higher faculty, man must be content to let these problems remain forever unsolved. Thus man cannot experience God, just because God is not sensuous. Again, man cannot trace back the world to an origin or know it in its totality, because from the nature of the mind such is not a possible experience. The two types of problem are fundamentally distinct, and the methods of their solution also are fundamentally different." Thus the criticist agrees with the dogmatist that in the one case only an inductive study of the history and status of the problems before the scientist could enable us to predict with any probability what will or will not prove possible knowledge: whereas, in the other case, he maintains that a direct study of the nature of knowledge can show that some problems are and some are not solvable. We must accordingly turn our attention to the latter case to ascertain precisely what constitutes this branch of the theory of knowledge.

What is this study of knowledge which can reveal the field of possible knowledge and its bounds? If the question means by a study of knowledge a study of the knowing process and of the factors conditioning it, then evidently we are referred again to one of the special sciences, to the empirical study of the origin and growth and function of knowledge in the individual and in the race. This study is not a fundamental or peculiar science. Let me take Kant's doctrine, not as proof of this, but as an illustration of what I mean. In the first place, his 'Critique' assumes that we possess certain types of information, and it endeavors to show that the mind must possess certain faculties in order to make this knowledge possible. Kant's actual argument, to be sure, confuses this with some other problems; but in the main his reasoning shows clearly that he is presupposing a definite psychological theory and that his problem introduces only what lends itself to inductive and empirical research. In short, it is psychological. In the second place, Kant's 'Critique,' holding to a certain theory

of existence and to a certain theory of the knowing process, deduces from them the impossibility of our knowing a supersensuous world or the sensuous world in its totality. In short, his results presuppose two things which make his theory far from logically ultimate, a theory of existence and a psychology of cognition. It is true that there is far more than this involved in Kant's 'Critique'; but the moment we consider these further problems, we pass over to a radically different sort of study of knowledge and its possibility, for this study is not a study of the knowing process proper, but of *that which is known*, the evidence upon which it is based, and the postulates or axioms which it assumes. Thus to return to our question, if we examine actual specimens of the science of the possibility of knowledge, the science that the criticist assures us is ultimate and *sui generis*, we find only two things: first, psychology and cognate branches of science, and secondly, a study of the logical foundations of our knowledge. Either we find that the criticist is analyzing the sciences *logically* to ascertain what data, or facts, what postulates or principles, and what logical formulæ make them possible; or we are introduced anew to the *historical* and *empirical* study of the origin and growth of knowledge in the individual and in the race. If there is some further problem or some further method, examination of the criticist's work fails to reveal it; and the dogmatist, in despair lest he has overlooked it, can only beg that it be produced.

I am well aware that the criticist replies to all such statements: "You do not understand criticism. It differs from other epistemologies precisely in its keeping psychology and epistemology distinct. The mind, and the knowing which it studies, are not the personal but the over-personal. Of course psychology is one of the special sciences. This we too, not only admit, but teach, for psychology itself presupposes epistemology." Yes indeed, it is perfectly clear what your intentions are, and that if epistemology would only be what you want it to be, it would indeed be fundamental to psychology and in no way itself psychological.

But the question is not one of definition or of good intention. The question is, What is the epistemology you offer mankind? I know what you want to do, but do you do it? Produce the epistemology that does not presuppose psychology. Produce the epistemology that is fundamental. My point is, *the deed has never been done and cannot be done;* and therefore that there is but one refutation to dogmatism, to wit, *the production of an epistemology that is at once truly fundamental and not a vicious circle.* Most dogmatists of to-day were brought up in the Kantian philosophy. They had explained to them the nature of criticism, its fundamental character, and its difference from psychology. What is more, they believed what they were taught. But later they began to examine more critically the epistemology actually offered them and found it not fundamental but saturated with scientific prejudices of one sort or another, found it distinctly a doctrine of the day and generation of its author, found it, in short, a vicious circle. To such a student of philosophy it is not enough to reiterate, epistemology is such and such. There is but one thing to do, that is, to produce the epistemology which is in accord with the criticist's definition.

8. If the dogmatist is right in his conviction that the summary aforegiven states fully the criticist's problem of the possibility of knowledge, then the following seems to him a sufficient refutation. As to the data, or facts open to possible observation, history shows that human prediction is quite fallible, especially where new methods and new instruments have come to man's aid. As to our sensory and intellectual limitations, only the elaborate empirical and inductive studies of the psychologist can give us precise information; and psychology is one of the special sciences posterior to several others. As to the postulates and principles of science, history shows that these have often changed, and experience has proved that not only in chemistry and physics, but even in mathematics, the method of trial and error has underlain man's discovery and selection of these fundamental propositions. Moreover, prediction here too has been decidedly fallible,

and no evidence whatsoever is forthcoming that any *a priori* method of discovery will ascertain what principles will be sufficient, not to mention which ones will prove necessary or even that any will prove necessary. The history of philosophical mathematics from Kant's time until to-day ought to banish from any philosopher's mind the belief that the theory of knowledge can reveal with certainty the necessary principles for the demonstrations of the future scientist. Even the logician should learn from past experience that many an accepted logical principle may in the future prove to require radical revision, or at least may be capable of further analysis or better formulation. Thus the science of the possibility of knowledge is not *sui generis*, but is empirical and inductive, as are most other sciences. The information that it offers carries with it no categorical imperative to the special scientist to be guided thereby; for he is precisely the one that in the past has successfully rebelled against the older or traditional principles, and that has been the discoverer of the new ones which take their place. Thus our general conclusion, I believe, must stand: *The theory of knowledge is not logically fundamental to the sciences, and it cannot by any direct or a priori study of the knowing process ascertain the possible field or the limits of the sciences.*

IV

EPISTEMOLOGY DOES NOT GIVE, BUT PRESUPPOSES, A THEORY OF REALITY

1. We have next to inquire whether or not the theory of knowledge can give us general existential truths revealing the outlines of reality or constituting a theory of reality. By maintaining that the fundamental postulates, or principles of science, are laws of thought, and that these laws of thought can be discovered by the student of knowledge, transcendentalism claims to be able to show *a priori* the most general features of the existent world. Thus according to the familiar doctrine of Kant, the world we

experience is determined in part by the experiencing mind, for the mind's nature gives to whatever we experience its form. In this way he explains that the world which we experience is a world in space and time and a world ruled by causal law. Or, as we might put it to-day: were our minds of a different nature, the world which we should then perceive and know might be quite other than our present world; for example, it might be a spaceless world, or if a spatial world, it might have four dimensions; or again, if it were spatial and had three dimensions, it might none the less be a world in which parallel lines meet or in which the sum of the angles of a triangle are more or less than two right angles. In short, we owe it to the nature of our mind that in this world the sum of the angles of a plane triangle equals two right angles. Hence, if our modern mathematicians can deduce for us various geometries other than the familiar one of Euclid, the transcendentalist can show us from the nature of our experience which one of them all is the one that truly holds in the world about us. The others may be perfectly logical, that is, true if their premises are true; but the epistemologist shows that their premises are not true. Moreover, to do this he does not have to go to nature, nor does he have to experiment, measure, and observe until he finds some facts inconsistent with all but one of the geometries; rather, he can employ the far easier method already described.[1]

Besides the Kantian and more closely related doctrines I wish to include under the term transcendentalism the neo-Hegelian theory of knowledge. Thus we are told by some Hegelians: Reality is experience; and reality is at least to some degree man's experience, for though our experience falls short of completeness and perfection, and though on this account we must look beyond man's mind for the perfect experience of reality, still man's experience reveals the essential nature of that perfect experience. Our experience develops, and the course of its development reveals the goal whither it tends. That goal is the experience of the abso-

[1] Cf. as a recent example of Kantian transcendentalism, Bauch, Bruno, *Studien zur Philosophie der exakten Wissenschaften*, 108–141.

lute or universal mind, and this experience is absolute reality. Briefly expressed, it is the business of the epistemologist to ascertain from our knowledge the general nature of a perfect knowledge, and from that to infer the general nature of absolute reality.

Thus from the nature of our knowledge it can be shown that no self-contradictory experience is true, and from this it can be inferred infallibly that reality is self-consistent. This example is perhaps not so startling to the uninitiated as some others, because it happens that no sane man believes that two contradictory propositions can both be true. Yet for our purpose its seeming self-evidence makes it an excellent illustration, for if the dogmatist is in the right, even this argument of transcendentalism is fallacious. Again, that reality is an organic unity, and that this can be deduced from the nature of knowledge is another favorite doctrine of some Hegelians. They argue: As our knowledge grows at one part all other parts undergo change; for even the proposition, two plus two equals four, is not the same truth to you and to me now that it was in our childhood. As our insight into other things mathematical has increased, so too has our insight into this information belonging to childhood; and so the adult's statement, two plus two equals four, is, strictly speaking, not the same as the child's, for it has become a profounder knowledge. Hence if knowledge grows as a totality and never by mere addition of new information to the old, if its various parts are so organically connected that a change anywhere means a change everywhere, and if an increasing and better knowledge always reveals these aspects even more prominently; then a completely true or perfect knowledge must be a perfect organic unity. Hence each so-called part will be what it is because of the whole, and the whole will be what it is because of each part. Now if such a knowledge is the truth, if, in other words, to be true it is compelled to be such a knowledge; then the world also of which it is a perfect knowledge must be an organic unity. The universe must be what it is because of its members, and the members must be what they are because of the whole to which they belong; it cannot be a mere aggregate of in-

dependent parts. Hence, again, if you ask the criticist how he knows this, he does not reply that he has got his information in experimental laboratories, astronomical observatories, or through research in the field; rather, he asserts it follows from the nature of knowledge.

2. How persuasive is the argument, yet is it not utterly fallacious? And if it is fallacious, is it not perhaps the most gigantic case of self-deception of which the human intellect has been guilty? What does the dogmatist teach in opposition? One thing just as dogmatist he does not do, and that is to deny any of the existential propositions of transcendentalism. It may be that the world is a causal system, or it may be that the world is an organic unity. What he does object to is the *means by which the criticist claims to get this information.* He denies that the study of the nature of knowledge can reveal any such theory of reality. Hence he believes that if the criticist's theory of reality be true, it has been logically smuggled into the theory of knowledge and then exhibited afterward as a home product.

In particular the dogmatist's objections will differ somewhat for different types of transcendentalism. Thus the transcendentalism of Kant, and of those who follow him or Hume or Berkeley closely, often asserts less general existential propositions than does the present-day Hegelian transcendentalism. Now these less general existential assertions are easy either to disprove or to trace back to their logical origin in the special sciences; whereas the criticism of such a proposition as the one asserting the world to be an organic unity is more difficult both to formulate and to follow.

Let us consider first the objections to the former type of transcendentalism. The attempts to discover *a priori* the structure of reality within the field of the natural sciences has been, as almost all philosophers admit, most unsuccessful. Who to-day would dare infer from the nature of knowledge the number of the planets in our solar system? Yet is it any the less foolhardy for the philosopher, basing his opinions solely upon his theory of knowledge, to deduce the nature of space and time, to decide whether

mechanics or energetics is in the right, to show that we ought to banish such notions as matter, empty space, and infinity from our existential sciences, to deduce the persistence of force, or to claim that events in nature are not related by causal law? Moreover, where the attempt has been made and where the inference seems to be quite correct, there remains still the question: Was not the method actually used quite other than *a priori?* Did the argument indeed keep quite within the theory of knowledge? The dogmatist believes it did not. Rather he believes the principles were discovered by means of a logical analysis of the scientific views of the day and were afterwards fallaciously shown to be laws of thought or necessary forms of cognition. If this is the course of procedure, transcendentalism follows logically the results of the special sciences, and it certainly is not in a position to dictate to science her principles. Indeed, the position of transcendentalism relatively to the sciences reminds one of the stern father who ordered his small boy to go to bed, and upon the latter's reply, "I won't!" said, "Then don't! I'll be obeyed." A growing science is a hard youngster to discipline, and history shows that the philosophers who have been foolhardy enough to lay down rules for its behavior for all time to come have had later to beat a retreat.

3. To be sure, merely to assert all this is not to prove it; yet to prove it fully would require me to examine with great care many different examples of critical epistemology. This cannot be done here; rather it must suffice to take the greatest of the criticists as our example and ask my questions regarding his work. Kant's 'Critique of Pure Reason' claims to show that certain great existential principles are deducible from the nature of knowledge, for they are forms either of our intuition or of our understanding. In other words, a study of the transcendental activity of the mind will reveal the necessary principles of all existential science.

Whence did Kant get, and by 'get' I mean infer, these great laws of the pure reason? Did he, after genuinely studying the nature of knowledge, derive his information from this study; did he not

rather get his great principles first from his own scientific and metaphysical research and from the science and metaphysics of his day, and then did he not, after reading them into the nature of knowledge, read them out again? My conviction, and the conviction surely of many students of Kant, is that the latter was altogether the case; for is it possible to understand thoroughly the conclusions of Kant's 'Critique of Pure Reason' and be quite ignorant of his scientific and metaphysical environment and precritical growth? Where did he get his phenomenalism, which is a premise and not a conclusion of his argument? Where did he get his psychology, which again is a premise and not a conclusion? Indeed, is not his psychology decidedly faulty, and has it not led him into many epistemological and metaphysical errors? Where did he get his first two antinomies which played such an important part in the development of his transcendentalism? Did they come from a study of knowledge or from a study of science? Moreover, is there not good reason to believe that the Newtonian conception of nature underlies many of his conclusions and often leads him to think of the world of things in themselves as a follower of Locke and Newton would have done?[1] Further, were his conclusions regarding the fallacious character of the arguments for the existence of God genuinely the outcome of his study of the nature of knowledge? Were they not rather the result of a profound study of the arguments themselves? Again, is his doctrine of space and time truly the outcome of a direct and cautious study of our spatial and temporal intuitions? Is it not the other way round? That is, is not his doctrine of space and time an hypothesis logically dependent upon his metaphysical conviction that mathe-

[1] All the statements made in this essay regarding Kant are meant chiefly as illustrations. To those who interpret Kant differently they may seem to call for an extended exposition and proof, which would take us far from our main theme. In justification of most of my views regarding Kant's Critique I shall then have to refer to the excellent study of his theory of knowledge by Prichard. Kant's Theory of Knowledge. Oxford. 1909. Cf. also Erdmann, Benno. La critique Kantienne de la connaissance comme synthèse du rationalisme et de l'empirisme. *Revue de Métaphysique et de Morale.* 1904.

matics can furnish us infallible information regarding the nature of real space and real time? Finally, how about his doctrine of causation? Surely the two following premises underlie logically this part of his epistemology: first, the facts under observation in the natural sciences do not reveal a causal relation or necessary sequence;[1] and secondly, all explanations of nature presuppose logically that the sequence of events in nature is a necessary order. In other words, was Kant truly in doubt about the existential validity of physics until by investigating knowledge he proved to himself that experience would be impossible unless the understanding by a transcendental activity makes nature a causal system; or was not this rather the logical order of his thought? Nature is a causal system, physics is existentially true; what possible theory of knowledge then will account for the fact that although nature does not reveal this causal-nexus to our senses still we know that it is there? Kant became here and there an empiricist; but we must not forget that he grew up and never ceased wholly to be an old-fashioned rationalist, which indicates that he remained a dogmatist in spite of his efforts to be a genuine criticist. In short, his transcendentalism as a whole presupposes his precritical psychology and metaphysics, even though it be true that here and there in his 'Critique' are to be found brilliant studies of the knowing process. If this be so, the Kantian transcendentalism is a vicious circle;[2] and that it is so, is no argument against the greatness of Kant, for even a Kant could not do the impossible.

4. However, the transcendentalist can make his position far more secure by reducing the existential principles he claims to infer from epistemology to a few high generalizations; for ex-

[1] As philosophers of the enlightenment beginning with Locke and Leibniz and ending with Hume and Kant were coming to see more and more clearly.

[2] How apparent and utterly naïve the vicious circle is in the phenomenalism of Karl Pearson! His 'metaphysics of the telephone exchange' is almost explicitly the presupposition instead of the conclusion of his theory of knowledge. In short, by assuming a goodly supply of information regarding the transcendent world he can prove to us that we can know nothing at all about that world!

ample, if he teaches only these two propositions: reality is a self-consistent system, that is, two contradictory existential propositions cannot both be true; and reality is an organic unity. Whence does he infer these propositions, whose truth of course is here in no way under debate?

It is impossible to believe that the former proposition comes from a study of knowledge. In the first place, the epistemologist believed this truth from his childhood and it seems most unlikely that he avoids assuming the proposition as a premise in his epistemological research. In the second place, what is our proof that two contradictory propositions cannot both be true? There seem to be only four tenable answers: it is a self-evident truth or axiom, it is a generalization from particular propositions, it is an indemonstrable or ultimate assumption of formal logic, it is a deduction of formal logic from some more nearly ultimate postulates. In any case, it is a proposition presupposed by a large part of logic and is logically prior to any epistemological investigation. It is not a law of thought. If in our thinking we use it, we use it as a premise, and we use it because it is true. If our thought is almost always *compelled* to use it, this is solely because it is true, and because so few inferences fail to presuppose it. In short, we can contradict ourselves, but we cannot contradict ourselves and be correct; and this is so, not because of the nature of thought, but because two contradictory propositions are not both true. Thus we may conclude: No examination of thought discovers the law of contradiction or proves it, rather such an investigation presupposes it. Hence if the world is a consistent system, our thought has no more to do with making it so than has the nest-building instinct of the oriole.

5. Again, is the world an organic unity? Let me grant it for the sake of the present argument. Does this proposition follow from the nature of thought? The dogmatist denies that it does. Rather the doctrine has its logical source in a principle usually named in these days, the internal or organic theory of relations. But whence this principle? Sometimes the philosopher who

holds it appears to infer it from the general results of the sciences. If so, it is a generalization such as a law of physics. Sometimes the philosopher appears to infer it from a genuinely empirical and inductive study of the evolution of knowledge in the race and in the individual. If so, again it is a generalization from science.[1] Now neither of these methods of discovery is consistent with transcendentalism, nor can either be made to be so. There seem to be but two ways of escape from this conclusion. The first is, to retrace our steps and to show that the theory of knowledge is fundamental and that reality is to be identified with the knowing mind. The second is to admit frankly that this principle is an ultimate postulate or axiom of a science logically prior to epistemology; namely, a proposition of metaphysics. With the latter dogmatism has no quarrel, for it frankly gives up transcendentalism. With the former, however, the case is different. Its first proposition is false. Its second, that reality is to be identified with the knowing mind, is certainly a proposition which cannot be proved by epistemology, for epistemology presupposes too many existential propositions from science to avoid a vicious circle in any such proof. If, then, the epistemologist assumes it, he does so as a metaphysician and a dogmatist.[2]

6. What then should be our general conclusion regarding transcendentalism? Transcendentalism stands or falls depending upon the truth or falsity of two propositions: first, that highly general information regarding reality can be inferred from the nature of knowledge; secondly, that this information is truly fundamental, that it does not itself presuppose an array of existential generalizations and postulates borrowed from the other

[1] Joachim in his book, The Nature of Truth, seems to me to do both.

[2] Kant's boasted discovery, which he compares with that of Copernicus, comes here in question. Is it an assumption or a valid conclusion of his Critique? If the former, he is an out-and-out dogmatist. If the latter, he has wrought a logical miracle; for his epistemology certainly assumes existential propositions, and how could it do so without assuming an existential proposition of such high generality or the contradictory of this proposition? It is gratuitous to add that I believe he unconsciously presupposed the last.

sciences. The evidence shows that the latter at least of these two propositions is false. In short, transcendentalism is a vicious circle. Its supporter pretends to derive from a stated source information which unconsciously he has imported from elsewhere. It is like a 'salted' mine, in which the most valued ore has been put not by nature but by human hands. The result has been inevitable. Every intellectual enterprise except transcendentalism seems to be prospering. We are learning much from the sciences to-day regarding subjects that were once the center of the philosopher's interest, the nature of the heavenly world, the nature of matter, the nature of life, and the nature of mind. Even the empirical and inductive study of the nature and growth of knowledge is prospering, for we surely know far more about it than did Kant. In contrast, what careful philosopher would offer mankind to-day the amount of *a priori* information Kant claimed to derive by means of his transcendentalism? Yes, the intervening years have certainly proved the need of greater caution, and this too in spite of an increasing insight into the nature of knowledge! Is it not, then, high time for the epistemologist as well as the metaphysician to declare his freedom from this difficult and fruitless enterprise? There is no reason why a direct study of man's growing knowledge and of the knowing process, if it be conducted as one of the special sciences, should not yield great and valuable and demonstrable results: but as long as the individual epistemologist feels it his duty to tease out of knowledge by a dialectic a world-hypothesis, rather than to devote himself to a modest, open-minded, and inductive study of cognitive facts, so long will his work continue to promote intellectual distrust and to give back disappointing rewards.

V

AN APPEAL TO THE PRAGMATIC TEST, TO THE VERDICT OF HISTORY

1. THERE remains one further line of argument which must not be totally neglected, the appeal to the pragmatic test, to the

verdict of history. Has epistemology been psychologically and historically the chief source of metaphysical problems and of their solution? During the past two centuries, in which the influence of epistemology has been so great and in which she has had as her leaders the ablest philosophical thinkers, has the progress of metaphysics been due chiefly to epistemology rather than to the special sciences? Have two centuries of its dominance in philosophical research been a help or a hindrance?

It would be most unconvincing to offer a brief answer to these questions, if I pretended for a moment that my answer were based upon an analytic and well-established solution of the minuter problems belonging to the history of philosophy. The same philosopher has usually been both metaphysician and epistemologist; and the actual course of his thought from day to day has seldom kept the two sets of problems distinct, but has interwoven them most intricately. Then, too, his writings may completely conceal the actual evolution of his thought. However, history is written in large letters as well as in small; and it is therefore not impossible to make a brief and convincing statement regarding the influence of epistemology upon metaphysics in the last two hundred years.

What has done most to change our modern theory of reality? To what discoveries or doctrines of the past two hundred years is our present-day metaphysics especially indebted, to epistemology or to the progress of the natural sciences? Most decidedly the latter. Even epistemology itself is similarly indebted. How great a change in our conception of the world has taken place! Not as great to be sure as the change from the thought of Dante to that of Sir Isaac Newton; still the two changes are comparable. Mathematics, physics, and biology have undergone a very great and wonderful growth. Chemistry has been born and reached maturity. So, too, has the historical research into almost every field of human interest. That all this could have taken place without influencing directly and profoundly our metaphysical views is unbelievable. Let us see.

2. First there has been the great growth of mathematical knowledge. In the past one hundred years this has quite changed our view of the nature of mathematics itself; and, what is especially important, it has done away with the older metaphysics of space. Instead of a definite and infallible conception of the nature of *existent* space and time, such as Kant believed we possess, we know to-day that their nature cannot be inferred solely from pure mathematics, but must be learned in part at least empirically and inductively as truly as must the nature of light or electricity. To be sure, mathematics also will continue to contribute very largely to this knowledge, but mathematics contributes also very largely to our knowledge of light and electricity. In short, mathematics, and mathematics quite divorced from any epistemological considerations, has completely transformed this old and important metaphysical problem, the nature of space and time.

A similar truth holds regarding the problem of Kant's first two antinomies. The problem of the nature of the mathematical infinite and continuum certainly seems to have reached a new and higher stage; and the resulting insight into these two notions, together with a better understanding of the nature of mathematics itself, have removed one chief source of error in the older metaphysics. For, as pure mathematics alone cannot solve the problem of space and time, so, too, it cannot solve the problem of the origin, extent, or continuity of the physical world. This problem, as so many others, must remain unsolved until facts are discovered which can be shown to form a crucial test of the merits of rival hypotheses. Whereas if mathematics could furnish us knowledge of the existent world without the aid of other sciences, as Kant believed it could, then indeed a purely dialectical procedure might give us the information sought in this way by the older dogmatic metaphysics. Indeed, one of the greatest philosophical discoveries of all time seems to have been made, and made in the nineteenth century; namely, the discovery that mathematics is a non-existential science; and this discovery we owe not to the epistemologist but to the philosophical mathematician.

3. Not only are we indebted to mathematics, but also to physics and chemistry for vast changes in our conception of the physical world. Of all metaphysical problems the nature of matter is one of the oldest. Now in the last few years, as we all know, we seem to be learning more concerning the nature of matter than man succeeded in discovering in the preceding two thousand years. Even such a good old conviction as that mass is an absolute constant is now contradicted, and what could be more startling than to be told that electricity is to be an all but fundamental concept in the new philosophy of nature? A thousand years of transcendentalism or of any other theory as to what matter must be in order to be a possible experience, could not have revealed to us such truths. Again, the rise of thermodynamics and its doctrines regarding the conservation of energy and the irreversibility of nature's processes have modified greatly our conception of the physical world about us. It may be that their ultimate metaphysical significance is still hidden from us, but in any case their great importance to metaphysics seems to be assured.

4. In the third place, nothing during the past one hundred years has transformed more remarkably our theory of nature and of life than has the doctrine of animal and plant evolution and in general the modern historical point of view. To whom do we owe this new insight? In part, indeed, to men whose names are foremost in the list of epistemologists, to Kant and Hegel, and to men whom they have strongly influenced. However, it is very easy to exaggerate this truth by inferring that we owe this part of their contribution to their epistemology. Moreover, without any desire to minimize our debt to them, there is every reason to believe that the evolutionary and historical point of view would have come in the nineteenth century had they never lived and had epistemology been completely neglected in those days; for the men and the influences that led us to the new way of thinking belong to almost every department of European science and go back probably to the days of Galileo. There is the growth of astronomical theory from the Renascence to Kant and Laplace

with their evolutionary hypotheses of the origin of our solar system. There is the new and profound interest in history and historical research due on the one hand to linguistic and literary discoveries and on the other to the political, social, and religious ferment of the times and, we should add, due in general to the new and widespread romantic interest in the life of past ages and of other lands. Finally comes the rise of the biological evolutionary hypothesis with its tremendous influence upon the thought of our day. Surely this doctrine also was chiefly due, not to the philosophical inquiries of the eighteenth century, but to the enormous accumulation of geological and biological data which was compelling the scientist to seek a theory to explain and to systematize them. Indeed, one must infer in all departments that instead of our new historical point of view being indebted to epistemology, epistemology has itself been completely transformed by this influence from without. The most superficial study of the epistemology taught to-day, be it that of the modern Hegelian or that of James and Dewey, will reveal the truth of this conclusion; for knowledge is now regarded by all as an essentially evolutionary process.

5. As against these changes in our conception of nature and of life there stand five important metaphysical doctrines which appear to be indebted especially to the study of knowledge: first, the doctrine of primary and secondary qualities; secondly and thirdly, the eighteenth century's criticism of the older doctrine of causation and of substance; fourthly, the idealistic, or spiritualistic, theory of reality; and fifthly, in more recent days, the issue regarding the organic, or internal, theory of relations leading to the opposed theories, monism and pluralism. Some of these doctrines and their logical relation to epistemology have been already considered; but we are now concerned solely with influences, psychological and historical. The dogmatist has to admit that the influence of epistemology here has been very great. However, he makes this admission with a satanic delight, for he believes that the influence has been all but disastrous. The intellectual world has been led astray for over a century by a com-

plete confusion of two fundamentally different problems and by the resulting mad hope that under the leadership of psychology metaphysics was to find its way at last into the promised land. Even our greatest philosophical thinkers for two centuries have been under the spell. None the less much can be said to show that even within these five problems other influences than epistemology have been at work.

In the theories of the primary and secondary qualities there is clear evidence that the physical doctrines of the day had their strong influence upon all who held the theories. Moreover, there is ample evidence to show that physics really went on its own way minding its own business and neglecting what the epistemologists had to say on this subject. Indeed, what physicist to-day need or would bother his head with epistemological doctrines respecting what are and what are not primary qualities! This he learns by questioning nature and by ascertaining what theories of matter will account for the facts he observes. Indeed, the metaphysician who to-day goes for information on this subject either to the psychologist or to the epistemologist is liable to find that not one in ten can tell him what physics has to say regarding the primary qualities of matter, let alone, give him a theory at all adequate in the light of our present knowledge and therefore worth listening to. Rather what he will get as an answer is a vestige pointing back to the physics of an earlier century. Perhaps nowhere has a combination of antiquated physics and epistemological metaphysics given rise to more worthless discussion. The truth of the case is, we do not know what are the primary qualities of matter. Energetics gives us a very different answer from that given by the mechanist. Then, too, we are in the midst of a period when a flood of new light regarding the ultimate nature of matter is coming into physics.[1] Indeed, the whole subject needs to be studied anew from top to bottom by the metaphysician un-

[1] Cf. on one physicist's view as to what is the basis for dividing qualities into primary and secondary, Duhem, P., *La théorie physique.* Paris, 1906. Pt. 2, Chap. 2.

der the instruction of the physicist. But all of this is beside our question except in so far as it shows that an older physics has been strongly influencing the views of many an epistemologist from Locke's day to our own.

6. As regards the various doctrines of causation the influences at work have probably been much more complicated than the text-books on the history of philosophy indicate. It is true that as we read Berkeley, Hume, Kant, and Mill, we are liable to feel that epistemological considerations alone are at work behind their criticism of the older doctrines of causation. The same feeling, too, may come in reading Mach and Pearson. Still it is far from certain that this feeling is justified, for they were dealing with a problem that, though usually regarded as epistemological, may in truth turn out not to be such. To be more explicit and to illustrate: If I am looking at a landscape gorgeous with the light of the setting sun in order to ascertain whether or not certain colors are there, is my problem epistemological? No, it is not, though it be true that the step from my problem to those of epistemology might be a very short one for many thinkers. Now the problem of Berkeley and Hume and many other classical writers since their day was in part one that is strictly analogous to the foregoing. They were not studying the knowing process so much as the actual empirical evidence of a necessary sequence of events. Inspection, Hume really tells us, does not reveal any such connection. It reveals a succession, but not a causal relation. So the nominalist Pearson of our own day inspects nature and does not *see* there any causal law. He does see the flow of events, but he claims that is all nature reveals. Hence, he concludes, to assert the existence of law in nature is to read into nature a quite foreign set of relations. This leaves him, and Hume before him, with the problem, what, then, is so-called natural law and why do we tend to talk as though it were a genuine element in nature? In short, quite apart from any question as to what is the correct solution of their problem, it does seem as though something in addition to merely epistemological influences were at work and that this

something else can be described as a reaction against older metaphysical theories, together with a greater open-mindedness in their direct observation of the facts of nature. If this is true, then we have to conclude that a clearer awareness of the absence of certain facts, a keener insight into the logical topheaviness of the theories of the day, as well as a greater attention to the nature of knowledge, were all at work in bringing about the reaction against the seventeenth-century doctrine of causation.

7. In regard to the doctrine of substance, a much stronger proof can be offered that direct evidence in the form of fact, together with the progress of theory in science, played an important part in the change from seventeenth-century thought, for the old notion was rejected not only by philosophers, but also by scientists. In metaphysics the substance hypothesis had led to views as far apart as materialism and occasionalism, as Spinoza's monism and Leibniz' monadism; and this divergence of opinion certainly promoted a skeptical attitude toward the whole endeavor to explain the world in terms of substance. In natural science the tendency was more and more to lay stress upon the *relations* between things, and less and less upon substance and attributes; in fact, modern physics was largely a reaction against just this notion, the old notion of forms. Especially does this change of view come out in the downright hostility to any explanation which makes use of the notion of force or forces.[1] In short, the growing explicit opposition to the old doctrine of substance not only had to come, epistemology or no epistemology, but did come through many influences other than the study of knowledge.

Moreover, the Kantian and post-Kantian epistemology has been rather a conservative influence against the tendencies of the natural scientists and of some metaphysicians. Though Kant admits the full justice of Hume's criticism of the dogmatic doctrine of substance, he endeavors to show that substance is a necessary form of thought and has validity *a priori;* and the modern

[1] Cf. the opposition to Newton's theory of gravitation on the part of the Cartesians.

members of the Kantian-Hegelian schools, in their doctrine of the absolute, tend strongly to uphold the substance-attribute notion as the fundamental notion in the theory of reality. Hence, whether right or wrong, the modern tendency within science to oppose any use of the substance notion and to confine the propositions of science to assertions of relations between terms, has little indebtedness at least to German epistemology.

8. In regard to the two remaining metaphysical issues, the issue between those who hold to the organic theory of reality, or present-day monism, and their opponents, the pluralists, and again the issue between the idealistic spiritualists and those who find their views unwarranted, it must be frankly admitted that the influence of epistemology has been very great indeed. But here again the question transforms itself into the other question, has this influence been for good or for bad? — a question, however, which lies beyond the field of our present inquiry. Here, then, the dogmatist must be content to urge his conviction that such doctrines should be based by their upholders upon facts and principles that may indeed be presupposed by a particular epistemology, but that themselves are truly fundamental. Until this is done monism, pluralism, or any other metaphysical theory is a house built upon the sands.

9. I have appealed to history, and the answer seems on the whole to be decidedly in favor of the dogmatist's prejudices except in the case of certain prominent metaphysical doctrines of to-day, which are explicitly founded by their advocates upon epistemological considerations. But even here the dogmatist finds the influence of many non-epistemological factors, such as the doctrines of evolutionary biology and psychology. Hence the following conclusion seems to be just: Where the change in our modern views of nature and of mind is admitted by all to have been genuine progress, there epistemology has not played the part it should if it be the truly fundamental science; for this progress has come notoriously from other sources and has been very influential even in bringing about changes within epistemology

itself. On the other hand, where no doubt exists that epistemology has been supreme in its influence, there one finds today the most serious questioning as to whether the influence has been good or bad.

VI

METAPHYSICS SHOULD BE EMANCIPATED FROM EPISTEMOLOGY

1. We are now prepared to take up the general question, Should not metaphysics be emancipated from epistemology? If epistemology is not logically fundamental, if epistemology cannot of itself show either what knowledge is possible or how knowledge is possible, and finally if epistemology cannot give us the logical foundations of a theory of reality, may we not conclude that metaphysics owes neither its problems nor their solution especially to epistemology? I believe that we may, for I am convinced that all the reasons for making metaphysics identical with epistemology or logically and methodologically dependent upon it are those which have been given and disputed.

Metaphysics as a logical study of the foundations of the sciences needs as its data only two things, the sciences in their most rigorous formulation and formal logic. What metaphysics as a theory of reality needs may be more doubtful. The following may serve as a brief and tentative answer. It needs the preceding branch of metaphysics, for that study will reveal the theory of reality implicitly contained in the sciences; and with this metaphysics will certainly have to reckon. Will it need more than this? That depends upon how the following difficult questions are answered, questions which themselves perhaps belong quite within metaphysics. In the first place, will not logical analysis reveal besides the foundations of science the foundations of other independent systems of propositions, systems at least implicitly asserted in man's art, in his morals, and in his religion? If so, will not the theory of reality have to presuppose them? Let me reply, Yes. Secondly, what is the factual, or that ultimate,

concrete which we observe but do not either assume or infer? Can there be a science just of it, a 'Gegenstandstheorie,' if you will? Is this ultimate truly analyzable; or is it alogical, as Bergson and James believe? Here let me reply: If there be such a group of problems, either they are a part of metaphysics and not of some more nearly ultimate science upon which metaphysics depends; or they and their solution fall within the bounds of the different special sciences and of the other aforementioned non-scientific systems. In the former case, our non-metaphysical systems will presuppose our metaphysics, whereas in the latter case metaphysics will arrive at this body of information by logical analysis of all these systems. Probably this is not a genuine disjunction, and both propositions are in part true. However, all of this is a matter not of theoretical but of great methodological importance; for it reduces to the purely methodological question, who is the real metaphysician, the real authority in metaphysics? Is he mankind at large or is he the professional metaphysician? Finally there is a third question: May not metaphysics have among its postulates or indemonstrable propositions some that are nowhere else to be found, that are peculiar to metaphysics? If so, these parts of metaphysics are certainly fundamental. In short, all of these many problems (including logic) are fundamental, and the sum of their solutions certainly constitutes a science which underlies logically the remainder of our knowledge. It is the first science; and if so, it is metaphysics.

Further we may make the following general statements regarding the methodological indebtedness of metaphysics to other bodies of knowledge. In parts it may be indebted to none. In great part it is surely indebted to logic. As a study of the logical foundations of the sciences, it has to be given the sciences themselves as data. Finally as the theory of reality, it may draw information and help from every department of man's intellectual life. The growth of science can revolutionize metaphysics as it did in the days of Galileo. A radical change in one or more of the postu-

lates of science may do the same, and so also may a great empirical discovery. Then, too, as man grows in artistic taste, and in moral and religious insight, he discovers new and, it may be, fundamental truths. If so, his discovery may lead him to revise radically his theory of reality or at least to present to the metaphysician new problems for the latter to solve.

2. Finally we come to the special question, what does metaphysics owe to epistemology? It owes much by way of suggestion. The story of how human knowledge grows in the individual and in the race, and the story of the knowing process itself do often suggest to the student of logical analysis what to look for and where to find what he seeks. For example, that knowledge grows by the trial and error method, or the experimental method, indicates at once that science as a system of propositions has as its premises many unproved assumptions, postulates, and guesses. The story of this growth indicates also that the work of the metaphysician will never be finished as long as man keeps growing intellectually; for no sooner do we work out (as the philosophers did in the Middle Ages) the theory of reality presupposed in or consistent with the knowledge of one age than the work has to be done once more for the knowledge of a new age. A second example is the great mental law of association which suggests at once (as it did to Hume and to Kant) that causation must be one of the fundamental or nearly fundamental postulates of science; and, to take a third example, the theory of knowledge can throw much light upon the history of science, and the history of science in turn is full of suggestions for the metaphysician.

3. All this is true of the *methodological* relationship of epistemology to metaphysics, and it would be foolish indeed not to admit it; but at the same time we must not forget the limitations of this indebtedness, for the errors that can then arise are, as we have seen, very serious. A correct epistemology can be full of valuable suggestion to the metaphysician; but this science is in no peculiar respect nor to any peculiar extent fundamental to metaphysics. It is not peculiarly a part of metaphysics, nor is

it in any respect to be identified with metaphysics. On the contrary I have endeavored to show that epistemology is not a logically fundamental science, that the solution of the problem of the possibility and the limits of knowledge is logically subsequent to some at least of the special sciences, that epistemology cannot furnish us with a theory of reality, that metaphysics owes logically neither its problems nor their solution to the theory of knowledge, and finally that though the full verdict of history has not been delivered, there is strong evidence that criticism has seriously hindered as well as helped metaphysics during the past two centuries. If these conclusions are true, then metaphysics is by right free and independent of epistemology and should at once proceed to emancipate itself entirely from the dominion of this science.[1]

[1] Though few physicians are expert in diagnosing their own case, still I can perhaps help some readers to discover my bias or prejudices. As we look back over the course of this argument, what is the world of discourse within which it proceeds? The answer is, logical analysis. There are, I believe, two prominent and radically different points of departure nowadays in our philosophical studies. One man is impressed with *the facts of psychology;* and though he admits that psychology itself is one of the special sciences, he still seeks a philosophical foundation by means of a study of these facts. The other man, though not blind to these facts, cannot regard them as the most significant; rather he is impressed with the truth that the chief business of science is *to demonstrate.* As a consequence, the question, What are the premises of any hypothesis? is the all-important philosophical problem. Everywhere in man's knowledge he finds two sets of premises, on the one hand the principles of formal logic and on the other hand postulates and observed truths, or facts. Now *the sum total* of these presuppositions form the philosophical foundation upon which he believes he must build; and, of course, he sees in the other philosopher a thinker who has hopelessly confused psychology and logic. In short, *the one man is temperamentally a psychologist; the other, a logician.* Moreover, each feels that he has dug deeper down for his foundation than has the other. Hence the deadlock where neither seems able to convince the other, and where our ultimate duty to one another seems to be not to try to persuade or to refute but to try to make our positions clear to each other. Even though each party may see truths to which the other is blind, and even though the ultimate verdict may be a part victory for both, I am convinced that the two positions have their centers at different points, and that these points are mutually repellent. If so, one is essentially right and the other is essentially wrong, and there can be no compromise.

A REALISTIC THEORY OF INDEPENDENCE

A REALISTIC THEORY OF INDEPENDENCE

By Ralph Barton Perry

I

THE IMPORTANCE OF THE NOTION OF INDEPENDENCE

Eight years ago, in describing "a curious unrest in the philosophic atmosphere of the time," Professor James concluded with the remark that "strangest of all, natural realism, so long decently buried, raises its head above the turf, and finds glad hands outstretched from the most unlikely quarters to help it to its feet again." [1] This reanimated corpse is now fairly on its feet, and able to protest with Mark Twain that the reports of its death were "greatly exaggerated." As a living and hopeful member of the philosophical community, it is naturally concerned that its identity should be unmistakably defined, lest it should again be carelessly interred or reported missing; or lest in the mêlée of controversy it should suffer from blows intended for another. The present essay attempts such an identification of realism *redivivus* — or of what may now conveniently be designated neo-realism.

1. It is necessary, in the first place, to explain the crucial importance of the conception of 'independence.' For the term 'realism' is also traditionally associated with another conception, the conception, namely, of 'substance.' When construed in this latter sense, realism is contrasted with 'phenomenalism,' 'immediatism' and 'empiricism.' It is taken to mean that the real is not what is experienced, but some *substance* or *essence* which lies behind what is experienced. The real, according to this view, is not constituted by its predicates, but is manifested in them; it is the

[1] James, W. Essays in Radical Empiricism, 39–40.

subject that owns them, the ground that supports them, or the cause that produces them. According to 'phenomenalism,' 'immediatism,' or 'empiricism,' reality coincides with appearance — things are what they are "*known as.*" [1] According to realism in the contrasted sense, reality is *that which* appears, that *of which* something is known.

2. The most straightforward statement of this version of realism is to be found in the following passage from Thomas Reid's "Essays on the Intellectual Powers of Man": "Things which may exist by themselves, and do not necessarily suppose the existence of anything else, are called substances; and, with relation to the qualities or attributes that belong to them, they are called the subjects of such qualities or attributes. All the things which we immediately perceive by our senses, and all the things we are conscious of, are things which must be in something else, as their subject. Thus by my senses, I perceive figure, color, hardness, softness, motion, resistance, and such like things. But these are qualities and must necessarily be in something that is figured, colored, hard or soft, that moves, or resists. It is not to these qualities, but to that which is the subject of them, that we give the name of body. . . . In like manner, the things I am conscious of, such as thought, reasoning, desire, necessarily suppose something that thinks, that reasons, that desires. We do not give the name of mind to thought, reason, or desire; but to that being which thinks, which reasons, and which desires." [2]

The peculiarity of such a realism as this lies in the absolute distinction between real body and real mind, as substances, and the 'qualities' or 'attributes' by which they are known. The 'reals' are *different* from the content of knowledge. Whether they are also *independent* is a second and more ambiguous question. That body is independent of mind would seem to be clear, in that as

[1] Cf. James, W., Pragmatism, 50.

[2] Reid, T., Essays on the Intellectual Powers of Man, Essay I, Ch. II, Hamilton's edition (1895), 232. For an account of the development of the same general view in recent German philosophy, cf. Stein, L., *Philosophische Strömungen der Gegenwart*, Ch. VI.

substances bodies "may exist by themselves," while bodily qualities "must necessarily be in" bodily substances. The qualities themselves, whether bodily or mental, are evidently not independent in that they "must be in something else." Whether the substances themselves are independent of the qualities that are in them is more doubtful. Locke, whose view of substance closely resembles Reid's, regards it as probable that the soul may exist without thinking, that its nature, in other words, is independent of those forms of consciousness by which it is known.[1] That the same view might be held with reference to bodies is suggested by Locke's repeated assertion that "the real essences, on which depend their properties and operations, are unknown to us." [2]

It is probably safer, however, to conclude that for both Locke and Reid, some properties, namely, the 'primary' qualities, extension, hardness, etc., belong necessarily to the nature of the body. There is a notable difference between these two authors as respects the ground of the distinction between 'primary' and 'secondary' qualities. For Locke, the primary qualities are such as produce *similar* ideas in the mind. Thus the quality 'hardness,' and the 'idea of hardness' produced by it, are *similar*. The secondary qualities are such as produce *dissimilar* ideas in the mind, as when "a violet by the impulse of such insensible particles of matter of peculiar figures and bulks, and in different degrees and modifications of their motions, causes the ideas of the blue color and sweet scent of that flower to be produced in our minds." [3] Reid, on the other hand, sought to avoid that "theory of ideas" which he held to be the besetting sin of philosophy. Knowledge is not a having of ideas produced in the mind by things. It is an act of belief in

[1] Cf. Essay concerning Human Understanding, Book II, Ch. I, §§ 10 ff. For Locke's view of substance, cf. Controversy with the Bishop of Worcester, No. IV (St. John's Edition, Vol. II, 352): "We cannot conceive how simple ideas of sensible qualities should subsist alone, and, therefore, we suppose them to exist in, and to be supported by, some common subject; which support we denote by the name substance."

[2] Essay concerning Human Understanding, Book IV, Ch. VI, § 12.

[3] *Op. cit.*, Book II, Ch. VIII, § 13. Cf. §§ 7–26, *passim*.

an object, of which one must have a 'conception.' Precisely how Reid distinguished 'conception' from 'idea' is far from clear. But it is evident that he wished to get rid of the traditional barrier between the mind and its objects. The 'conception' was an act or instrument of the mind itself, and not a product or counterpart of the things. It was part of that faculty of knowing which the author was satisfied to leave inexplicable since he was confident that it must in any case be presupposed.[1] In any case primary and secondary qualities are distinguished without reference to 'ideas,' the former being the qualities that are known directly and distinctly, the qualities of which one knows "what they are in themselves." "Therefore," says Reid, "were I to make a division of the qualities of bodies as they appear to our senses, I would divide them first into those that are *manifest* and those that are *occult*." Reid's 'manifest' qualities correspond to Locke's primary qualities, such as 'extension,' 'hardness,' etc.; and his 'occult' qualities comprise Locke's secondary qualities, together with the feelings which bodies induce in the organism and the 'powers' which they display in their operations on one another.[2]

Thus with Reid the qualities of bodies, whether manifest or occult, belong to the bodies themselves. They are not primarily 'ideas,' of which some are similar and some dissimilar to bodies. Their original locus is in the bodies themselves. There can, therefore, be no question of their remaining *mere* ideas through the uncertainty of the existence of their bodily counterparts. In other words, Reid believes himself to have removed the assumption which underlies the idealism of Berkeley and Hume. And yet the realism of Reid is open to a very obvious idealistic rejoinder. For the qualities do not *constitute* the body. He makes it perfectly evident that the principle of substance is the controlling motive in his thought. He thinks that "it requires some ripeness of under-

[1] Essays on the Intellectual Powers of Man, Essay II, Ch. XX. For the difficulties and ambiguities of Reid's view, cf. Sir William Hamilton's notes to his edition of this and other essays.

[2] *Op. cit.* (1895), 313, 322.

standing to distinguish the qualities of a body from the body." The relation of the qualities to the bodily "substratum" must doubtless remain "obscure"; it "is not, however, so dark but that it is easily distinguished from all other relations." [1] The qualities of bodies are thus left in a precarious situation. Since they are not identified with the body, they may the more easily be captured by mind and converted into ideas; and since body bereft of them is reduced to a nullity, it may the more easily be ignored as a non-entity. Thus, the principle of substance betrays realism into the hands of its enemy.

3. It is reasonably clear, then, that the traditional realism has been both confused and compromised by an alliance with substantialism. In view of this fact, the critics of realism are scarcely to be blamed if they have not shown a nicety of discrimination which realists themselves have failed to show. Of contemporary critics, Professor Royce is especially notable for expressly identifying realism with the theory of independence. Nevertheless, even this writer has not succeeded wholly in separating this theory from substantialism. Thus he distinguishes three "popular ontological predicates." "*To be immediate*, or, on the other hand, *to be well founded* in what is not immediate, and, thirdly, *to be genuine and true*, — these seem to be the three principal conceptions of what it is to be real in the popular ontology." The author presently concludes that realism is "a synthesis of the three popular ontological predicates, although, as history shows, with a preference for the second predicate." In other words, "realism is fond of substances, of 'inner' or of 'deeper' fundamental facts, and of inaccessible universes." [2] Now it happens that the realism of the present day has strong aversion for these things. It is in sympathy with the whole modern trend of thought toward identifying reality with the elements, processes, and systems of experience. But it maintains that these elements, processes, and systems are *independent*

[1] *Ibid.*, 323.

[2] Royce, J., The World and the Individual, First Series, 54–55, 68; cf. also 63, 66, 67, 86, 106, 115.

of being experienced. Although they may compose or enter into an experience, they *need* not do so. In other words, neo-realism asserts the independence of the experienced on the act of experience; or of the sensible and intelligible properties of things on the operations of sensation and intellection. Thus realism must purify the notion of independence of all suggestions of other-ness, remoteness, or inaccessibility, not only for the sake of a full and forcible presentation of its case, but even to avoid being confused with a whole alien and objectionable tendency of thought.

4. It must be confessed that realists have not as yet taken pains to define 'independence.' Thus in a discussion before the Aristotelian Society of the question, "Are Secondary Qualities Independent of Perception," Mr. Nunn, as a realist, adopts the "affirmative answer." [1] And in reply, Mr. Schiller justly puts the question, "What does *independent* mean to a realist?" But as Mr. Schiller himself remarks, the idealist has been no more precise in his use of the term than the realist. Both Royce and Joachim, who, like Royce, explicitly identifies realism with the independence theory, constantly employ the term in their polemic without undertaking to define it. Both of these writers characterize an independent entity as that to which another entity "makes no difference." [2] But this is only a figurative paraphrase of the term. It introduces practical or dynamical considerations which are more confusing than clarifying.

Nor can the idealist be said to have given a satisfactory account of his own notion of independence. Thus Mr. Joachim apparently maintains that truth is "independent of the intuition *qua* this act of intuiting here and now." [3] Similarly, the majority of contemporary idealists insist strenuously that the logical or universal principles are *independent* of the psychological circumstances attending their appearance in finite minds. But so far as I know the precise

[1] *Proceedings of the Aristotelian Society*, N. S., 1910, 10, 191, 218.

[2] Royce, *op. cit.*, 118, 120, 123. According to Joachim, realism asserts that 'experiencing makes no difference to the facts' (The Nature of Truth, 33, 58).

[3] *Op. cit.*, 52.

meaning of the term in this application is left to be determined by common sense. Nor has the idealist ever given a general and precise definition of the correlative notion of dependence. This notion is essential to the idealistic theory of the internality of relations, and to such fundamental conceptions as 'coherence,' 'synthetic unity,' 'significant whole.' And if the idealist's polemic against realism is successful, we are left to conclude that experiencing *does* "make a difference" to facts. This is as truly the central contention of idealism as the contrary is the central contention of realism. But we are left in the dark as to the precise nature of the dependence which is predicated. Idealism has even derived a certain advantage from its failure to define dependence. For it has been able to vary the meaning to suit the polemical exigency. And this absence of explicit definition has enabled idealism to profit by the vague but natural assumption that any relation whatsoever involves dependence. To prove dependence idealism has not found it necessary to do more than to establish some sort of connection between the term in question and some other term. The moment dependence is distinguished from bare relation, a very considerable portion of idealistic reasoning is rendered worthless — a mere recitation of the obvious and trivial.

A realist might fairly take the position, then, that he means by independence the negative of what his opponents mean by dependence. If a vague, common-sense notion will suffice in the one case, it will suffice also in the other. The question can be argued in the vague terms common to both parties; and this is, as a matter of fact, what has thus far taken place. But in adopting such a course, realism loses an important opportunity. Realism is responsible for forcing this issue of dependence or independence, and should undertake to clarify the conception to which it has given a fresh prominence. Realism as a constructive doctrine is professedly concerned with the merits of the question rather than with the turn of controversy. Nor will any realist be deterred from thorough analysis by fear of enlightening his adversary. Furthermore, the present realistic movement is largely inspired by the logical motive, and finds the clarification of current notions a proper and congenial task.

II

MEANINGS OF THE TERM DEPENDENCE

THE term 'independence' is evidently used to deny 'dependence.' Like other negative terms such as 'immaterial,' 'unworldly,' etc., it has acquired secondary meanings of a positive character. Thus political independence has come to signify self-government, or certain positive 'liberties,' such as 'free speech' and 'freedom of the press.' Similarly, practical independence may mean competency, self-reliance, or initiative. But with these derived meanings we here have nothing to do. They are particular cases of independence in which the circumstances of the application have impregnated the general meaning of the conception. The primary and general meaning of independence is *non-dependence.*

Hence we must begin our analysis with an enumeration of the various senses in which the term 'dependence' may be intelligibly used. One cannot be at all confident that such a list as follows is final, either in respect of completeness or of logical coördination. Indeed, one may feel reasonably sure that it is not. But while inviting corrections and additions, one may hope that such a list will at least cover the various senses of the terms that are likely to be in question in connection with the present issue.

1. *Relation.* — Even though one may conclude that bare 'relation' is so radically different from the types of dependence that follow as to justify its eventual rejection from the list, it is important to include it provisionally. We must have this conception before us from the outset, since it will figure so prominently in our conclusions.

It is not possible to define 'relation.' It must either be accepted as an ultimate logical category, or be simply cast out altogether on the ground of the alleged dialectical difficulties in which it is involved. But writers like Bradley who have thus rejected it have confessed their inability to find a satisfactory substitute, and have perforce taken refuge in agnosticism. That these dialectical diffi-

culties are artificial, has, I think, been demonstrated by James.[1] All exact or analytical thinking, as at present carried on, is dependent on the conception of relation; and the empirical testimony in its favor is so overwhelming as to justify its acceptance without further ado. It is true that any attempt to deal with relations systematically at once encounters doubtful cases, such as 'identity' and 'difference.' But the unambiguous cases such as 'before,' 'after,' 'more,' 'less,' 'like,' 'unlike,' etc., are abundantly sufficient to establish the genus.

2. *Whole-part.*[2] — A whole is said to be dependent on its parts, — on what it contains, and can be divided or analyzed *into*. It is worth while to introduce at this point a distinction between 'material' and 'formal' instances of the whole-part dependence. The first is exhibited in the relation between the present city of London and Trafalgar Square, or between the existing government of the United States and President Taft. The second is exhibited in the relation between a city and its streets, or between a government and its chief executive. In other words, a material relation is a relation between particular values of variables, while a formal relation subsists between the variables themselves. The dependence of whole on part may be of either type.

3. *Part-whole.* — Parts are said to be dependent on the whole to which they belong when these wholes are 'organic.' The distinction between 'formal' and 'material' may be applied here also. Thus the hypothenuse of a right-angle triangle is formally dependent on the definition of the right-angle triangle. Not only does it derive its meaning from its participation in the whole, but its magnitude is determined by its interrelation with other parts, such as the opposite angle and its adjacent sides. A particular hypothenuse is likewise both defined and determined by its material membership in the particular triangle to which it belongs. Similarly, an organ or member in the biological sense is said to be dependent both formally, as respects its meaning, and materially,

[1] "The Thing and its Relations," Essays in Radical Empiricism, III.

[2] Cf. also Spaulding, below.

as respects its structure and function, on the integrity of the organism to which it belongs.

But such dependence would appear to be reducible to dependence of other types. Thus when one says that the hypothenuse depends on the right-angle triangle for its meaning, or that the conception of an hypothenuse depends on the conception of a right-angle triangle, we are virtually *naming a part for its participation in a whole.* We are virtually saying that the side-opposite-the-right-angle-of-a-triangle cannot be such without the triangle. But this is no more than to say that the conception of a triangle depends on the conception of a triangle, which is as redundant as it is obvious. Or it may be construed as meaning that a part cannot *be a part,* that is, *belong to a whole,* without the whole. But this is equivalent to saying that the complex relationship of part and whole depends on the whole as one of its terms. And this is a case of dependence of whole on part, and not of part on whole.

Similarly, to say that the length of the hypothenuse is materially dependent on the magnitude of the other sides and the included angle, is virtually to say that an interdependence of parts constitutes the nature of a certain whole. The dependence of the part is here conditional on its membership in the whole; and its dependence is on the other parts, not on the whole. We are simply saying that in so far as an element belongs to a certain whole it must possess the relations proper to it as a part of that whole. We do not assert that the element is dependent on its membership, and thus categorically dependent on the whole; but only that if a line is to assume the rôle of an hypothenuse, it must play the part. On the other hand, there is evidently a new kind of dependence here exhibited by the relation between part and part. But as this is not a part-whole dependence, it will receive consideration elsewhere, under causality.

The dependence of members of a living organism may be disposed of in the same manner.[1] The respiratory system cannot be a vital function without the whole organism. But this is merely to say

[1] Cf. also Spaulding, below, 243 ff.

that it cannot belong to an organism without an organism to belong to. To make the dependence of the part evident one must describe the part as part-of-whole. But the dependence of member-of-organism on organism is not a dependence of part on whole, but rather a dependence of whole on part. It asserts the dependence of a complex relationship on one of its terms. The dependence of the respiratory system on the circulatory system, however, means that the two are connected by the laws of the complex process to which they belong; or that the one supplies the necessary conditions of the other; both of which relations would be instances of causal rather than of part-whole dependence.

4. *Thing-attribute.* — Whether the thing-attribute relation is or is not a case of the whole-part relation need not here be decided. But it is clear, I think, that the relation presents no novelties in connection with the matter of dependence. It is doubtful, as we have seen, whether in some varieties of substantialism the thing is dependent on its attributes at all. If not, then the relation is not a case in point. But where a thing is regarded as dependent on its attributes, it is either 'made up' of them, or defined 'in terms' of them. It seems clear that except for an agnostic substantialism a thing must be regarded as dependent on its attributes in that they are *in* it or *of* it. Both would be instances of the whole-part type of dependence, as described above.

5. *Attribute-thing.* — The question of the dependence of attributes on the thing to which they belong, resembles the question of the dependence of part on whole. Red cannot be attribute of the rose without the rose; nor would it bear the peculiar relation that it does to odor, form, and growth of the rose, were it not for the nature of the rose as a whole. But this will, I think, turn out to mean either that a rose is a rose (redundancy); or that the red-rose relationship depends on 'rose' as one of its terms (whole-part); or that the redness of the rose is determined by its age, chemical structure, nutrition, etc. (causation). We may therefore dispense with the attribute-thing relation as a primary type of dependence.

6. *Causation.* — It is desirable so far as possible to avoid staking

the issue of dependence on a special theory of causation. Nevertheless, it is impossible to allow a certain theory of causality to remain at large, lest it upset our calculations at the eleventh hour. I refer to the theory that causation is creation *ex nihilo* by an 'activity.' I do not mean in the least to exclude the category of purpose; *i.e.* to suggest that there is no such thing as moral or rational causation. I mean to insist only that so far as causation is observable or verifiable at all, in so far as it can in any given instance be profitably discussed, it must be regarded as a complex or process in which there is a relation of necessity between distinguishable and definable parts. The cause must be displayed, as well as the effect; it must not be kept in the background a recondite and incalculable factor. I shall not argue the matter further than to appeal to the fact that the 'creation' theory has long since been discredited in science and all other exact discourse.

If this possibility be excluded, there need, I think, be no further occasion for dispute here. Causality is a material relation between two complexes, derived from a primary formal relation between their constituent variables. Thus if $v = gt$, for all values of these variables, then any given velocity (v), is dependent on the constant of gravity (g), and some magnitude of time (t). The formal relation among the variables is called the 'law,' and the material determination of the values of the variables, as prescribed by the law, is causation.

It would, perhaps, be more in keeping with verbal usage to confine the term 'causation' to a special variety of the type of dependence just described; that variety, namely, in which a complex occurring later in time is determined by a complex occurring earlier in time. In other words, it is customary to limit the adjective 'causal' to laws which contain time as a variable; and to treat time in the positive or forward direction as the independent variable. Or one may still further narrow the conception of cause to mean those other values which together with time determine the value of a future complex.

It is to be remarked that causation is conditioned by the law.

In other words, it takes place only *within the system which the law describes;* and can be attributed to a complex only when the complex is identified as "a case of" the system. Thus a complex which is identified as a member of the gravitational system is caused, as respects its position, velocity, orbit, etc., by the distances and masses of surrounding bodies. Causes and effects are thus interdependent *within the given system,* or *under the law.* But this leaves open the question of whether they are dependent *on the existence of the system or the law.* These determine their behavior under certain conditions, but do not prove that the conditions themselves are necessary. For it is possible that a given complex should be accounted for in terms of one system, and yet conform to the requirements of another system as well. Suppose, for example, the position of a body, *a* to be defined in terms of its direction and distance from a second body, *b;* and suppose it to be also defined in terms of its direction and distance from a third body, *c.* It will then be the case that the position of *a* is unequivocally defined in terms of *either a* or of *b.* Similarly, the kinetic energy of a body is definable in terms of its equivalence to the potential energy that has been converted into it; or in terms of the energy of heat into which it may be converted. In such cases, it is more correct to say that the complex in question is not dependent on *either* determination, in view of its possessing another determination which is sufficient to account for it. It follows that *a* is dependent on *b* in the causal sense, only provided *a* is completely determined exclusively within the system in which it is the effect of *b*; only provided, in short, it has no other sufficient cause.

7. *Reciprocity.* — It is customary to use the term 'reciprocity' to express a relation of the same type as causation, but without the same emphasis on temporal antecedence and consequence. It is evident that the relation among the various values of the variables of a law is mutual. It is possible not only to predict the future, but also in like manner to infer the past. Similarly it is possible to infer simultaneities, as *e.g.*, in the case of the configuration of the planetary system, or the co-presence of extension and

color in the visual field. It is not even necessary that time should enter into such calculations at all; as is illustrated by the interdependence of spacial magnitudes as formulated by geometry. 'Reciprocity,' then, may be taken to mean the mutual determination of values of variables under the law, where the factor of time-direction is not essential. Inasmuch, however, as the most familiar cases are cases of causation, and inasmuch as the underlying principle is the same, I shall hereafter omit reciprocity and speak only of causation. I shall assume, in other words, that causal dependence is reciprocal.

8. *Implying.* — Finally, there is the simpler logical relation of implication. It is unnecessary to discuss the question as to whether this is or is not a 'primitive' conception. Mr. Russell shows that it may be expressed in terms of other conceptions, such as 'contradiction' and 'logical addition';[1] but in any case there is some fundamental form of logical necessity.

It is important to point out that the relation of implication is not a symmetrical one. That which *implies* is dependent in one sense; and that which *is implied*, in another. Thus the premises of a syllogism cannot both be true unless the conclusion is true; while the conclusion on the other hand may be true even though the premises be false. Only the dependence of the implier on the implied is positive and unqualified.

9. *Being implied.* — That which is implied, on the other hand, is dependent on the implier only in the limited sense already noted in the discussion of causation. For the implied may be *otherwise* implied. That which is implied by two or more sets of premises cannot be said to be dependent on any one of these sets. In the absence of any one it would none the less be necessitated by the others. Its dependence, in other words, is limited to the specific logical system in question.

Because of this fact, the ordinary mathematical conceptions of dependence and independence are not of material assistance in our present task. The 'dependent variable' is that variable whose

[1] Principia Mathematica, I, 6 ff.

value is derived by implication when a value is assigned to another value, called the 'independent variable.' But since the operation may be reversed, the one variable is logically as dependent as the other. Furthermore, the question as to whether the value of the dependent variable can be *otherwise* derived, is not raised. Similarly, an 'independent postulate' is a postulate in a given system that is co-determinant with the other postulates, but cannot be deduced as a theorem from these other postulates.[1] But the dependence of a postulate as established by this criterion is relative to the system in question. By virtue of being a theorem in another system, it might be independent of the first system. We conclude, therefore, that *a* is not made unqualifiedly dependent on *b* through being implied by it, unless it is implied *only* by *b*.

Omitting from the above list of possible meanings of the term 'dependence' those which involve needless repetition, we are left with five: *relation, whole-part, exclusive causation, implying, being exclusively implied.* It is not claimed that these are logically ultimate or coördinate, but only that they are intelligible, and, so far as our main problem is concerned, complete.

III

THE MEANING OF INDEPENDENCE IN NEO-REALISM

We are now in a position to formulate the realistic notion of independence, reserving the proof and the applications for a later portion of the paper.

1. *Independence is not non-relation.*[2] — Realism does not deny non-relation.[3] But it is not non-relation which the realist has in

[1] Cf. Huntington, E. V., Monographs on Topics of Modern Mathematics, edited by Young, J. W. A., 169.

[2] Cf. also Spaulding, below.

[3] Whether the conception of non-relation is tenable or not will, I think, be found to turn upon what is made of 'difference,' 'possibility,' etc. If these be genuine relations, then relation is universal; otherwise not. I leave the question open, to avoid needless complication of the issue.

mind when he uses the term 'independence.' Thus Mr. Joachim is correct in supposing that according to realism, 'the facts' and 'experiencing' "are or may be related"; and that "the relation when, or as, it obtains, leaves each (factor) precisely what it was, viz., absolutely in itself and independent." [1] In other words, it is fundamentally characteristic of neo-realism to *distinguish* 'relation' and 'dependence.' Otherwise, as the critics of realism have taken pains to point out, the independence theory would be equivalent to agnosticism. For if the real were necessarily out of relation to knowledge, then it is obvious that, as real, things could not be in the relation of being known. Thus it behooves realism to define a species of relation in which the terms, although related, are nevertheless independent; or to show that dependence is something over and above bare relation.

Although realizing that Professor McGilvary is in substantial agreement with the view here set forth, I cannot but feel that his presentation of the matter is too easily open to misunderstanding. "By an 'independent' object," he says, "the realist means an object that exists when there is no awareness of it." Now this must mean one of two things. It may mean that an object is independent in so far as there *is* no awareness of it. But in this case the only independent things are the unknown things; and one must with Kant divide the world into known phenomena and unknown reals. Or it may mean that an object is independent in so far as it does not *require* awareness in order to exist. But this is the same as to say that an independent object is independent of awareness; and we still require a definition of independence. We require, in short, a definition of independence that shall not either affirm or deny the fact of awareness. "If," Professor McGilvary continues, "he (the realist) ever speaks of the qualities of which he is aware as *now* being independent of awareness, he begs to be understood as meaning by 'independent' something different from what he means by independence when he speaks of the independ-

[1] *Op. cit.*, 41.

ence of the qualities of which he is not aware.[1] This is consistent with Professor McGilvary's own definition of independence. But it is clear to me that what is required for an empirical realism is a sense of the term 'independence' that shall hold of objects equally whether there be awareness of them or not. And such a sense must be defined without including in the definition either the presence or the absence of awareness.

Thus Professor Dewey is equally mistaken in supposing that realism assumes "*the ubiquity of the knowledge relation.*"[2] Realism does not argue from the 'ego-centric predicament,' *i.e.* from the bare presence of the knowledge-relation in all cases of knowledge. On the contrary, it denies the possibility of *arguing from that predicament at all.*[3] Its use of the predicament is polemical and negative merely. It convicts idealism of so arguing, but does not propose to fall itself into the same error. Realism defines dependence as a *peculiar kind of relation;* so that the mere presence of knowledge as a relation cannot be used to argue dependence. Is being known a relation of dependence or not? If it is, then all known things are dependent; if it is not, then things are independent of being known, *whether as a matter of fact they be known or unknown.*

2. *Independence is not priority.* — That which includes, implies, causes, or explains is not independent of what is included, implied, caused, or explained. That which is inferred or determined is not more dependent than its premises or ground. In other words, the difference between logical activity and passivity, or the difference of *logical direction,* is not the same as the difference between independence and dependence. Such a notion of independence appears in all varieties of 'absolutism.' The 'ideal of reason,' converted in more recent times into an 'ideal experience,' 'a perfect coherence,'

[1] E. B. McGilvary, *J. of Phil., Psychol., etc.*, 1907, **4**, 686.

[2] Brief Studies in Realism, II, *J. of Phil., Psychol., etc.*, 1911, **8**, 554, and *passim.*

[3] Cf. my article, The Ego-centric Predicament, *J. of Phil., Psychol., etc.*, 1910, **7**, 5–14.

an 'absolutely organized experience,' or into the 'mandate' (Sollen) binding on the act of judgment, is conceived as the final 'presupposition' of thought.[1] It is regarded as independent of all particular acts of thought in the sense that while the latter may be psychologically antecedent, the former is logically antecedent. The validity of the ideal is not derived from particular acts of thought, but constitutes the standard by which the validity of the latter is determined. Truth and being attach primarily to the completed whole of knowledge, and to the parts or approximations only in so far as these participate in the whole.

It is not necessary to urge what has been said concerning the questionable character of this alleged dependence of part on whole, or of the implied on the implier. Nor is it necessary to urge the objection that this 'ideal of reason' upon which the whole argument turns is a meaningless combination of words.[2] For the question immediately at issue would, I think, be promptly conceded by the idealist. The ideal whole may be prior to its parts, but these are none the less indispensable to it. The absolutely organized experience is made up of the finite experiences which it organizes; the incoherences are taken over into the completely coherent whole; the mandatory ideal is an idealization of the judgments which presuppose it. The solidarity of the whole requires that every least part shall be and contribute precisely what it is. So that even were it admitted that 'priority' is a sort of independence, the ideal whole would not in the least on that account escape dependence on its parts.

It is virtually the contention of idealism that the two notions of independence just formulated are exhaustive of all the possibilities. Either reality is independent of thought in the sense of being wholly out of relation to it, or in the sense of giving the law to it. Thus idealism may be said to confront realism with a dilemma: "Either your reality is unknowable, and so utterly negligible, or it is the ideal of knowledge itself, and so the very quintessence of

[1] Cf. Joachim, *op. cit.*; Royce, *op. cit.*; Rickert, H., Der Gegenstand der Erkenntnis.

[2] Cf. the author's Present Philosophical Tendencies, Ch. VIII, §§ 7, 8.

thought." It is plain that the whole case for realism must rest on the assertion of a third alternative. It must be possible to regard reality as sustaining, or as being capable of sustaining, the relation which constitutes knowledge, while at the same time sustaining that relation only accidentally. And if reality be "the ideal of thought," as in a sense it undoubtedly is, then it must on realistic grounds be possible to regard this as a rôle which reality assumes without prejudice to its independence. It will not be sufficient to assert that reality is 'prior' to finite thought in the sense that finite thought is regulated or determined by it; it must be further asserted that this very regulation or determination is gratuitous, so far as reality is concerned. It must be shown that though reality be related to thought as its ideal, or presupposition, that relation is of the non-dependent type. It is clear, in short, that another meaning of independence is called into play, and that this third meaning is crucial.

3. *Independence is the total absence of dependence in the senses enumerated above.* — In order to prove the dependence of a on b it is necessary to show that a contains b; or that a is the cause or effect of b in a system which exclusively determines a; or that a implies b; or that a is implied exclusively by b. To exhibit any relation of a to b other than these is beside the point. Whether a and b be otherwise related, or not, does not affect the independence of a. And if it can be shown that a and b are related, and yet not dependent in any of these senses, the relation in question is by definition a non-dependent relation.

This is a suitable occasion on which to eliminate three current misconceptions.

A. In the first place, the realist does not propose to *define* reality in terms of its independence.[1] This would be a palpable and clumsy self-contradiction. If a is independent of b, then a must be definable, if at all, in terms other than b. Independence itself is not a relation, but the absence of a certain type of relation. Hence independence itself does not define anything. If a be re-

[1] Cf. Royce, *op. cit.*, 66, 92, 93, 108.

lated to *b*, and yet independent, this is equivalent to saying that *a* can be defined without reference to this relation.

B. In the second place, realism does not assert that "everything that is true of" *a*, is independent of *b*.[1] For *a*'s independence of *b* is true of *a*; and this judgment evidently depends on *b*. The independence of *a* as respects *b* expressly means that the *b*-things that may or may not be true of *a* are in any case not necessary to *a*. The doctrine turns entirely on the distinction between what *a* depends on, and what is merely true of it.

C. Thirdly, realism does not deny that when *a* enters into a relation, such as knowledge, of which it is independent, *a* now acquires that relation, and is accordingly different *by so much;* but denies only that this added relation is necessary to *a* as already constituted. Thus when *a is known*, it is *a* itself, as constituted without knowledge, that is independent of that circumstance. The new complex *known-a* is of course dependent on knowledge as one of its parts.

IV

A REALISTIC THEORY OF INDEPENDENCE FORMULATED IN GENERAL TERMS

WE are now in a position to advance the notion of independence as a theory: in other words, to set forth its reasons and its applications.

1. *All simple entities are mutually independent.* — Simple entities cannot be dependent[2] in the whole-part sense because as simple they cannot be wholes composed of parts. Simple entities cannot be causally related because they cannot be values of variables, since this again would belie their simplicity. And it is acknowledged by all logicians that simple entities can neither imply nor be implied, these being relations confined to propositions or combinations of propositions.[3]

[1] Royce, *op. cit.*, 117.

[2] The term 'dependence' will henceforth be employed in the sense defined above, 113.

[3] Cf. Russell, B., Principles of Mathematics, 14, 15.

2. *Simple entities are independent of the complexes of which they are members.* — It is evident that a complex cannot be a part of one of its own components. Nor can a simple constituent sustain relations of either causation or implication with its including complex.

3. *Complexes are mutually independent as respects their simple constituents.* — This follows from the previous assertion. If the constituents into which a complex may be analyzed do not depend on that complex, the complex itself may be destroyed without affecting the constituents. Therefore two complexes having some constituents in common are not made interdependent by that fact. Consider the argument advanced by Professor Royce. He supposes two independent entities to have some quality in common, such as 'redness' or 'roundness.' One of the beings is then supposed to be destroyed; while the other, being independent, survives. But if the first being is destroyed, 'redness' must go with it; hence the surviving being cannot possess 'redness,' which contradicts the original supposition. "It follows," he concludes, "that the many entities of the realistic world have no features in common."[1] But the argument turns entirely upon the assumption that when an entity is destroyed its qualities are destroyed likewise, or that the simple constituents of a complex are dependent on the complex; and this assumption, as we have seen, is false.

4. *Complexes as wholes are dependent on their simple constituents.* — The cherry is dependent on 'redness,' 'roundness,' etc. This is no more than a restatement of one of our definitions of dependence. But when taken together with the previous assertion it reveals the important fact that dependence is not always reciprocal. While a complex depends on the terms into which it may be analyzed, these are none the less independent of the complex.

5. *A first complex is dependent on a second complex when the second complex is a part of the first.* — This also is simply the restatement of the whole-part type of dependence. But it is im-

[1] *Op. cit.*, 130, 131; cf. 114.

portant to observe that here again dependence is not reciprocal. A complex part is not dependent on its including whole simply by virtue of its participation therein; but only in so far as it stands in relations of dependence with the other parts. The members of a collection are not dependent on the collection, but may be dependent by causation or implication on other members of the collection. The ordinary supposition to the contrary is due to a confusion that virtually begs the question. Thus we may say that the members of the planetary system depend on the whole system for their being members-of-the-planetary-system. But this is true only in the trivial and redundant sense. It does not prove that Jupiter, *e.g.*, is dependent on the collective planetary system, which is the very question at issue. Jupiter *is* dependent, however, not on the planetary system as a whole, but on the sun, Saturn, etc., as causes and effects, or on the law of gravitation as a premise of implication.

It follows that when two complexes are interdependent, this does not involve the interdependence of their parts. Since *a* does not depend on *abc*, *a* is not necessarily dependent on *r*, even when *abc* is dependent on *rst*.

6. *A first complex is dependent on a second complex when the first is either cause or effect of the second within a system which exclusively determines the first.* — Thus Jupiter is dependent on the sun inasmuch as its velocity is a function of the sun's mass according to a law which alone accounts for that velocity. If the velocity of Jupiter were deducible from the plan of God regardless of the mass of the sun, then despite its conformity to the law of gravitation it would be independent of the sun. Or, if one preferred, one might say that it would then be dependent on the sun *within the planetary system of gravitation;* it being understood that it would be independent of that system by virtue of its place in the plan of God. Similarly, the *mass* of Jupiter cannot be said to be dependent on the mass of the sun, inasmuch as it is definable in terms of its own satellites. Or it could be said to have a *conditional* dependence on the sun's mass, relative to its gravitational relations with the sun.

But even supposing the velocity of Jupiter to be determinable only in the planetary gravitational system, it is important to remark that it is the *velocity* of Jupiter, or some such gravitational property, that is then dependent. If one wishes to say loosely that "Jupiter is dependent," then one must recognize that this is so only in so far as Jupiter is dependent on its gravitational properties as its parts. Dependence by causation is reciprocal; but where it is complicated with the whole-part relation the resulting dependence is not necessarily reciprocal. Thus while Jupiter as a whole is dependent on the motion of the sun by virtue of comprising gravitational properties that are causally dependent thereon, it does not follow that the motion of the sun is dependent on Jupiter as a whole, although it *is* dependent on its gravitational properties. Being independent, let us say, of the apparent color of Jupiter when seen from the earth, it is then independent of the whole Jupiter when this is taken to comprise that color.

7. *A first complex is dependent on a second complex when the first implies the second.* — Thus the premises of a syllogism depend on the conclusion, and the law of a mathematical or physical system together with the values required for the solution of the equation, depend on the value of the unknown quantity. It is important to remark that it is *that which implies* that is dependent, and not its components taken severally. The major premise of a syllogism does not depend on the conclusion, nor the law on a particular cause or effect; for the single premise, or the bare law, do not of themselves imply. So that the falsity of the conclusion does not necessarily disprove the major premise but only the combination of premises; nor does the non-occurrence of an effect disprove the law, but only the occurrence of the cause under the law.

8. *A first complex is dependent on a second complex when the first is implied by the second, and is not otherwise implied.* — If a conclusion follows from several alternative pairs of premises it cannot be said to be dependent on any one pair. But if a certain pair of premises constitute its sole determination, then it *belongs* to them, and is dependent on them. Here, again, dependence is not neces-

sarily reciprocal. In other words, that which is implied may be independent of the implier, despite the fact that the implier is dependent on the implied.

We have thus discovered several instances of non-reciprocal dependence; and in so doing have removed a dialectical objection that has been urged against realism with some force. If 'objects' be independent of the 'ideas,' it does not follow from the formal notion of independence that 'ideas' must be independent of their 'objects.'[1] For the relation in question may belong to any one of the several types of non-reciprocal dependence described above in (2), (4), (5), (6), and (8).

9. *A first complex is independent of a second complex whenever the first is not dependent on the second in any of the senses enumerated above, regardless of their being otherwise related.*

In other words, it is not necessary to present a list of non-dependent relations. Independence is not a question of relation or non-relation, but of the presence or absence in any given case of a certain type of relationship. Entities are independent unless they are proved dependent. Their bare relation is in the great majority of cases discovered before any dependence is proved; and in innumerable instances no such dependence is proved at all. Things are 'together' in consciousness, or in space, they 'succeed' one another in time, they are 'different,' 'more,' 'less,' whether or not they are whole and part, cause and effect, or implier and implied. These simpler relations are entirely intelligible; and must be so regarded even by the most extreme advocates of interdependence. For they enter into all cases of dependence. Such relations hold, for example, of the several postulates, constants, values, etc., of a deductive system, and of the parts of an organic unity. It is impossible to reduce relation to dependence, to reduce temporal suc-

[1] Cf. Royce, *op. cit.*, 119, 69. Realists themselves have cited consciousness as a case of non-reciprocal dependence, but without, so far as I know, discussing the matter in detail. Cf. Russell, B., Meinong's Theory of Complexes and Assumptions, *Mind.* N. S. (1904), 13, 515.

cession to physical causation, for example; because the notion of physical causation is more complex and includes the notion of temporal succession. A complex notion can be no clearer than the simpler notions that enter into it. Dependence is a complex notion that is intelligible only provided the simpler notion of relation is intelligible. If bare relation be a "miracle," [1] then dependence is a compound miracle.

There can be no logical presumption in favor of dependence. Because things once thought independent are afterwards discovered to be dependent, we may distrust our present judgments of independence; but if so we are governed by psychological and not by logical motives. There is as much ground for the plain man's feeling of wonder at the laws of nature, as for the idealist's grieved surprise when his attention is invited to an external relation. In other words, there is no logical ground for either emotion. If one is used to employing the method of inference, one is shocked by unmitigated facts; if one is used to aggregates, sequences, and contrasts, one is startled to discover identities and widely ramifying necessities. But there is no logic that has ever been conceived that prefers the one to the other. The assumption of dependence where it is not found is not only a dogma; it is a superstition that none of its devotees have ever subjected to a searching examination. Had they done so, they would have been forced to the conclusion that a pure, or entire, dependence, is a meaningless combination of words.

The question of independence, then, is an empirical question that must be raised over again for every case under dispute. Given an entity a, and a second entity b, one must inquire whether b is a part of a, or whether a implies b, or whether a is exclusively determined by a system in which it is cause, effect, or implication of b. An affirmative answer to any of these questions asserts the dependence of a on b. A negative answer to all of these questions is equivalent to the assertion of the independence of a on b. And

[1] Cf. Joachim, *op. cit.*, 44, 49.

if such a negative answer is reached, then such relations as *a* does sustain to *b* cannot prejudice its independence.

10. *A first entity may acquire dependence on a second entity.* — This statement must be carefully guarded, and is true only in a very limited sense.

A. In the first place, a simple entity, *a*, may enter into a complex which is dependent on a second complex containing a simple entity *b*, of which *a* was formerly independent. Thus *a* may enter the complex *alm* which is the cause of *brs*; as when the round sun is the cause of the red sunset, 'roundness' having been independent of 'redness.' But, as we have seen above (§ 3) the dependence of complexes does not involve the dependence of their simple components. These are as independent as they were before, despite their figuring in an instance of dependence. This conclusion is evident unless *a* is identified with *alm*, and *b* with *brs*, which is a contradiction in terms.

B. In the second place, a complex may become dependent on a second complex of which it was formerly independent. Thus a body may move into a new field of force and so acquire a causal dependence *de novo*. This affords a proper instance of acquired dependence, provided it be admitted that the body in question has *changed*. The motions of a body *a* up to a certain time were dependent on certain bodies *b*, *c*, etc., within the field of force *M*; and independent of certain other bodies, *r*, *s*, etc., lying in a second field of force *N*. After that time *a* is dependent on *r*, *s*, etc. In other words, *a* has changed from a^1, which is independent, to a^2 which is dependent on *r*, *s*, etc. But it may be objected that since a^1 and a^2 are reciprocally dependent, therefore a^1 is indirectly dependent on *r*, *s*, etc., and a^2 on *b*, *c*, etc. In other words, the body's moving into the field of force *N* is a function of its determination by the field of force *M*; and *vice versa*. We must not, however, hastily conclude that two things dependent on the same thing are dependent on each other. For as we have already seen, causal determination in order to involve dependence must be exclusive. And *a* at the moment of passing into

the second field of force is determined by *both; i.e.* its position, velocity, etc., could be accounted for in terms of either system. Hence if regarded as member of one, it is independent of the other. If, then, we indicate by a^1 the body a so far as wholly determined by system M, and by a^2 the body so far as determined by system N, we may say that a^1 is independent of r, s, etc., the members of system N; and that a, in changing from a^1 to a^2, *becomes* dependent.

It is impossible to say that an entity can acquire dependence only when we include in our definition of the entity in question, all that ever happens, or may possibly happen, to it. This is what Professor Royce, *e.g.*, expressly does. "The man in China who may become my enemy or my neighbor," he says, "is already such that certain changes in him, if they occurred, would not be indifferent to me. This possibility already makes part of his being." [1] Now the possibility in question can be construed in either one of two ways. In the first place, it may be construed as the present actual nature of the man in China. But this is indifferent to me. In the second place, it may be construed as the man's present actual nature *together with a hypothetical relation to me.* This, it is true, is not indifferent to me, but only because I have *included the difference to me in the hypothesis.* It in no way establishes my dependence on the man in China as presently constituted. And even if we grant the eventual dependence, even that does not prejudice our present independence. For even if our paths *do* cross, the point of intersection is deducible from the antecedents in my own life history, quite regardless of the earlier days of the man in China. I should reach that point anyway, following my own course, so that my susceptibility to his influence, my coming within his range, is not dependent on the earlier stages of his course.

Furthermore, it is pertinent to observe, if I decline to define anything short of all that does or may happen to it, I must not only

[1] *Op. cit.*, 126.

deny change from independence to dependence; I must deny change altogether. For as fast as I attribute change to any entity *a*, that change is taken up into its nature; and *a* thus qualified does not change. And the same will hold true of difference, or of any other relation or predication whatsoever. But it is needless to press this objection. It is sufficient for the purpose of a realistic philosophy to say that if there can be change at all, there can be change from a state of independence to one of dependence.

V

A REALISTIC THEORY OF INDEPENDENCE APPLIED TO THE CASE OF KNOWLEDGE

1. *When an entity is known or otherwise experienced it is related to a complex.* — It is impossible to furnish a justification of this assertion without undertaking a complete account of the nature of consciousness. But it is desirable so to explain it as to reduce opposition to a minimum. This assertion would contradict the supposition that in consciousness there is no difference between subject and object, or between consciousness as agent and consciousness as content. It would also contradict the supposition that the subject or agent in consciousness is a simple 'activity' or 'substance.' On the other hand, it would agree with a theory which regarded the subject of consciousness as a context into which the object is brought by virtue of a peculiar relation; or with a theory that regarded the subject as an 'apperceiving mass,' or background of feeling, or organized self-consciousness, to which the object known or experienced is assimilated; or, finally, it would agree with the view that the subject in consciousness is the living and responding organism.[1]

2. *Simple entities are not dependent on consciousness.* — There is, as we have seen, no sense in which simple entities can be said to be dependent at all. It follows that in so far as the knowledge of such

[1] Cf. my Present Philosophical Tendencies, Ch. XII.

entities is possible, they must be regarded as independent of knowledge. But the knowledge of such entities is involved in the method of analysis. If one is to recognize a complex as such, one must be able to ascertain its simple components; for a complex depends on such simple components both for its nature and its meaning.

It is not necessary to assert that simple entities can ever stand alone in knowledge, that they can be known without knowing something else *at the same time.* It may well be that they must be known together with some context or schematism. There may be a *minimum cognoscible,* which is a complex. But this does not affect the question whether simple entities *can* be known. That such is the case is the universal testimony of analysis. Empiricism claims to know simple 'sensory' qualities, or 'impressions.' Rationalism claims to know logical 'indefinables' or 'categories.' And we must conclude that in so far as such elements are known they furnish instances of independence.

Nor, indeed, can a philosophy which rejects analysis avoid the same conclusion. Such a philosophy merely differs from other philosophies in respect of what it holds to be simple. Whereas the devotees of analysis regard 'self,' 'activity,' 'substance,' etc., as complexes, this philosophy declares them to be indivisible. We may fairly inquire, then, for the sense in which such indivisibles are to be regarded as dependent. They cannot be wholes dependent on parts; they cannot cause or be caused in the scientific sense; they can neither imply nor be implied. It would, then, be meaningless to speak of them as dependent. If they are none the less denied independence of knowledge, then they must be regarded as identical with knowledge. No realist or other sane person would, of course, propose to regard a thing as independent of itself. But one who denies realism on such grounds must be prepared to deny the difference between object and subject of knowledge, and identify being altogether with the act of knowing. Such a view does not require attention until some serious effort has been made to answer the objections that have long since been urged against it.

There is an interesting corollary to the conclusion we have al-

ready reached. If simples are independent, it follows that knowledge escapes subjectivity in proportion as it carries analysis through to the end. The ultimate *terms* of experience are at any rate independent, whatever may turn out to be the case with certain complexes of these terms. If the knower desires to eliminate the personal equation and seize on thing-in-themselves, his safest course is to sift experience to its elements and thus obtain a sure footing in the independent world. Such elements, whether sensory qualities or logical indefinables, will afford him a nucleus of independence to which he may add such complexes as will satisfy his criterion.

The present is a suitable occasion on which to comment on a sentiment with which such a view as the above has had to contend. Thomas Reid referred to Hume's abolition of substance as a turning of the elements of experience "out of house and home . . . without friend or connection, without a rag to cover their nakedness." [1] 'Tender-minded' idealists have been moved by the same sentiment — a sort of vicarious nostalgia. "'Greenness,' 'Harmony,' 'Equality,'" says Mr. Joachim, "are to remain eternally and unalterably themselves, whether they are also experienced or not. They are 'the facts,' and they *are there* independently and in themselves. But what is their *being there?*" [2] If this argument has any weight, it is derived from a careless use of pronouns. The hard-hearted realist is quite ready to conclude that the simple elements are *nowhere*. They may enter into this or that group, but they do not *belong* to it; they have no home. The benevolent idealist, on the other hand, offers 'experience' or 'consciousness' as a public refuge for all ontological outcasts. It is the same sentiment that inspires the belief that there must be some last definitive word that can be 'said' about everything. Reality must be defined; everything must be brought into the fold lest it perish in outer darkness. It is important to devise something that can be said of everything; and you *can* say of everything that it either is

[1] Inquiry into the Human Mind (1895), 103.
[2] *Op. cit.*, 40.

experienced or "would be present to a sort of experience which we ideally define." [1] So idealism derives a certain support from the sentimental demand or supposed logical need of some enveloping characterization of things, of some permanent address where things may be always reached despite their wanderings. With the sentimental demand we need not trouble ourselves, while the logical need is the very question at issue. Is there one relation of dependence which all things sustain, or not? If we avoid begging the question, and are critical in our use of the term 'dependence,' we must, I believe, conclude as above, that simple elements, at least, depend on no relation. They are the entities 'at large,' and belong exclusively to no constituency.

3. *Complexes are independent of knowledge as respects their simple constituents.* — This is a further corollary of the conclusion reached above, and requires to be stated separately only in the interests of clearness. Whatever conclusion may be reached as to the dependence of *some* complexes on knowledge, it is important to observe that this can in no way prejudice the independence of the terms into which they can be analyzed. If we should conclude, for example, that an imaginary complex *is* dependent on the act of imagination, it will none the less remain true that such elements as 'blue' or 'identity,' if they be found in the complex, are independent of the imagination. In other words, such dependence as there is must attach to complexes *as such*, and cannot involve their ultimate parts.

4. *The propositions of logic* [2] *and mathematics are independent of consciousness.* — We have now to do with the independence of *some* complexes, assuming that each type of complex must be dealt with on its merits. We have only to select an instance of the type and apply the criteria already adopted. Is the proposition, $c^2 = a^2 + b^2 - 2\,ab \cdot \cos\gamma$, where γ is the angle of a triangle, c the opposite side, and a, b the adjacent sides, dependent on the relation to knowledge?

[1] Royce, Conception of God, 30.

[2] Cf. Marvin's proof that knowledge 'presupposes' logic, above, 51 ff.

In the first place, the above proposition does not *contain* the relation of knowledge, as one of its parts, as it does contain 'line,' 'equality,' 'angle,' etc. The relation to knowledge is not to be found in it by analysis. This is true of all the notions of the cognitive relation mentioned above (1).[1] There is no relation to a background of feeling, or to an apperceiving mass, or to the activity of a self or responding organism. The proposition in question is therefore not dependent on knowledge in the whole-part sense. Nor does the proposition *imply* any of these relations. The only serious question is whether it is causally determined, or implied *by* such a relation. But as we have seen, this is not itself decisive as respects its dependence or independence (see II, 6, 9). Assuming for the moment that the proposition *is* implied by knowledge, and *does* sustain causal relations with the subject of knowledge; we have still to inquire whether it is thus exclusively determined. And it is evident that this question must be answered in the negative. For the proposition is sufficiently determined, without reference to knowledge, by the logical and mathematical systems to which it belongs. It is implied by a set of postulates, and is cause and effect in relation to coördinate theorems. In other words, whether it be determined in the knowledge relation or not, it is in any case not so determined exclusively. This may be expressed more loosely by saying that even were it not necessary for cognitive reasons, it would still be necessary for logical and mathematical reasons; so that its cognitive necessity does not make it dependent.

Thus the proposition in question, since it is not dependent on the knowledge-relation in any of the accepted senses, may be declared to be independent thereof.

5. *Physical complexes are independent of consciousness.* — The question of the independence of physical nature introduces no novelties. The mean velocity of the planet Jupiter, for example,

[1] The argument would be more empirical and decisive were I to employ only what I regarded as the *true* conception of the cognitive relation. But as such a course would narrow the scope of our conclusions I have so far as possible left the question open.

neither contains nor implies the cognitive relation. Assuming that this complex is implied by the knowledge of it, and that it sustains causal relations with the subject of knowledge, it is none the less independent because of the fact that it is completely determined by other relations, such as its distance from the mass of the sun. It can be deduced, and has, as a matter of fact, been deduced, from the celestial gravitational system without reference to cognition.

But I wish in this connection to profit by the powerful support of Mr. L. T. Hobhouse. In his "Theory of Knowledge," this writer declares that the "independent existence" of A is a "negative characteristic of A's existence." "It says," he continues, "'The A which I now apprehend would exist now and would still be A even though I did not apprehend it, and thus (for example) it may continue to exist, though I should cease to apprehend it. . . . We are brought, then, at once to the question, How can this independence be known? And the answer is, *that it depends entirely on our success in discovering universal laws in the occurrences of phenomena.*'"[1] He concludes, in other words, that where a physical event can be inferred from other physical events by virtue of an established law, the inferred event can be regarded as independent of other conditions, such as its "apprehension," that are not required for its inference.

But Mr. Hobhouse proposes a method of eliminating apprehension altogether. Thus if B, which is known from observation to be the effect of A, is given when A is not apprehended, we may infer A to be *causally operative despite its not being apprehended.* In other words, we may now conclude that although when the law was discovered A *was* apprehended, its being apprehended was not a condition of its effectiveness. This is, perhaps, the most convincing way of presenting the argument. Nevertheless, it is important to note that it involves a dangerous and needless concession to the opponent. For it is not necessary to eliminate a condi-

[1] Hobhouse, L. T., Theory of Knowledge, 522 (italics mine).

tion in order to disprove its necessity. If A can be shown to be the cause of B, so that B can be inferred from A alone, this is sufficient to prove the independence of B on C, whether C as a matter of fact happens to be present or not. B is dependent only on those parts of the context which exert determination upon it, or require to be employed in deducing it. Strictly speaking, it is never possible to obtain an empirical instance in which *only* the determining conditions are present. It is the task of science to distinguish within a total manifold those factors which do count and those which do not. Thus the determination of the length of a side of a triangle by a specific ratio of the magnitudes of the opposite angle and its adjacent sides, is discovered within a fuller context, containing, for example, the absolute magnitudes of the adjacent sides. And at the same time that it is discovered that the ratio in question does count, it is found that the absolute magnitudes do *not* count. Similarly, when Galileo discovered that acceleration was a function of the time of a body's fall, he discovered that it was not a function of the body's weight or volume. And to establish this it was not necessary for him to obtain an instance of a body without weight or volume; it was sufficient for him to show that the factors, although present, *did not enter into the calculation.*

We may conclude, therefore, that in so far as physical phenomena are deducible from physical causes without reference to consciousness, they are independent of consciousness, even though consciousness be present; even, indeed, though they were to prove deducible from consciousness also. In short, if physical event B be sufficiently determined by physical cause A, B is independent of C, *whatever its relation thereto.*

6. *Logical, mathematical, and physical complexes may be or become objects of consciousness, despite their independence.* — Since dependence has not been identified with bare relation, the assertion of independence does not involve the assertion of non-relation. If knowledge be defined merely as a relation, it is, therefore, impossible to argue that a thing's independence forbids its being known.

The question cannot, however, profitably be discussed in terms

so general and non-committal. We must suppose that when a thing *is* known, it enters into a system which is internally determined. If we are not to regard the subject of knowledge as a simple indefinable, and its relation to its objects as an ultimate relation of which no more can be asserted than its disjunctive or external character,[1] there is only one course open to us. We must observe the knowledge process in the concrete, and take into account whatever physiological, psychological, or ethical factors it appears to involve. If such a course is adopted, we can scarcely deny that the knowledge process *has laws of its own;* and that the parts of the knowledge process, *including the object,* must come under the terms of the law and be determined by it. In other words, *if* a thing is known, it must submit to the conditions which knowledge imposes.

Thus Mr. Joachim says, paraphrasing what he regards as the independence theory: "Greenness is an entity in itself. And though, as experienced, it is related to a sentient consciousness, yet *even in that relation* it remains in itself and unaffected by the sentience." He then very fairly inquires, "Is it then irrelevant to the nature of greenness what the nature of the sentience may be? Clearly, the sentience to which greenness can be related is 'vision,' not 'hearing.' But we are to understand that this restriction is not based on the nature of greenness as such, but is just a fact. And presumably also the restriction in the range of the sentience — the restriction, *e.g.*, of vision to color, of hearing to sound, of this type of vision to greenness, etc. — is just a fact, which in no way enters into the nature of the sentience." [2]

I regard Mr. Joachim's remarks as entirely pertinent. The relation between greenness and vision is not arbitrary. To suppose so would be to ignore certain well established conclusions of physics and physiology. Nor is the relation of the object to the

[1] This appears to be the course adopted by Messrs. B. Russell and G. E. Moore. To the present writer it seems to over-simplify the issue, and avoid very pertinent questions. Cf. Moore, The Refutation of Idealism, *Mind*, N. S. (1903), 12, 442, 449, 453.

[2] *Op. cit.*, 43 (italics mine).

other factors of consciousness, within the conscious process itself, ever arbitrary. At any rate there is as much evidence of law and determination here as anywhere else.

In discussing this matter further, I shall employ that doctrine concerning consciousness which I personally hold to be true. In this case, I feel justified in doing so because the doctrine in question does not evade Mr. Joachim's difficulty, but exhibits it in the strongest possible form. Let us assume, then, that consciousness is a process containing a nervously endowed organism, a specific type of response to stimulation, and portions of an environment selected by the response. Let us assume, furthermore, that this operation as a whole is *interested* or *teleological*. It follows that when there is consciousness of B, B is introduced into a system governed by two types of law. On the one hand, B will now obey the laws of optics, acoustics, etc., determining the interrelations of physical stimuli and physiological sensory mechanisms. On the other hand, B will now obey the biological and ethical laws which govern the action of an organism on its environment. B, in so far as known, is determined by the subject of consciousness, whether this be regarded as a physiological complex or as a moral agent. And we must conclude that B is therefore deducible from these factors under the terms of the laws governing its relations with them. So that did we but know our sense-physiology, our biology, and our ethics, as well as we know our celestial mechanics, we could presumably deduce B from our consciousness of it; or 'greenness,' *e.g.*, from the sensory process by which it is apprehended.[1]

Are we, then, to conclude that 'greenness' is dependent on the sensation of it? No; and for a reason that has already been set forth. To prove B to be dependent on C it is not sufficient to prove that B is implied or causally determined by C. It is necessary to prove that it is *exclusively* determined by C. And in so

[1] In order to make such a deduction it would, of course, be necessary to possess laws governing the *interaction* of organism *and environment*. Laws governing the action of the organism by itself would not suffice.

far as B is implied or causally determined by A, as in the case of physical events, that determination establishes B's independence. We may conclude, in other words, that even though an object enter into relations of determination when it *is* known, such relations do not prejudice such independence as it possesses by virtue of its logical, mathematical, or physical determination. In so far as any given object is deducible otherwise than from consciousness, it is independent of consciousness.[1]

The realist is by no means one of "those who admit that the sole and exhaustive relation of the 'self' or 'ego' to objects is that of knower of them." He would willingly grant that "one who is knower is, in relation to objects, something else and more than their knower," and that "objects are, *in relation to the one who knows them,* something else and other than things in a knowledge relation." [2] He does not, in other words, deal with the knowing relation abstractly, but regards it as a complex process, involving physical, physiological, biological, and ethical factors that are determinable by the laws proper to these sciences. I do not wish to limit the extent to which this determination may go,[3] nor even to preclude the possibility of there being physical complexes *exclusively* determined by the organic processes involved in consciousness. But even in such cases the principle of independence would not be endangered. If perceiving modifies its objects as one body modifies another, then we must attribute to the object at least as much independence of consciousness as we attribute to one body in relation to another. No body is ever wholly dependent on another body. Its being modified by another body means that the second body makes some difference — but not "all the difference." Hence the alteration of the perceived body by the physiological mechanism of perception could in any case prove only that a body

[1] Cf. Pitkin, below, 396, etc., for evidence showing that on the whole it is characteristic of organic response not to disturb the environment; that is, not to introduce into it factors which are not determined by its own non-biological laws.

[2] Dewey, J., Brief Studies in Realism, II, *J. of Phil., Psychol., etc.*, 1911, 8, 551, 552.

[3] Cf. Pitkin, below, 405.

otherwise independent of consciousness is in a certain limited respect dependent thereon. Furthermore, considerations such as these could not possibly be used to establish either the universality or the uniqueness of dependence on consciousness. It would be a dependence happening to *some* bodies, under peculiar conditions which *sometimes* obtain, and more often do not. It would be only a special case of a very common kind of dependence, arising from the fact that the organism belongs to the field of interacting bodies.

Thus a thing may *become* known and *cease to be known* (IV, 10), even though knowledge involve a modicum of dependence. Thus *B*, *e.g.*, might, owing to physical reasons alone, be brought within the conscious process. Its earlier history, including arrival at the point of entrance into consciousness, would be determined by its physical antecedents. From thenceforth its history would be determined by new laws, remaining independent of them just in proportion as it could still be accounted for in terms of the old laws. It might then drop out of the new system and thereafter be exclusively determined by its physical conditions. In this way a body might have a continuous history that is independent of consciousness, despite an interval of determination by consciousness.

VI

CASES OF SUBJECTIVITY, OR DEPENDENCE ON A PRIMARY CONSCIOUSNESS

By 'subjective' I shall mean whatever is dependent on consciousness. It is important to recognize the existence of such a category, and to present instances that will illustrate the meaning of independence by contrast. We may also hope in this way to develop a power of discriminating doubtful cases; although many cases must for the present remain doubtful.

We must distinguish at this point between dependence on a primary and on a secondary consciousness. We shall find that a

thing which is dependent on one consciousness-relation is independent of others; or that cases of subjectivity are themselves in an important sense independent.

1. *Parts of consciousness as such, are dependent on the whole of consciousness.* — An object-of-consciousness cannot be such without consciousness. As we have seen (III, 3) this is really equivalent to asserting the dependence of a whole on its parts; it asserts the dependence of consciousness in a broader sense, on consciousness in a narrower and included sense. As it asserts the dependence of consciousness itself, and not the dependence on something else on consciousness, it is included here, therefore, only for the sake of clearness.

But it is worth while again to emphasize the asymmetrical character of whole-part dependence in this application. Mr. Russell observes that awareness is "utterly unlike other relations, except that of whole and part, in that one of its terms presupposes the other. A presentation must have an object." [1] Were Mr. Russell to enter into the particulars of the question, he would find, I think, that presentation *is* a case of whole and part; and that the one-sided dependence of presentation on object is only a special case of the asymmetrical dependence of whole and part.

It is further to be observed that even should a complex prove to be dependent on the subject of consciousness, this would in no way involve the dependence of its parts on the subject of consciousness, whether those parts be simple or complex. Still less would it involve the dependence of such parts on the parts of the subject.

2. *Parts of consciousness are reciprocally dependent within the system of consciousness, but only in a limited sense.* — In other words, a thing *is* a part of consciousness by virtue of the action of the other parts; and once it is such its behavior is conformable to the laws of consciousness. Thus when I perceive B, B is dependent for the status 'perceived-object,' upon the act of perception. And in the new rôle of the 'perceived-object,' it obeys the laws of

[1] Russell, B., Meinong's 'Theory of Assumptions and Complexes,' *Mind*, N. S., (1904), 13, 515.

perception, and is determined by the other factors involved in perception. Thus if we limit our view to the system *objects-perceived-by-M*, *B*'s history therein, its appearance, alterations, and disappearance, are functions of the subject *M*. But, as we have seen, this does not mean that *B* is unqualifiedly dependent on *M*, unless it has been shown that the limited system in question determines *B* exclusively.

Thus, neither of the cases thus far cited can be said to furnish a real case of subjectivity. We require an instance of something which is a part of consciousness, which implies consciousness, or is *exclusively* determined thereby.

3. *The presence of some elements alone in one complex is dependent on the selective action of consciousness.* — There is, in other words, a privative character attaching to the assemblage of contents of consciousness which can be accounted for in no other way but by the sensibilities, threshold, attention, etc., of a sentient organism, or by the organism's selective interest.

The limited manifold of a mind's contents appears upon retrospection, when it is contrasted with the larger manifold from which it is taken.[1] One then learns to distinguish *what-one-was-conscious-of*, from the complete environment of consciousness. But introspection alone does not reveal the causes of selection, the conditions making the difference between what does and what does not 'get into' consciousness. The difference is evidently not one of elementary constituents; for the contents of consciousness are interchangeable with the contents of the surrounding field. There is nothing in the inherent nature or quality of 'greenness,' 'roundness,' 'relation,' etc., that determines either their presence or their absence from among the contents of a mind. But an explanation *is* found in the capacities and action of the organism. Thus in

[1] In an article entitled Conceptions and Misconceptions of Consciousness, *Psychological Rev.*, 1904, 11, 282–296, I attempted to justify and illustrate this assertion. James (Essays in Radical Empiricism, 24) and Lovejoy (Reflections of a Temporalist on the New Realism, *J. of Phil., Psychol., etc.*, 1911, 8, 594) have expressed their agreement with this view. But in the article mentioned I did not sufficiently *account for* the limited manifold.

order that 'greenness' shall appear among the contents of mind *M*, *M* must possess the capacity of vision developed to the point of color discrimination; *M* must be attending to 'greenness'; and greenness must be relevant to some interest which is moving *M*. These and other like conditions determine the difference between greenness 'in,' and greenness or any other element 'out,' of consciousness; or between the class of the 'ins' and the class of the 'outs.'

Thus the complex of which one is conscious is determined as a limited or partial complex by the relationship which it sustains to the subject of consciousness. Much that is supposed to be dependent on consciousness in a more drastic sense can be explained by this principle, notably the cases of spatial perspective and temperature relativity. These are selections from the full geometrical or thermal field, and are not created, but only picked out by the position or state of the sentient organism.[1]

4. *The presence of some elements together in one complex is dependent on the combining action of consciousness.* — The same conditions which determine the inclusion of contents of mind, determine also their partnership. The physical, physiological, biological, and ethical principles which determine the entrance of 'greenness' into the complex of *M*'s content, determine also what shall be there *with* 'greenness'; for example, the complex 'greenness' *and* 'roundness,' *as co-contents*.

This may be a matter of little or of great importance for the elements so correlated. In other words, it may mean no more than the bare fact of fellow-membership, the peculiar cross-relation among contents; or it may mediate some of the further varieties of dependence enumerated below. Thus the relation sustained by *A* and *B* within the content-field may also be wholly determined by other causes; as when, *e.g.*, *A* and *B* are perceived in their natural spatial relations. Or, *A* and *B* may be combined in a new way; that is, in a way determined by the agency of consciousness ex-

[1] Cf. Holt, below, 303 *et al.*; and Pitkin, below, 393.

clusively. It is this which occurs when the imagination is said to be 'creative.' Or A and B, through their co-presence as content, may indirectly acquire new relations, such as 'meaning'; and these new relations may be of crucial importance for A and B. They may, for example, bring about the employment of A and B in the subsequent operations of M. In short, as fellow-members of one consciousness, A and B may begin a new epoch in their careers through being brought within the play of practical and social forces.

Thus far, then, we have recognized two instances of genuine dependence on consciousness; both of which can be characterized as *content-patterns*. Content-complexes possess an individuality both as respects what they include, and as respects what they include together; and in both respects are determined exclusively by the agency (selective and combining) of the subject of consciousness.

5. *Value is dependent on consciousness.* — This is a matter on which neo-realists are by no means agreed.[1] To the present writer, however, it seems evident that value is a function of desire. This does not mean that the 'precious metal,' gold, is dependent on desire; but only that its *preciousness* is thus dependent. It derives its economic value from the 'demand' for it;[2] and its decorative value from the sensuous gratification which it affords. Gold in other respects may be, and is, for the most part, entirely independent of consciousness. Gold can, on this ground, be declared to be dependent on consciousness, only provided its preciousness is included in its definition. There is a physical or chemical gold that is not precious; which is, in other words, definable and determinable without reference to the part it plays in economic and æsthetic life.

[1] Moore and Russell, *e.g.*, hold that 'good' is independent of consciousness. Cf. Moore, G. E., Principia Ethica, 137. For my own view, cf. The Moral Economy, Ch. I, and Present Philosophical Tendencies, Ch. XIV.

[2] Mere rarity does not, of course, give value to a thing unless there is a demand for it.

Whether value is dependent on *knowledge*, or not, is another question. Though contrary to my belief, I am perfectly willing, for the purposes of the present argument, to concede that a thing cannot be desired without being known. In that case, then, value does depend on knowledge of the object possessing value. But in any case, as we shall see presently, value does not depend on being known to be such. That is, it is possible to desire without knowing that one desires. And it is the primary relation of desire that endows a thing with value, whether the relationship itself be known or not. The important fact is that *A*'s value is *A*'s being desired by *M*, *N*, or some entity capable of desire. If one then assumes that desire is a variety of consciousness, and that an entity capable of desire is a subject of consciousness, it follows that *A*'s value is dependent on consciousness; not only on the primary desiring act which directly endows it with value, but on whatever other conditions in the conscious subject, such as the presence of other desires, affect that primary desire.

6. *Works of art are dependent on consciousness.* — By 'work of art' I mean whatever complex is caused by the physical organism acting in pursuance of its interests. Such a complex may owe its internal and external arrangement to the organism's action, *to a greater or lesser extent.* It may be simply used 'as it is'; or it may be moved, divided, redistributed, or brought into new physical configurations. In any case, what happens to it exclusively in consequence of the purposive action of life, is dependent on consciousness. Consciousness is the means of bringing things within the range of purposive action. It determines the limits of the environment 'taken account of,' as distinguished from the total environment. The range of consciousness defines a field of things liable to action. A thing 'noticed' is a thing that can be avoided, used, or remade, as exigencies may require. Furthermore, the actual dealings of the organism with such objects, the process of art itself, is guided by consciousness.

It is important to note that the modification of the object is not in this case *directly* due to consciousness. By consciousness the

object is brought within reach of other causal agencies. It is made dependent on the body by the action of the mind. Again, it does not follow that any object *A* which is subsequently modified by the action of the body is unqualifiedly dependent on the mind. It is dependent thereon only for what is 'done' with it or 'made' with it. It is quite open to us to suppose that *A* is independent of its being manipulated at all. Furthermore, if for any reason the modifying action of the organism were not to take place, *A* would never enter upon the phase of dependence. Consciousness renders its objects dependent in this sense only in so far as it is followed up by some physical operation involving the objects. In short, works of art are dependent on consciousness for, and only for, *whatever there is of art in them.*

7. *Higher complexes, such as history, society, life, or reflective thought, are dependent on consciousness.* — Whatever complex contains consciousness as one of its components, or whatever set of premises implies consciousness as its necessary conclusion, is evidently dependent on it; and I have cited the most obvious instances that occur to me. It is, of course, to be remembered that while these complexes as wholes or sets of premises depend on consciousness, it does not follow that the several components depend on consciousness. Thus while a municipality depends on consciousness, because it contains or implies it, its bricks and mortar do not share this dependence. If they are dependent, it must be for some other reason, such, *e.g.*, as their being works of art.

'Reflective thought,' as defined by the pragmatists, affords, perhaps, the most instructive instance. 'Reflective thought' is a complex process in which one 'bit of experience' *means*, or is 'idea-of' another. In order that *A* shall mean *B*, *A*, at least, must be 'experienced.' Whether we express this in terms of the whole-part relation or in terms of implication, in any case the meaning process depends on the simpler process of experiencing. It does not, however, follow that experiencing is dependent on meaning, or that the thing experienced is dependent on being either experience or idea.

It will be observed that in the above discussion a realm of subjectivity has been explicitly admitted and defined.[1] If there be a polemical virtue in admitting it, there is a constructive virtue in attempting to define it. It is no part of realism, as I understand it, to reject "purely subjective existence," out of hand;[2] but rather to be more specific about it, and above all to avoid hypostasizing the facts of subjectivity into a substance, or into a new continent inhabited only by subjectives. But perhaps I should say that the realist *does* deny '*purely* subjective existence'; for any realist would deny that there is anything that is subjective *through and through.* A subjective complex can always be analyzed into elements, or even into lesser complexes that are 'objective.' Subjectivity, in the sense of exclusive determination by a subject of consciousness, attaches only to certain relationships or complexes in their solidarity.

Furthermore, realism does not consist essentially either in the denial or the assertion of subjectivity; but in the assertion that there are cases of entities, simple and complex, that are independent of consciousness. 'Epistemological monism' means that when perceived, things are directly and identically present in consciousness; in virtue of being perceived, they constitute what is called content. And realism adds the further assertion that, in certain notable cases, at least, things are none the less independent for being so perceived. Thus the case for realism rests on showing that to be content of a mind, is not to be dependent on a mind.

The questions of error, illusion, hallucination, dreams, etc., all raise new issues; and these issues are dealt with in other parts of the present volume. Subjectivity is not error. The whole point of error lies in the difference between building 'air-castles,' and *mistaking them for something more substantial.* But in the

[1] This list of cases of subjectivity is not intended to be complete, but only illustrative. It is not intended to exclude, *e.g.*, the possibility of cases in which the body perceived is physically modified by the sentient organism in the act of perceiving it. Cf. above, 135.

[2] Lovejoy, *op. cit.*, 597.

concluding portion of the present chapter I shall present certain considerations that are at least relevant to the question of error. For I propose to point out that subjectivity itself possesses a certain independence as respects a secondary consciousness, a superadded knowledge of it; which will at least show that there is a radical difference between bare subjectivity itself, and that vicious subjectivity through which the term is confused with the misfortunes of cognition.

VII

THE INDEPENDENCE OF SUBJECTIVITY ON A SECONDARY CONSCIOUSNESS

1. *The subject of consciousness is independent of being known.* — The subject of consciousness is of course a case of subjectivity. I do not mean that what assumes the rôle of subject is dependent on that rôle, but that it is dependent *in* that rôle. It is only in a loose sense that one can speak of dependence here at all; it is, more strictly, a case of identity, and I have not thought it worth while to cite this as a case of dependence. The important fact is that a subject need not *be known*. A subject may be the condition of the content-status assumed by its content without itself assuming such a status.

Thus there may be consciousness without self-consciousness. Idealists have always accorded a partial assent to this conclusion, in that they have denied the subject a place among its own content. They have called attention to the fact that the content-manifold *as a whole* is the passive correlate of an active subject. But they have felt called on to provide some unique way in which the subject may be known without becoming content. The result has been to formulate a contradiction that they have never succeeded in relieving. For to refer to the subject as *known*, whatever peculiarity may attach to knowledge in this instance, is evidently to put it on the passive side of the correlation. The

difficulty is as gratuitous as it is insuperable. There is no reason whatsoever for supposing that whatever knows, must be known. There is no reason why the subject, in order to condition a content-manifold, should itself lie within the manifold.

On the other hand, there is no reason why the subject of the cognitive relationship *M-A* should *not* be known, through sustaining a like relation to another subject *N*. In other words, there is no difficulty in supposing a complex relationship, *N-M-A*, where *A* is content of *M*, and *M* of *N*. Thus it is entirely consistent that the acting organism which does not appear within the field of its own objects should nevertheless appear within the field of objects of a second organism.

2. *One consciousness may be independent of another.* — Two individual units of consciousness may be dependent in that one includes or implies the other, or in that the two are mutually and exclusively determined. But on the same grounds one is independent of the other in so far as it does not include or imply it, or sustain relations of exclusive determination with it. And such cases abound.

Suppose, for example, as is universally the case when the question of solipsism is under discussion, each of two consciousnesses lays claim to the other. Thus *M* finds *N* as a part of itself, and *N*, *M*. Then in so far as *M* includes *N* as its object, it does not follow, as is commonly argued, that *N* depends on *M*, but rather that *M* depends on *N*. Argued on these grounds the conclusion would be just the reverse of solipsism and would result in an utter self-abnegation. As a matter of fact, however, it is possible in the majority of such cases to define a narrower *M* which excludes *N*, and is independent of it. *M* does not depend on *N* unless *M* is defined to exclude everything which happens to it. *M* may, however, be a soul-substance, or a constant nucleus of states, or a central purpose, and is then not dependent on *N* unless these include *N* or are defined and determined by *N* exclusively. And the same holds true of *N* in its relations with *M*. The root of the solipsistic absurdity is a failure to remember that such a situation is mutual.

If there is ground for asserting one witness, there is the same ground for asserting a 'cloud of witnesses.' And if any individual consciousness can set up independently and then proceed to annex other consciousnesses, then these other consciousnesses enjoy the same right. If the solipsistic train of reasoning is generalized, it destroys itself. But as a dialectical argument it is always generalized. It postulates an independence in the case of one consciousness which cannot on principle be denied to others, and which is self-contradictory if generalized.

Philosophies which emphasize the unique certainty and independence of the self make much of the argument from analogy. We are said to know ourselves first, and then infer the existence of other selves from the similarity of their behavior to our own. But as Mr. Moore has very effectively pointed out, the argument from analogy in this case assumes the independence of physical facts.[1] Another's consciousness is said to be inferred from his behavior. But such an inferred consciousness can be regarded as another's only provided I regard his behavior as a physical reality. If I construe another's behavior as my perception, then I can infer only my own consciousness, and not his. The analogy from which I argue may be formulated in either one of two ways. I may say that when *I have* a perception of a bodily contortion, I have also a feeling of my own pain. Or I may say that when *there is* a certain bodily contortion there is correlated with that body a feeling of pain. And the argument from analogy leads to different conclusions in the two cases. In the first case having had a second and similar perception of bodily contortion, I expect myself to have a similar feeling of pain. I argue, in other words, from a relation between my perceptions and my feelings. But in the second case, observing a second and similar bodily contortion, I infer a similar feeling of pain to be correlated with *that* body, as mine is correlated with my body. In the one case I argue from my perceptions to my feelings, and never get outside the operation of the laws of

[1] Moore, G. E., The Nature and Reality of Objects of Perception, *Proceedings of the Aristotelian Society*, N. S., 1906. 6, 111–121.

my own consciousness; in the other case, I argue from bodies to feelings, and have from the beginning regarded my own consciousness as only an instance of such correlation. As Mr. Moore justly concludes, the existence of other consciousness, if it is inferred at all, is inferred *from bodies* as such, and not from the states of the mind which performs the inference.

In my own view, other consciousness is not inferred at all. It is observed precisely as physical phenomena are observed. It consists in a complex relation between a sentient and interested organism and some parts of its environment; and its independence of another onlooking self is only a special case of the independence of physical events on the observation of them.

In any case, there is no reason for doubting the mutual independence of selves as respects their mere consciousness of one another. They may enter into relations of whole and part or into physical or social relations of causality; but no universality or necessity attaches to such dependence. The only *general* arguments for the dependence of one consciousness on its apprehension by another, namely, the dialectics of solipsism, and the alleged inference of others by analogy with self, virtually presuppose independence at the outset.

3. *Mental content is independent of introspection.* — Any doubts as to the truth of this assertion must cast suspicion on the validity of the method of introspection. For introspection is supposed to be the means of knowing what contents are in the mind. These contents are in the mind by virtue of the selective action of some subject of consciousness. But once there it is supposed that they may be observed there by introspection. Just in proportion as introspection itself introduces new elements, it is a source of confusion. Such new factors must if possible be identified and eliminated. Introspection yields genuine psychological results only in so far as it reveals that which was determined to be in mind apart from the act of introspection itself. Otherwise it is not knowledge of psychical data, but simply a psychical disturbance, which itself constitutes a new psychical datum.

It is very easy to fall into confusion here. It is said that psychical facts appear only on retrospection when they are contrasted with the non-psychical or objective. "The instant field of the present," says James, "is only virtually or potentially either object or subject as yet." The 'state of mind' is "first treated explicitly as such in retrospection." [1] But to be state of mind, and to be "treated as such," are very different matters. To say that the limited field of 'states' is *first discovered* when a mind doubles on itself, and sees around its former limits, is one thing, and is substantially correct, so far as any single mind is concerned. But to say that the limits did not exist until they were 'seen around,' is a very different and entirely unjustifiable assertion. The "instant field of the present" is a potential object of introspection, but only because it already possesses a psychical character. Did I feel at liberty to employ a conception of mind which I have not had an opportunity of expounding or justifying in the present article,[2] I should go further, and say that even the *knowledge* of mental contents is independent of introspection, in that mental content may be directly, and in some instances more accurately, observed by a second mind.

4. *Value is independent of judgments about value.* — Value, as we have seen, consists in a relation to desire. In order that a thing shall be valuable it must be object-of-desire. But it does not follow that the complex relationship, object-of-desire, must itself be object of consciousness. For the purposes of ethical inquiry, needs, desires, demands, etc., together with their objects, must be regarded as facts to be thought about, and if possible, explained systematically. But they are no more dependent on ethical thought about them, than physical events are dependent on physics.

It is only as facts or events that desires are final or infallible. If *M desires A*, then he does, and there's an end of the matter. But if *N*, or *M* himself, thinks that *M* desires *A*, then he is liable to error. Were value to consist in thought about value, we might

[1] Essays in Radical Empiricism, 23, 24.

[2] I refer to the view discussed in Ch. XII of my Present Philosophical Tendencies.

be driven by the fear of a skeptical relativism into the haven of an absolute thinker that should standardize values. To say that the good is what anybody *thinks* good, is both dialectically and empirically untenable. But to say that the good is what anybody desires, is simply to offer a definition which is both in agreement with fact and logically innocent. There is no more dialectical difficulty in this than in saying that an instrument is what anybody uses, or a footing what anybody stands on. The current confusion of what should be a perfectly evident truth, is due mainly to the invention and wide use of terms like 'evaluation,' 'appreciation,' 'affective judgment,' etc., in which the notions of desire and of judgment are fused together into a vicious equivocation.

5. *Perception and simple apprehension are independent of reflective thought.* — Reflective thought in which *A means* or is *idea of B*, requires that one or both shall be 'experienced'; and therefore contains or implies whatever relation is in question when it is said that *A* or *B* is 'experienced.' The relation of meaning or ideation is a relation *within* a manifold of elements, some of which already belong to consciousness in a more primitive sense. The reverse dependence, however, does not hold. In order that concept *A* shall be apprehended, it does not require to be used as an idea; in order that body *B* shall be, or be perceived, it does not require to be meant by an idea.

There is good ground, therefore, for the pragmatist's polemic against identifying things with their thought-status, or intellectual form. Things have an independent footing in an immediate or presentative knowledge, which not only exceeds but also underlies mediate or representative knowledge. The only fault in the pragmatist's view is that it does not clearly and expressly take the next step, and say as any thorough realist will say that *things are likewise independent of experience.*

This consideration affords just ground for suspecting that such writers as Dewey, for example, are not thorough-going realists. They emphasize independence of a certain elaborately complex instance of experience, the instance, namely, of discursive or mediate

knowledge; but they by no means make it clear that they do not take the realm of experience itself to be all inclusive.[1] And such a generalization would certainly be contrary to realism. Furthermore, Professor Dewey's restriction of the term 'knowledge' to the discursive process, allows most instances of selective consciousness, of *experiencing*, to fall outside the application of his principle of independence. Thus sensing, for example, is not knowledge; and therefore the principle that things are independent of knowledge, does not hold of the case of sensing. It would be more proper, I think, to regard sensing as a case of knowing. Even 'smelling,' which Professor Dewey thinks to be clearly beyond the pale, should be so regarded; for it is evidently different from "gnawing or poking" in that it introduces a specific content into the mind, and so makes the mind aware of a characteristic of its environment.[2] In any case it is clear that if things are universally dependent on such experiencing as sensing, and if knowledge takes place only within the field of experiencing, then the independence of things on knowledge still leaves them dependent on action, or on life, or on some such principle, which for a thorough-going realism must be regarded as all one with knowledge.

Philosophy is here again the victim of an equivocal term. For 'experience' may be taken to mean the *things* experienced, or the experience-relationship itself. To contend that experience is independent of discursive thought may still leave one well within the ramparts of idealism. For the independent thus defined, may be construed as the complex process of *experiencing*. One does not become a realistic outlaw until one has either expressly interpreted experience in the first sense, as things, simply, or has expressly asserted things to be independent of experience, in the sense of experiencing or being experienced.

[1] Cf. Dewey, J., Reality as Experience, *J. of Phil., Psychol., etc.*, 1906, **3**, 253–257. I have discussed this matter more fully in my Present Philosophical Tendencies, pp. 224–225, 314–316.

[2] Cf. Dewey, J., Brief Studies in Realism, I, *J. of Phil., Psychol., etc.*, 1911, **8**, 396 (note).

VIII

Conclusion

Our conclusion, briefly summarized, is as follows: —

1. Independence is non-dependence.

2. Dependence is not the same as relation, but is a special type of relationship, in which the dependent contains, implies, or is exclusively caused or implied by that on which it is dependent.

3. The independent may be related or not, provided it is not related as above (2).

4. The object of consciousness is related to consciousness, but it does not follow that it is dependent on consciousness.

5. There are entities, embracing all simples and some complexes, which are not dependent on consciousness, because not related to it as above (2).

6. This in no way prevents their being otherwise related to consciousness.

7. There are cases of subjectivity, that is, of complexes, that as such are dependent on consciousness.

8. Subjective complexes both contain entities that are independent of them, and also are independent of secondary conscious relationships into which they may enter.

A DEFENSE OF ANALYSIS

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By Edward Gleason Spaulding

I

INTRODUCTORY

In this essay I shall attempt both a general and a specific defense of analysis. A general defense might not be exclusively dependent upon a general realistic position; but there are revealed in a defense of analysis as such many reasons which make for the correctness of the realistic position. My specific purpose becomes, then, not simply to defend analysis *qua* analysis, but also by this means to defend the general realistic interpretation of both whole and part. I shall, then, defend analysis as a method of knowing which discovers entities or parts which are real in quite the same sense as are the wholes which are analyzed. This position may be called Analytical Realism.[1]

1. *The Types of Analysis and of Wholes.* — There are two general types of analysis: (1) formal, and (2) experimental or 'material,' both of which imply a relation of great importance to science and philosophy, namely, the whole-part relation.[2] That which is analyzed is a whole. Analysis is the discovery, or, possibly, the invention of parts — the parts of the whole analyzed. Which of these analysis is — discovery or invention, — revelation of fact or falsification —, is in reality the central question at issue. On this point parties divide. But all agree that that which is analyzed is in some sense a whole, and that that to which analysis leads is in some sense a part.

[1] The general evidence and proof for the realistic position are presented in the Introduction to this volume.

[2] See Perry, this volume, 107, and Russell, B. Principles of Mathematics I, 360 *et passim.*

By experimental analysis is meant that kind of analysis which is made in the case, for example, of chemical compounds. These are sometimes physically taken apart, and their constituents are perceived or revealed in quite the same way as are they themselves, as wholes. It is this kind of analysis that is made, to a certain extent, at least, of those entities which are dealt with in the chemical, the physical, the biological, and, perhaps also, the psychological laboratories. It may not be justifiable to call all such analysis 'material,' except by analogy, but it can be called experimental.

Of the same character is that analysis which accompanies our non-scientific, perceptual, and certain conceptual processes. Perception is itself analytical, discriminatory, selective. In it, preceding all scientific hypothesis, there is analysis like that to which experimentation itself leads.

By formal analysis is meant that kind which is made of such typical wholes as the motion of a projectile, the flow of an electrical current, the number-continuum, the continuity of time, etc., where the parts are distinguished and discovered, but nevertheless left *in situ*. Some of these wholes are physically observable entities and experimentally analyzable. But not exclusively so. At a certain point other methods must be brought in, which are identical with mathematical analysis, methods which are based on rational principles, methods which lead to analytical results that in many cases are directly confirmed by further experimentally directed observation and measurement. Such analysis may be called formal.

Examples of specific complexes which are analyzed might be cited in great number, and so, of course, might also the specific analyses and the results to which they lead. But, just as the types of analysis can be distinguished, so also can a classification be made of the complexes or wholes which are analyzable, although to do this itself involves analysis, and constitutes a statement of results rather than a method of proof. But the very type of analysis which is involved in discriminating not only different kinds of

analysis, but different kinds of wholes, is subsequently considered in detail in this essay, and receives its full justification.[1] There are:

1. Aggregates or collections of any number of objects in any order, in numerical conjunction. Thus there is the collection of objects with which I am now concerned, namely, this chair, and this table, and this pen, and my thoughts, and the concept 'whole,' and 1 and 2, etc.

2. Classes formed or composed of parts which are not classes, but which may be either organic wholes, or individuals, or simples, or collections. Thus the atoms of carbon, all electrons, the even integers, the rational fractions, are such wholes.

3. Classes formed or composed of subordinate classes; examples: element, number, integer, etc., which are subdivided respectively into the classes, monovalent and bivalent element, cardinal and ordinal number, odd and even integer.

4. Unities or organic wholes; examples: any specific individual chemical compound existing at some particular place and time, any one organism, any one individual molecule or atom.

2. *What is Analysis?* — The wholes which are analyzed differ as the above classification indicates, and analysis is itself either material or formal. But what are the characteristics of the genus *analysis* which, for example, is presupposed by the classification of analyses and by the discovery that there are wholes or complexes composed of parts? The answer is that analysis is, doubtless, itself somewhat complex and devious, and that perhaps anything more than a working definition of it is most difficult. Analysis may be a process, but if it is, it would appear to be such a complex one that a simple definition of it is impossible, and that its own character can be revealed only by an elaborate analysis. But an exact and precise logical definition may not be necessary. Every one understands in a general way what analysis is, what it means, and what it does. To this general understanding appeal may be made, and, relying

[1] See Section IV of this essay.

on it, it may be said that to analyze means to discover that an entity is in some sense formed or composed of parts. Thus, as previously asserted, analysis involves the whole-part relation. The entity which is formed or composed of parts is for that reason called a whole or complex, although, in some cases, its parts may in turn be wholes or complexes, as we have seen. The position, however, that analysis means in every, or even in any case, *discovery* of parts, — implying that these already exist or subsist independently of the analysis and discovery — is one which is disputed. As opposed to it the position is taken by some, that to analyze means to invent, to construct for purely practical purposes of one kind or another, such as prediction and the control of nature, an *artificial division* into parts.[1] This view fits in with, or is a part of that aspect of pragmatism which is well called the instrumental or biological view of knowledge.[2] According to it, analysis is simply an intellectual instrument, a mode of adaptation, where anything which works, in the sense that it does adapt the organism to its environment, is to be accepted at least at its *face value*, namely, that it does work. Only, of course, pragmatism goes beyond this, and identifies this working with truth. Secondly, this pragmatic view is sometimes extended to mean that reality in general, or any specific part of reality which may be selected and distinguished from other parts, is plastic and lends itself to almost any kind of analysis and moulding, but that the analyses which are or have been actually made are necessarily constructed from a human point of view. This is the *humanistic* interpretation of analysis, as well as of its counterpart, synthesis, and of philosophical and scientific method in general.[3] Thirdly, both of these interpretations are compatible with that interpretation of analysis which makes its validity identical with its verification, giving psychological pragmatism,[4] — or dependent upon and tested by

[1] Bergson, H. (Mitchell, A., trans.) Creative Evolution. 1910.

[2] Cf. Montague, W. P., May a Realist be a Pragmatist, *J. of Phil., Psychol., etc.*, 1909, **6**, 460 and 485.

[3] Cf. Montague, *ibid.*, 561.

[4] Cf. Montague, *ibid.*, 543.

its utility or value, giving logical pragmatism.[1] These four positions as to the nature of analysis are open to various criticisms, among them being those which can be made from a realistic standpoint. For the realist regards analysis, in the great majority of cases at least, to be the discovery *in a whole* of elements or parts which exist or subsist independently of the analysis and discovery. He grants, of course, that analysis is useful, admits, perhaps, that there are few things more so, but he finds that such usefulness presupposes the realistic interpretation of analysis.[2] So, also, he admits that the validity of analysis may, to a certain extent at least, be tested by its value, although so to do involves many difficulties and ambiguities as to what *standard* of value shall be selected. Further, those aspects of wholes which shall be discovered as parts may be dependent for their *discovery* upon distinctly human interests. For various and sundry reasons, namely, for those of scientific tradition, of religious feeling, of æsthetic appreciation, — all *human* 'things' — the actual analyses which men are interested in making may be only *some* out of many that are possible; they may be selective. However, the realist can make all of these admissions and yet retain his realism. Indeed, not only this, but he holds, further, that he can show that all of these positions which he is willing to admit *demand his realism* rather than controvert it. It is only to the position, that the validity of analysis is in any specific case identical with its verification, that the realist is fundamentally opposed. For such a position means, he holds, subjective idealism.[3] Of that he can and will have none.

But the pragmatic interpretation is not the only one. There is at least one very distinct type of attack, which, at the same time that it is pragmatic to a certain extent, goes quite beyond this interpretation. It is an attack which, while in direct opposition to the realistic view of the results of analysis as discovery, is, never-

[1] Cf. Montague, *ibid.*, 561. [2] Montague, in the four papers just cited.
[3] Montague, *ibid.*, 543.

theless, realistic in its interpretation of the whole which is analyzed. It opposes one kind of realism only to reinstate another, using *rationalism* as its method of attack, and *mysticism* in support of the realism which it does accept. Such an attack on analysis has been recently advanced by Bergson,[1] and has attracted much attention. A similar attack was made by Bradley [2] less recently.

The very core of this attack is the claim that analysis is identical with falsification in that very precise sense in which this term (falsification) can be defined, — namely, as involving contradiction. According to this attack, analysis is the finding, or inventing, or constructing, or discovering — or what-not — (in a whole) of *parts* which in a certain one, or in a few, or in many respects are the contradictories of the whole. For example, it holds that the analysis of motion leads to 'rests,' as terms,[3] but that, since rest is the contradictory of motion, *either* the analysis *or* the intuition of the whole, of the motion *qua* motion, is false, and the former alternative is chosen. For Bergson, such contradictory parts are invented — by intellectual processes, and, were he consistent, he would have to admit that anything short of One all-inclusive, interpenetrated, Evolving-whole is self-contradictory, and so false and not real. For Bradley, the parts are produced, or even possibly discovered, by intellectual processes, but, since they involve contradiction, anything short of One Absolute is false and unreal. Briefly, the recipe for both of these philosophers seems to be, Self-contradictory 'things' are what we find or get when we reason; therefore, to get at truth, at reality, avoid reason, and use feeling, intuition, ecstasy, absorption!

It is not my purpose to present the history either of the attack or of the defense. But the point must be made, that all the attacks on analysis are made by methods which themselves involve analysis or are analytical. The analysis which is attacked may be different from the analysis which is used in attacking, and so,

[1] Creative Evolution, and Time and Free Will (Pogson, F. L., trans.) 1910.

[2] Bradley, F. H., Appearance and Reality, 1894.

[3] Bergson. Creative Evolution, 163.

conceivably, a specific attack might be valid. But if it were, it could serve to invalidate *only* certain kinds of analysis, to show their limitations, etc., but the invalidation could not be universal. The validity of at least the means of attack would, willy-nilly, be presupposed. Some analysis, at some point, would be exempt from successful attack and criticism. Then the supposition would remain, that, if some analysis is valid, all might be, and that at best only certain specific analyses could be in error, but that analysis *qua* analysis could not be invalidated.[1]

§ But to return to our question as to what analysis is. Given a whole which, for one reason or another, is known to be analyzable, then analysis reveals parts, but *it also reveals the relations* which relate and so organize these parts into some kind of whole. Consider also those properties which, in some cases, the whole, as a whole, may have different from those of the parts. Of course, analysis reveals these also. The analysis may be incomplete in the sense that there may be further parts, that is, parts of parts, which are not yet revealed; but, if the analysis is incomplete only in this sense, that is, if there have been revealed parts, their organizing relations, *and*, in some cases, the possibly specific properties of the whole, then the analysis may be said to be adequate. It exhausts the whole up to the point that it reaches, in that, while the specification of all that the analysis reveals does not specify the whole, the whole, nevertheless, *is* the parts *and* their properties *and* the relations relating the parts *and* the possibly specific properties of the whole. There may be further parts of parts, more properties, more relations to be revealed, but this of itself does not invalidate the position that the properties of the parts and the generating relations which are revealed are quite as real as is the whole which is analyzed, are not the contradictory of the whole, and exist, or subsist, independently of the discovery and of the specification.

This, then, is one meaning of analysis, a more precise and adequate one than the one previously given. It is, however, another

[1] Cf. my paper, The Postulates of a Self-critical Epistemology, *Phil. Review*, **18**, 615.

definition which is tacitly made by the attacking party of the Bergsonian, and, sometimes, of the Bradleian type, although not by the pragmatist, the definition, namely, by which analysis is held to give *only* terms and in which no cognizance is taken of the organizing relations. Advantage is taken of this omission to contrast the terms and their properties with the whole and its properties, and thus, through this neglect, to find the looked-for contradiction between part and whole, and so the falsifying character of the analysis.

II

COLLECTIONS AND ENUMERATIVE ANALYSIS

THE first type of whole which can be distinguished is that whole which is simply an aggregate, or collection. Among its parts there may be similarities and differences of various degrees. So, too, may the types of relations which exist, or subsist, between these parts be many or few, similar or widely different. Certain specific relations may exist, or subsist, between certain parts, others between other parts, but in any case, whatever be the parts, and whatever be the relations, the parts form a *collection or aggregate* in that all the parts are related to one another by the relation which is expressed by *and*.[1] The process of enumeration can be started with some parts, whether or not it is completed or completable. In this sense, all the parts of any collection, or any number of parts of any collection, form a whole; they are denumerable, and so stand in one to one correlation with the cardinal integers. This relation to the members of at least one other class, the cardinal integers, the parts of a mere collection have, whether or not between all of them as parts any one other relation holds exclusively or not.

In this connection I may quote Mr. Bertrand Russell. "When

[1] I shall regard *and* as expressing a relation, namely, the numerical conjunctive relation, although there are departures from this usage. Cf. Russell, Principles of Mathematics, 71.

a class is regarded as defined by the enumeration of its terms, it is called a *collection*. By a collection I mean what is conveyed by '*A and B*' or '*A and B and C*,' or any other enumeration of definite terms. The collection is defined by the actual mention of the terms, and the terms are connected by *and*. It would seem that *and* represents a fundamental way of combining terms, and that just this way of combination is essential if anything is to result of which a number other than 1 can be asserted." [1] "Every pair of terms, without exception, can be combined in the manner indicated by '*A and B*,' and if neither *A* nor *B* be many, then *A* and *B* are two. *A* and *B* may be any conceivable entities, any possible object of thought, they may be points or numbers or true or false propositions or events or people, in short anything that can be counted. A teaspoon and the number 3, or a chimæra and a four-dimensional space, are certainly two. Thus no restriction whatever is to be placed on *A and B*. It should be observed that *A and B* need not exist, but must, like anything that can be mentioned, have Being. The distinction of Being and existence is important, and is well illustrated by the process of counting. What can be counted must be something, and must certainly *be*, though it need by no means be possessed of the further privilege of existence. Thus what we demand of the terms of our collection is merely that each should be an entity." [2]

In this sense, then, anything, taken with at least one other 'something,' and these two with another something, and so on, form a whole. Accordingly, there is an aggregate or collection of *all* entities—of all terms, and relations, and classes, and concepts, and propositions, etc., which exist, or subsist. Such an aggregate may be called the *universe*, and is, *in just the sense defined*, a whole. It has parts, and its parts are connected by numerical conjunction, but that does not preclude the existence or subsistence both of wide differences and of great similarities among its parts, and, in the latter case, of classes whose parts are related by one or more specific relations; nor does it preclude the independence both of terms

[1] *ibid.*, 69. [2] *ibid.*, 71.

from one another and of classes, whether closely similar or widely different from one another, at the same time that these terms and classes are related. Relatedness and independence are quite compatible,[1] and that *totality* of entities which is the universe is quite as consistent with pluralism as with monism, with independence and great differences as with dependence and one fundamental similarity.

In the case, then, of the first type of whole, the terms are simply the parts which are enumerated, and the chief organizing relation is simply that which is expressed by the connective *and*. Any whole which is an aggregate may also be more than this, and, if it is, there are other organizing relations than *and*. But a whole may be a mere aggregate notwithstanding certain other relations, such as those of similarity and difference, among its parts. Such a whole, however, does not seem on the basis of genuinely empirical investigation to possess any distinctive properties as a whole; it *is* simply its parts, with their properties, summed and numerically conjoined. Nevertheless, on some other basis, that of some assumed, speculative principle, from whose standpoint the attack is made, the collective whole, especially that collective whole which is called 'the universe,' is *made* to have properties which its parts do not have, and to be of such a character *as* a whole that it cannot be analyzed without falsification.

One has only to consider the attacks of Bergson and Bradley to find this statement confirmed. Each of these philosophers attacks that ordinary conceptual analysis which is crystallized in the language of everyday discourse, and on the basis of which we can make an enumeration of kinds. But each also attacks that conceptual analysis which is identical in part with science.[2]

For each of these attackers of analysis, the real world, ultimate

[1] See Perry, this volume; 113; also The Program and First Platform of Six Realists, (See Appendix.) *J. of Phil., Psychol., etc.*, 1910, 7, 393; also Introduction to this volume.

[2] Bergson, Creative Evolution, 9, 160–163, 303 *et passim*, and Bradley all through his Appearance and Reality.

reality, cannot be disclosed by analysis — if we take their explicit claims and ignore their tacit usage and presuppositions. It is not a collection, not a class, not an organic unity, but is in some sense just One — One Absolute or One Evolution. Analysis can at best have only a pragmatic justification, for, false though it is, ironically it can serve one finite part of this universe, namely, one organism, in adapting itself to other parts, and in finding out that they are false and that only the whole is true! Why, now, all this subversion of the results of both common sense and science and of much philosophy? By *reason* of what are the conclusions of these philosophers reached — for they do *reason*, do use premises, do analyze?

The position, then, as to the nature of wholes, upon which this attack on the possibility of their analysis is based, is shown by only a slight inspection to be nothing more or less than that very theory which the realist finds used so frequently by his opponents, namely, the theory of 'internal relations.' The attacking party grants that wholes are manifolds and complexes [1] — in some sense, — but holds that the parts or elements are all constituted by their relations to all other parts in the complex. Briefly, there is a universal interpenetration! But this is the theory of internal relations, or at least one aspect of this theory, namely, that which may be called the 'modification' or 'constitutive' aspect of the theory in distinction from the 'underlying-reality' aspect.[2] According to the internal theory in general, as inclusive of both 'aspects,' independence [3] precludes relatedness, and conversely. But relatedness is undeniable fact. Therefore, it is concluded, related terms are mutually dependent. The next question is, What is the nature of this dependence? According to one theory, the constitutive, this mutual dependence can only mean that each term makes a difference to the other and, therefore, consti-

[1] See, *e.g.* Bergson, *ibid.*, 162.

[2] Cf. my papers, The Logical Structure of Self-Refuting Systems, *Phil. Rev.*, **19**, 3, 276, and 6, 610; and Russell, The Basis of Realism, *J. of Phil., Psychol., etc.*, **8**, 158.

[3] Cf. Perry, this volume, *loc. cit.*

tutes it, at least in part. The two terms in relation form a unity, a whole, of some kind. But then, if another term is related to *this unity* and to *each* of its terms, and so on, and so on, very clearly each so-called term becomes or *is* infinitely complex. Manifestly it becomes most difficult if, indeed, not impossible, to discover what a term is or to identify such. Seemingly, *everything is a complex*, even those ultimate terms which such a complex would seem to imply.

According to the other aspect of the 'internal theory,' the mutual dependence of two related terms implies a unity, but this unity cannot exist, or subsist, as identical with the terms, *for they are two*. Therefore the unity exists, or subsists, as an underlying or transcendent entity, whose function it is to mediate the relation. By using contradictory terms, for example, self and not-self, this unity can be made all inclusive and yet One. However, at this point, this second aspect of the internal theory does not concern us greatly. That which does is the constitutive, the interpenetrative aspect, for it is upon this that at least one part of the attack on analysis is based. As confirming this assertion we may cite M. Bergson's statement that "The distinct outlines which we see in an object, and which give it its individuality are the plan of our eventual actions that is sent back to our eyes, as though by a mirror, when we see the surfaces and edges of things. Suppress this action, and with it consequently those main directions which by perception are traced out for it in the entanglement of the real, and the individuality of the body is reabsorbed in the universal *interaction which, without doubt, is reality itself.*" [1]

Clearly, however, this position involves many difficulties. The argument both for it and for the other 'aspect' is grounded on the attempt to show that by the opposite view, the theory of external relations, in accordance with which relatedness and independence are quite compatible, the relatedness of terms cannot be explained. But this attempt fails! [2] In fact, the internal theory in either of

[1] Creative Evolution, 11 (italics mine). Cf. also, *ibid.*, 162, 188, 338–340.

[2] Cf. my two papers, just cited.

its aspects can be stated, argued, and known as a theory only at the cost of using the theory of external relations, and so, of limiting itself. Thus, *in strict consistency* with the constitutive theory, it is impossible to find or 'pick out,' or identify any entity as a genuine term; but the theory is stated, argued, and known — supposedly as an objective theory — and terms and propositions are identified as just those terms and propositions; and principles of proof are accepted. To recognize and identify any so-called term is really to tacitly assert that, even if the term is related to all other terms, it can nevertheless be identified as just that term without identifying all its relations, and that it is in this respect independent of these relations. Again, the assumption that the theory is a true, known theory presupposes that, although it is related to the knowing, it is independent of the knowing. Further, even granting that it does apply to some terms and relations, it requires the theory of external relations in that it demands (1) terms — ultimate terms — to be modified, or to constitute other terms through relations, and (2) that these terms can be got at in some way. The question, however, in which we are chiefly interested is not whether the internal theory has no application, but simply whether this application can be universal. Evidently it can not be, for the simple reason that observation shows that it does not fit all cases of relations. Clearly, then, it is hazardous to argue, on the basis of its *assumed universality* — for *all* relations between *all* entities, — that analysis is impossible. And yet this is exactly what is done when *everything* is put into a whole in which interpenetration is made universal.

The fact is that the theory of internal relations does not have a *universal* application. *The infinite complexity of terms does not exist, or subsist. Specific* reasons for the incompleteness, or the inadequacy, or even the falsifying-character of analysis, — specific reasons other than this infinitely-interpenetrating, complex constitution of terms — might conceivably be advanced in specific cases and found to hold good. They might hold good in some cases, and not in others; perhaps in all, *but possibly in none.*

Which is the case, only detailed empirical investigation can show. But to hold on the basis of the arbitrary application of the constitutive theory of relations that the analysis of a whole is impossible, is a self-limiting, a self-contradictory position.

My defense of analysis will proceed, then, along the lines just indicated. The attacking party does not and cannot hold consistently to the constitutive aspect of the theory of internal relations; he cannot make this theory universal, so as to base his attack on all analysis *qua* analysis on it. Nor can he consistently base his attack on its own outcome. My defense, then, will endeavor to show that, *dismissing* that argument against analysis which is derived from the constitutive theory — as it really is dismissed logically and involuntarily by the attacking party himself at a certain point, — the adequacy and validity of analysis can be demonstrated if *both* the terms *and* the organizing relations, to whose discovery analysis also leads, are considered. The attack which is really to be met is, then, not that which is grounded on the constitutive theory of relations, but, rather, the position that analysis leads to terms which are the *contradictory* of the *whole*. This position becomes *the real argument of the attacking party*. But this attack is based on the ignoring of the organizing relations, or, in some cases, on making a false analysis — which is, of course, easily attacked, or — what is much the same — on a misstatement of the actual results of correct analysis. In the latter case the remedy is easy to apply. Consider the analysis as it is actually made, in its correct form, and its supposed falsifying character disappears. In the former case, consider the organizing relations, and again the falsification disappears. Consider both terms *and* relations *and* the properties of the whole which may be left over, but which are revealed by analysis, and the analysis becomes *adequate* at the same time that there is opportunity for that 'creative evolution,'[1] for that creative synthesis which some of the attacking party emphasize so strongly, but which is not dependent, for its acceptance, upon the validity of their attack.

[1] Cf. Bergson, *op. cit.*, 217, *et passim.*

Enough has been presented to show what our conclusions must be with reference both to the first kind or type of whole, the aggregate or collection, and to the analysis with which the enumeration of the parts of such wholes is identical. This analysis stands as perfectly valid. No argument other than that one which is formed purely speculatively and by analogy, and which is self-refuting, can be advanced to show either its intrinsically falsifying or inaccurate character. There is no strictly empirical argument which leads to these conclusions. But further, just as no strictly empirical basis is found for applying either aspect of the theory of internal relations to the parts of a collection, so there is no empirical basis for applying either of these aspects to the cognitive situation which is involved in the act of enumerating, and of analyzing. Rather, the empirical evidence is the other way, namely, that the theory of external relations applies to this situation.[1] Then there is no opportunity for accepting the analysis as valid, as analysis, and yet of interpreting it from some non-realistic standpoint. Our conclusion is, therefore, that this first type of analysis stands as valid *qua* analysis, and that also it is to be interpreted only realistically.

III

THE SECOND TYPE OF WHOLE (SPACE, TIME, ETC.) AND ITS ANALYSIS

THAT the conclusion just reached for the first type must be accepted for the analysis of the other kinds of wholes is the position also held by the realist. But this must be demonstrated in detail for each kind. We proceed, then, to the consideration of the second type. In wholes of this type there are parts, revealed by analysis, all of which, in any one whole, are similar in at least one, possibly in many respects, and are related by one or more common relations other than that of numerical conjunction.

[1] This volume, Introduction.

Now it is against certain specific types of the analysis of wholes of this second type, especially against their formal analysis, that the attack is especially directed, in order to furnish, it is held, a basis for the (erroneous) generalization that *all* analysis is false. For, in the case of at least certain specific types of analysis here, the *terms* to which analysis leads, if attention be directed exclusively to them and the organizing relations be ignored, can be made to *seem* to be the contradictory-opposite of the whole which is analyzed. This contradictory character of the parts is sometimes connected, though erroneously, with the application of the constitutive theory of relations to the whole which is analyzed.[1] However, that there is no empirical reason for applying this theory to these wholes, and that analysis does not lead to contradictions, if its results are stated accurately and justice is done it, will be demonstrated in what follows.

The wholes of this second type are, as wholes, classes, or assemblages of similar individuals; they are designated by so-called universals, by generic and abstract terms, terms with an extension and an intension. Examples of such wholes, so designated, are carbon, American, even integer, etc. The class as many is formed by the terms composing it. The terms themselves may be certain other kinds of wholes, such as organic wholes, but they are not classes, for that would give us the third type. The analysis which leads to the discovery of the parts may be either experimental or formal, or both. For example, in the case of discovering the atoms of any element, or of the atomic theory as applied to any element, the analysis is, in part at least, experimental; perhaps in certain cases it is purely so, while in others, such as that of discovering points, instants, irrational numbers, derivatives, etc., it is formal. Formal also — and this is an important example — is the analysis of those changes, either of position or of state, in which the terms are identical with the *derivatives*, $\frac{dy}{dx}$'s, of certain entities with respect to time.

[1] See the preceding section.

The actual analyses which are attacked, are, in the order in which analysis shows they should be arranged according to the principle of logical priority,[1] those of number, space, time, change, motion, and change of state. Here, as with the first type of whole, that attack which is based on the argument (Bradley's), that any and all *diversity* and so any and all relations of any and all terms are self-contradictory, will not again be replied to, nor will certain other positions, already dismissed. So also that attack which is based on the arbitrary application of the constitutive theory of relations will not be considered, for it is not made directly against the analysis of this kind of whole — except by analogy. *Only that attack* which is grounded on the supposed direct contradiction between the terms revealed by analysis and the whole will concern us here. The model for this attack is really, in every case, I think, the specific attack on the analysis of motion, and this is in its logic as old as Zeno. Briefly, this model attack goes as follows: Motion is given *as a whole*, to immediate experience. Its chief character as a whole is that it is continuous change — of the position of a body, in time. In accordance with the theory of constitutive relations it might be held, and as a matter of fact is held by Bergson, that what the analyst would attempt to distinguish as the body, the time, and the positions, respectively, are fused and interpenetrated so as to form *one whole*. This is Bergson's doctrine of *duration*.[2] But it does not enter this model attack which we are now considering, and which Bergson also uses. This is constructed by surreptitiously granting time to be the independent variable in the usual sense. Then the attack on the analysis of motion follows. Analysis — so this model attack goes — breaks space up into points, time into instants, and then makes motion consist of rests. The moving body is *in* or *at* a point at each instant, and this is interpreted as rest. But rest is the con-

[1] See this essay, 205.

[2] Cf. Matter and Memory (Paul and Palmer, trans.), 1911, and Creative Evolution 9–10, 46, 201, 338–346, *et passim*. Bergson's doctrine of 'duration,' as an attack on analysis, is examined later in this essay, 212.

tradictory of motion. Therefore does the analysis falsify. It makes the originally given continuous entity, motion, a discontinuous set of its own contradictories, rests. Each rest is *thought* by itself, in fact when we *think* motion, *intellectualize* it, we make it rests. Each rest is thought of as 'external' to the others — as just that rest, identical with itself, unchangeable, and so the very contradictory of a specific kind of change — motion. Each rest is inert, and the various rests are external to and exclusive of one another, and so are discontinuous with one another — at least so the argument goes. On the basis, now, of this model attack, the conclusion is reached, that not merely does this specific analysis falsify, but that, quite analogously, all analysis 'spatializes,' works in terms of inertia, of geometry, of statics, of immobilities, of discontinuous entities, etc. (surely a curious jumble which a more careful analysis would clarify), and so falsifies that which everything is, namely, a universal Becoming.[1] But it is clear that this model attack does not do justice to the actual analysis against which it is directed, if, indeed, it states this correctly. Clearly, it considers only the terms, and ignores the organizing relations. But worse than this, it misstates the terms; it sets up a false analysis, only to knock it down — always an easy task. For the analysis of motion, stated correctly, *does not lead to rests!* If in this case, then, if in this model attack, justice is not rendered analysis, and yet if the attacking party generalizes from this model, does it not suggest that his entire attack is seriously vitiated? My defense will confirm this suggestion.

The first kind of analysis which I shall thus examine is arithmetical analysis, as it is found in authoritative sources, making no claim to originality other than in the selection and arrangement of results, and in some of the argumentation.[2]

[1] Bergson in numerous places in the three works cited.

[2] Among the works consulted here and in connection with the sections on space, time, and motion are: Pierpont, J., The Theory of Functions of Real Variables, 1905; Dedekind, R., Essays on Number (Beman, W. W., trans.) 1901; Young, The Theory of Sets of Points, 1906; Russell, Principles of Mathematics, 1903.

1. Arithmetical Analysis. — Much analysis is intimately connected with arithmetical analysis, for in this such general and important problems as those of *continuity* and of discontinuity, of finitude and of *infinity*, etc., have received their most complete and precise treatment. Here, however, only such features of arithmetical analysis as must be taken account of in order to defend it and to elucidate certain other analyses will be presented.

A. Numbers. — Modern arithmetical analysis finds good reasons for grouping numbers into several classes; there are ordinal and cardinal numbers, positive and negative numbers, real numbers, rational integers and fractions, and irrationals. Classifying these, real number is the *genus*, and real numbers are either rational or irrational, and, in turn, the rationals are either integers or fractions.

B. Rational Positive Integers. — The rational positive integers are the terms of the series, 1, 2, 3, 4, . . . $n-1$, n, $n+1$.

Some of the important characteristics of this series or whole and of its terms are:

1. It is a series whose terms present an objective order of *magnitude*, which is to be defined as a certain pair of indefinable relations, *greater* and *less*, which are asymmetrical and transitive,[1] each being the converse of the other. *Terms capable of these relations are magnitudes.* Therefore the rational integers are magnitudes.

2. These numbers form a series or progression whose terms subsist in a certain order by virtue of an asymmetrical transitive relation *such that*, if x, y, and z be consecutive integers, and $x < y$, and $y < z$, $y = x + 1$, and $z = y + 1$, and xRy, yRz implies xRz. The specific generating and organizing relation is, then, in this case, asymmetrical and transitive.

3. It is a series or progression which not only lacks continuity, but is not even *dense* or *compact;* that is, between *any* two of its terms there is *not* another term or integer. It is thus discrete and

[1] For definition, see below.

consists of terms which are only *next* to immediately preceding or successive terms — a characteristic which is not found in the arithmetical continuum.

4. The series is Archimedean; that is, there is no number a so small but that some multiple of a, say na, is greater than any prescribed positive number b.[1]

5. The terms of this series are not existents; that is, they are not of necessity correlated with specific instants of time or with these *and* specific points of space. This means that they are not psychological entities, although they can be correlated with these. *Counting does not generate, but, rather, presupposes them.* Nor are they physical entities. The assumption that they are presupposes its contradictory.[2] Indeed, both psychological and physical entities imply these numbers, but not conversely. In this sense the latter are logically prior to the former; they subsist independently of all existential entities.[3]

6. Further, these numbers are neither spatial nor temporal; that is, they are not terms either of finite (though small) spatial extension in one or more dimensions, or of temporal extension, time. The assumption that they are this presupposes the contradictory; for, in defining and analyzing such extension or duration, not only are elements of extension, points, which are not extended, and elements of time, instants, which are not duration, implied, but *also the correlation* of the numbers with these *non-extended* points and instants is implied. Therefore the numbers are not extended.

7. Thus these numbers are logically prior also to both the points of space and the instants of time. Instants and points imply the integers, but not conversely. The integers, then, are individuals or terms which are *external* to each other without being spatially external. Externality, logically, does not have an exclusively

[1] This feature is important in connection with the later discussion of velocity and acceleration.

[2] If they were physical, they would be spatial and temporal; but they are neither. See 6 and 7.

[3] See Perry, this volume.

spatial connotation. Its ultimate logical meaning is *exclusive individuality.*

C. Relations. — Before going further in my statement of the results of arithmetical analysis, clarity must be introduced in the matter of relations. The term 'relation' has already been used, but not defined. Modern analysis tends to show, however, that 'relation' is an indefinable. Term, however, can be defined as any entity which can stand in any relation, and terms can be classified as physical and mental entities, complexes and simples, existents and subsistents, classes, individuals, and relations.[1] Leaving 'relation' undefined, however, analysis succeeds in distinguishing and classifying relations. One of the classifications which is important for this essay is that which distinguishes relations as symmetrical and asymmetrical, and as transitive and intransitive.

1. A relation is transitive if it is *such that* xRy, yRz together imply xRz; it is intransitive if this implication does not hold.

2. A relation is symmetrical if it is such that xRy implies yRx; it is asymmetrical if it is such that xRy excludes yRx. If xRy, then x is referent, and y is relatum.

3. A relation is ordinally correlating if it is such that it couples every term of a series s with a specific term of another series s', and *vice versa*, in the same order in each. It is merely correlating if it couples any term of the one series with any term of the other in any order. In either case it is *one-one.*

4. A relation is one-one when, if x differs from x', and y from y', there subsist xRy and $x'Ry'$, but not xRy' and $x'Ry$.[2] Motion is a specific instance of such a one-one correlation between points and instants.

5. A relation is many-one if, x and x' being different, xRy and $x'Ry$ both subsist. Rest is a specific instance of a many-one correlation between many instants and one point.

6. In these cases, moreover, if x, the referent, belongs to some

[1] Not as relating, but as related in another context.

[2] Cf. Russell, Principles of Mathematics, 113 and 305.

class contained in the domain of the relation, then the relation defines y as a function of x, and the series of x's forms the independent variable, the 'argument,' and the series of y's the dependent variable; that is, an independent variable is constituted by a series of terms each of which can be referent to a certain relatum. For example, time is the independent variable in both rest and motion. In actually existing rests we have one point correlated with many instants through the occupation, by a material particle, of that point for a finite time. In motion each point is correlated with one and only one instant of time through the occupation, by a material particle, of each point for an instant. But this occupation is not to be interpreted as rest.

7. There are two theories of relations, known respectively as the theories of external and of internal relations.[1]

This presentation of the results of analysis in the field of the integral numbers suffices to make clear what the reply must be to any attack on this specific kind of analysis. Clearly in the case of the rational integers there is given no whole which is prior to the parts, and which, as a whole, can be contrasted with the parts to prove the falsifying character of the analysis. The parts cannot be shown to be the contradictory of the whole, because there is no whole which is empirically given prior to them. The only whole is the series or class of *individuals* in a certain relation. Any other kind of whole here could be constructed only on the basis of arbitrarily applying the theory of internal relations to the integer series. But this would be a very artificial procedure, and is, in fact, carried out by no one. We may conclude, then, that the analysis of the integer series, as it has been stated in its essential details, is quite sufficient to present the character of that whole and of its analysis, and to refute that type of attack which claims that such analysis is falsification, that numbers are spatial, etc. In fact, this analysis offers no opportunity for the argument that analysis leads to parts which are the contradictory of the whole.

[1] This essay, Section II. Asymmetrical relations are unintelligible on any other theory than that of external relations. See Russell, *ibid.*, XXVI.

D. Rational Fractions. — So far as the purpose of this essay demands that the analysis which deals with the rational fractions shall be considered, these numbers are treated in the subsequent section on the whole group of rationals. Suffice it to say, that, leaving *division* and *multiple* undefined, a rational fraction is that number which subsists by virtue of any integer a being a multiple of any integer b, and which is represented by the customary symbols a/b or $a : b$.

E. The Whole Group of Rationals, both Integers and Fractions. — Analysis reveals the following important (for this essay) characteristics of this assemblage of rational integers and rational fractions.

1. The terms of this assemblage form as many types of series as they are objectively capable of; that is, there are as many orders among them as there are defining serial relations of which the terms of this assemblage are the field. The order of magnitude is one such order, the so-called 'natural order.'

2. Any one of these orders is a series or progression whose terms subsist in some specific order by virtue of an asymmetrical transitive relation.

3. A proper name can be given to each of the terms of any series of this assemblage.

4. Any of the series of this assemblage is *dense* or *compact;* that is, between any two terms there is an infinite number of terms of the same series.

Definition. *By an infinite number* is meant such a class, u, that $u - 1$ (class u') is in one-one correspondence with u; u is then similar to a proper part, u', of itself.

5. By virtue of 4 there is, in any series of the assemblage, no term immediately preceding or succeeding any specific term; that is, no term is *next* to any other. Yet no series of this assemblage is *continuous* in the strict sense of this term. The assemblage is only compact. For example, it does not subsist in one-one correspondence with *all* the points of a right line.

6. The assemblage is Archimedean.

7. The general concluding statements (5, 6, and 7) which were made above concerning the nature of the cardinal integers, their relation to psychical and physical entities, to counting, etc., hold good also for this assemblage and need not be repeated here.

F. Irrational and Real Numbers. — That there are irrationals is discovered in the realization that there is some value for x, whereby, for example, $x^2 = 2$. This value is found to be neither a rational integer nor a rational fraction. It belongs to that class of numbers which are called irrationals. What these numbers are cannot in the nature of the case be stated by the proper names which are applied to the assemblage of rationals, but it is possible to determine an infinite sequence of rational numbers, $a_1, a_2, a_3 \ldots$ such that each number, a_n, satisfies more nearly than the preceding ones the conditions of the problem.[1]

Irrationals may accordingly be defined as the limits of such series of rationals as have neither a rational nor an infinite limit, a limit being defined as follows: "L is the limit of the sequence $A = (a_n)$ when for each positive rational number ϵ, chosen small at pleasure, there subsists an index m such that $l - a_n < \epsilon$."[2]

The importance of the irrational numbers rests in part upon the fact that only through them is the assemblage of numbers, that is, integers, rational fractions *and* irrationals, *continuous in the strictest sense of this term.* This is one of the principal reasons why the presentation of arithmetical analysis has been introduced into this essay. For one of the chief attacks on analysis is that which holds that analysis falsifies that which is continuous. It is important, then, to present clearly and with precision that which analysis shows the continuum to be. We shall then be in a position to do analysis justice, and to find out if it really does lead to contradictory parts and so falsify. The nature of the number continuum may be stated as follows:

Let η be the assemblage of rational numbers, both integers and

[1] Cf. Pierpont, *op. cit.*, 35.

[2] Pierpont, *ibid.*, 25.

fractions, in order of magnitude. This series is denumerable and compact, as has been seen. Let θ, now, be the assemblage of rationals and irrationals. Then η belongs to θ. Θ, then, is of such a character that between any two of its terms there are terms of η, and conversely. Then the assemblage of numbers constituting θ, in order of magnitude, *is the number continuum.*[1] The following are the attributes of this assemblage:

1. Between any two assigned limits, say, 0 and 1, there are all values or numbers.

2. The assemblage includes all its limits and all its members are limits. (See previous definition.)

3. These members or terms are *individuals*, infinite in number, external to each other, each different from every other, and are related by an asymmetrical, transitive relation.

4. These individuals are not analyzable into new terms like to or different from themselves, although the proper names by which some of them are designated may be. They are *simples*, not complexes. The assumption that they are so analyzable repeats the problem, and is ultimately found to presuppose its contradictory.

5. The assemblage is *perfect*[2] in that it contains its first derivatives, $\frac{dy}{dx}$'s, or limits. Every term is a limit or derivative, and this is important since thereby a one-one correspondence subsists between this series and the points of a graph representing motion of uniform velocity, or the change of velocity, etc. For then each term of the assemblage, between assigned finite limits, is the value or limit of a certain ratio or relation between, for example, a certain finite change of position on the one hand and a finite temporal period on the other, and these limits form a continuous series.

6. The assemblage is Archimedean.

7. If α (any real number) > 0, there is an infinity of rational numbers, also of irrationals, $< \alpha$, and also $> \alpha$.

[1] Cantor, *Math. Annalen*, 1895, **46**, 481.

[2] Cf. Pierpont, *op. cit.*, 162 and 168, and Russell, *op. cit.*, 291 and 342.

8. Between α, β, any two real numbers, $\alpha < \beta$, there is an infinity of rational numbers, also of irrationals. Then the assemblage is continuous in the strictest sense of this term, and there are no next or consecutive numbers. For assume that α, γ are such; then between them there is an infinity of real numbers, and α, γ are not consecutive.

The further general statements which have been made with reference to the integers and the rationals may also be made with reference to the assemblage of real numbers. Thus,

9. They are not existents, but are subsistents; that is, they are entities which are quite independent of all existents, both physical and mental, although the converse proposition does not hold. Existents, and space, and time imply them, but not conversely. Nor are they, of course, spatial or temporal entities. They are logically prior to space and time, although they are correlated with points and instants.

As concerns the possible attack, now, it is with the real numbers as it is with the assemblage of rationals. *There is no whole* which is given empirically either prior or subsequent to the parts which analysis reveals. The only whole is that which is identical with the class of entities *denoted* by the concept, real number, and which consists of the individuals composing it. There is no whole with which the parts can be contrasted in order to reveal a contradiction and so the falsifying character of the analysis. Then there is no opportunity for an attack on this analysis except from the standpoint of a whole which may be constructed artificially by the use of the theory of internal relations.[1] But such a procedure presupposes the very analysis it would invalidate.

The entire character of the assemblage is revealed by that analysis, some of whose main features have been presented above, and which discloses not only terms, *but* also relations. *This analysis presents the most exact definition of continuity extant,* one which, while it demands the complete externality of terms and the theory of external relations, precludes the interpretation of this external-

[1] See this essay, Section II.

ity as spatial or temporal. The real numbers are not spatial or extended, nor have they space between them, and, although, psychologically, knowledge of them may depend upon the knowledge of spatial things, logically they are not dependent on space.

2. The Analysis of Space. — We are now in a position to examine understandingly and with precision some of the important facts concerning space which have been revealed by modern analysis. These facts enable us again to confute that specific attack which we have found to be the most formidable. Reasons have already been given for excluding from consideration the other types of attack, such as the pragmatic, and the Bradleian. The attack which I am meeting proceeds for the most part along the lines of the model presented on a previous page.[1] This attack, on model lines, runs as follows: Space is given empirically as a one-, or two-, or three-dimensional continuous whole; or it is given as a whole which analysis resolves into dimensions. This analysis into dimensions is, however, not attacked. Now a dimension, or a spatial extension in one dimension, is analyzed into points. But a point is unextended, it has no dimensions. It is the contradictory of the whole, the *extended* 'thing.' Either, then, this analysis is false, or, if any analysis of the line is to be accepted as true, it must be that analysis which does not lead to points, but to elements having extension in at least one dimension.[2] For to derive extension from the unextended is impossible. *Either no* analysis, *or only* that analysis which is *division* and leads to extended elements — though these be very small! This is the dilemma, and this is the way the argument runs.

Is the analyst in a position to reply to this attack effectively, and can it be shown that the attacking party does not do justice to the actual results of analysis, or that he misstates these results, or himself analyzes falsely? The answer is 'yes' in each case. Let us consider some of the actual results of this analysis, noting,

[1] 171.

[2] Cf. Kant's second antinomy, and Zeno's historical first and fourth arguments.

however, that the question of the objective or (Kantian-) subjective character of space is not here involved.

The modern general analysis of space finds reasons, first, for distinguishing three more specific analyses or geometries, projective, descriptive, and metrical.[1] Yet all three of these geometries agree in analyzing space into points; constructively they are said to assume the class-concept, point. The actual points are the individuals which this concept denotes; they are its extension.

Point is, perhaps, indefinable. Yet it is found to have all the characteristics which the real numbers have, *plus* something more. It has a peculiar *quale* which can at best be defined only in terms of that of which it is the element, namely, space. But that may be to define the term in a circle and to admit it to be indefinable logically.

Constructively, now, each of these three geometries assumes two points. These two points determine a class, the straight line, analogously to any two real numbers determining the series of real numbers. Then there are at least three points, A, B, and C, and either A is between B and C, or B is between A and C, or C is between A and B. The further assumption is made that there is one point not of or on any given straight line; that is, that there is a fourth point, D. These four points determine a class, the plane. Assume, next, a point G, not of this plane. Then G and any three of the class of points which determine a plane determine a space of three dimensions. Space, then, is a class which is defined by its relation to the class-concept *point*. It is the *domain* of the concept, point, and of a certain class of relations holding between points.

What, next, are some of these relations? Modern analysis shows one of the most important of them to be that which is expressed by the word *between*. The definition, giving the very meaning and the criterion of *betweenness*, is as follows: "A term y is between two terms x and z with reference to a transitive asym-

[1] Cf. Russell, *op. cit.*, XLV–XLVIII.

metrical relation R when xRy and yRz." [1] *Between*, then, is a relation which determines an *order* of sequence of the points of a straight line, of a plane, of space. This relation receives a specific and precise statement in the following propositions which I quote from Hilbert's "Foundations of Geometry." [2]

1. If A, B, C are points of a straight line and B lies between A and C, then B lies also between C and A.

2. If A and C are two points of a straight line, then there exists at least one point B lying between A and C and at least one point D so situated that C lies between A and D.

3. Of any three points situated on a straight line there is always one and only one which lies between the other two.

4. Any four points A, B, C, D of a straight line can always be so arranged that B shall lie between A and C and also between A and D, and, furthermore, so that C shall lie between A and D and also between B and D.

It results from these four propositions that between any two points of a straight line there subsists an infinite number of points. Then in this respect the line resembles the series of rational fractions, and also of real numbers. But it is further shown thereby that the defining relations which relate the points are similar to those which relate the integers, the rational fractions, and the irrationals; that is, they are asymmetrical, transitive relations. Thus, any one of the above propositions implies that, if x and y are any two points of a straight line, then xRy excludes yRx. For example, by 2, if x and y are two points of a line, then there subsists a third point z lying between x and y, and at least one point q such that z is between x and q. This may, perhaps, be more readily seen if we state the axiom of Archimedes as given by Hilbert, "Let x_1 be any point upon a straight line between the arbitrarily chosen points x and y. Take the points x_2, x_3, x_4, . . ., so that x_1 lies between x and x_2, x_2 between x_1 and x_3, x_3 between x_2 and x_4, etc. Moreover, let the segments, xx_1, x_1x_2, x_2x_3, x_3x_4 . . .,

[1] Russell, *ibid.*, 214.

[2] Hilbert, D., (Townsend, E. J., trans.), 6.

be equal to one another. Then, among this series of points there always exists a certain point x_n such that y lies between x and x_n." [1] This gives a definition of the continuity of the line.

But further, if the numbers by which we designate the points of the line are the real numbers, and these numbers are taken in their order of magnitude, then the points which they designate must also have this order. But asymmetrical, transitive relations hold between these numbers in this order. Therefore they hold between the points.

The necessity of introducing the real numbers in order to designate *all* the points of a line is shown by examining, for example, the relation of the hypotenuse of a right isosceles triangle to the two sides. Let these, metrically, be of the value 1; then the hypotenuse $= \sqrt{2}$. But this is an irrational. Therefore some of the points of a line are in one-one correspondence only with the irrationals. It is alone *all* the real numbers, that is, the rationals *and* the irrationals, that are in complete one-one correspondence with all the points of a line.

Space, then, is shown by analysis to have the same kind of continuity (and also infinity) that the real number series has. But its continuity is a continuity of points, not of numbers; that is, there is a *quale* in the spatial element, the point, which the numbers lack. But there are also common properties. The points, like the numbers, are individuals, simples, not further divisible into similar elements, and are logically external to one another. The defining relations are also the same. They are asymmetrical and transitive. This logical externality of the members of this particular class of individuals and the asymmetrical, transitive relations holding between them *are* space of one, or two, or three dimensions, *are spatial externality*. Quite similarly, time is the class of individuals, called instants, related asymmetrically and transitively, external to one another, and not further divisible into similar elements. These individuals in turn have a *quale* different from the *quale* of the point.

[1] *Op. cit.*, 25.

Accordingly the 'axiom of the continuity' of space may be stated, in agreement with the above and preceding discussions, as follows: All points on a line are limits of rational points, and all infinite series of rational points have limits.[1] By this definition all the points of a line form a *perfect* series; for a series is perfect if all its limiting points $\left(\text{derivatives, } \frac{dy}{dx}\right)$ belong to it, and if all its derivatives are limits. But this is the case with the points of a line. A series is continuous, then, if it is perfect. But the series of points is perfect. Therefore it is continuous.

Analysis shows, further, that descriptive space is in its continuity like projective, and that the above axiom satisfies also the continuity of metrical space.[2] In general, the above results show the way in which modern analysis treats of space, of some of its characteristics, of its elements. This analysis states with clearness and precision what space is, what its continuity is, what terms and relations are involved. Space or continuous spatial extension *is* the domain of an asymmetrical transitive relation between points. The continuity and extension are defined and determined by elements and relations neither of which are, strictly speaking, continuous or discontinuous, and, possibly, either extended or unextended.[3] Analysis shows that the fundamental relations essential to geometry do not hold between spatially divisible terms, such as lines, planes, and volumes, but only between spatially indivisible points. It shows that however many parts a dimension be *divided* into, the parts are still dimensions or stretches with which *many* numbers are in one-one correspondence. But there are single numbers, simples. Then, corresponding to these, there must be single points, simples, not stretches, and not further analyzable into elements of the same kind. Yet the continuity of space is defined and determined not alone by these elements, but also by

[1] Cantor, G., *Acta Mathematica*, 2, 341–344 and 405 *et passim*.

[2] Russell, *op. cit.*, XLV–XLVIII.

[3] They might be said to be non-extended, even as inanimate objects are non-moral.

the defining relations between them. Let these be the premises. Then from them, from the assumption of points in a certain relation, a space empirically indistinguishable from the space in which we live can be constructed. Observed facts are explained by our premises. Thus the latter have empirical confirmation.

These are the results which are attacked by the critic of analysis — by him who would establish its falsifying character. When justice is done them, when the actual analysis is considered, can the attack succeed?

The attack is made along two lines, but in both cases it follows the model previously presented. In one attack the continuity-feature of space is selected as the fulcrum of the argument. Space, the attacking party holds, is given empirically by intuition, or some such mode of direct approach, as a unitary continuous whole. But analysis leads to terms or to parts of space which are *discrete* from one another. Therefore analysis leads from continuity to discontinuity. It leads to the contradictory of the thing analyzed. Therefore it falsifies.

The other attack proceeds somewhat differently. The analysis of space, it holds, leads to terms which are not spatial; it leads from the extended, the dimensional, to the unextended, the 'undimensional.' Then, again, it leads from the positive term to the contradictory. Therefore it falsifies.

Manifestly, in both cases, the attacking party considers only the terms and quite ignores the relations which analysis also discovers. Clearly he does not do analysis justice. Indeed, he may not even be defining the terms correctly in asserting them to be unextended and undimensional. *They may be simply non-dimensional.*

Can these attacks be repulsed? The answer can again be only affirmative, and, in fact, has already been given. The first requisite condition for determining whether analysis is intrinsically false or not, is that justice shall be done the analysis. Then, not only terms, but also organizing relations must be considered, and false analyses must not be set up, only to be knocked down. Observing this condition, we may reply to the first attack as follows:

In the case of space, as distinct from the numbers, there does seem to be *a whole* which is given psychologically, to any individual consciousness, prior to the parts which analysis reveals, and this whole may be said roughly to be continuous and infinite, etc. But to neither of these terms is therewith an exact meaning given. Analysis endeavors among other things to give just this requisite exactness, to make precise that which is otherwise a vague mass of confusion. The first attack selects *division* as that phase of analysis which it would impugn. Division is held, *or made* to mean discreteness. But this is just what the analyst finds it does not mean. *Division* in the usual, in fact in any strict sense of the term, does not lead to entities which differ from the entity *divided*, whether this be space or time, or space traversed in time, or what-not.[1] The parts resulting are in turn spaces, or times, or motions, and never points, or instants, or velocities. Though very small, they are always finite quantities; they are stretches, and never limits. But the *very condition* for there being such a division, for there being such a 'thing' as the so-called discreteness which the attacking party talks about, is *that which is really identical with continuity itself*. Clearly that which might determine the discreteness of two segments of a line need not itself be a segment. It could be a point. But that every point of a line generates a 'partition' of the line, and that every 'partition' is generated by a point is precisely Dedekind's definition of continuity.[2] The same 'partition' definition holds also, of course, for the numbers. Further, the point is not a third entity, which, film-like, belongs to neither segment, but it belongs to either one or the other of the two segments which it determines, at the same time that the line is continuous. "Thus," by Dedekind's definition, "if all the points of a line be divided into two classes of which one precedes the other,

[1] Cf. this section, on Motion.

[2] Dedekind, Essays on Number, 20. IV. "If the system R of all real numbers breaks up into two classes U_1, U_2 *such that* every number a_1 of the class U_1 is less than every number a_2 of the class U_2, then there exists one and only one number a by which this separation is produced." Cf. Pierpont, *op. cit.*, 78–79, and Russell, *op. cit.*, 438.

then either the first class has a last term, or the last a first, but both do not happen."[1] We must conclude, therefore, that this first attack on the analysis of space, which makes analysis lead from continuity to discreteness, fails of its purpose. The discreteness which it would introduce proves to be only another definition for the continuity which the discreteness is supposed to displace.

The second attack on the analysis of space is based on the contradiction which is supposed to hold between the elements to which analysis leads and the original entity analyzed. The entity analyzed is *extension* in one or more dimensions. The element discovered by analysis is unextended. Thence the contradiction, and the falsifying character of the analysis! Or, it is maintained, the entity analyzed is continuous. But the elements discovered, the points, are individual, and so, separate, discrete, discontinuous from one another. Manifestly neither of these arguments does justice to the actual analysis. Let not only the terms, but also the defining relations be considered, and the attack in each case is nullified. Both cases may be taken together. It is continuous extension which is to be analyzed. And analysis shows that this is identical with a series of points, each individual, and so logically external to the others, related asymmetrically and transitively. Extension *is* just this, a series of points, with each point *distinct* from every other, and any two, A and B, implying a third, C, beyond B, so that B is between A and C. What else could spatial extension be than just this field of an asymmetrical transitive relation holding between points? And spatial continuity is just this too, a series of points related in such a way that between any two there is an infinite number of points in one-one correspondence with all the real numbers. To grant the second aspect of the attack, that the points are individual and discrete, either nullifies the attack by making this very discreteness identical with *continuity as above defined, or repeats the problem*, if the discreteness of the points is interpreted to mean *extension* between them. For then *this extension* must be analyzed, and sooner or

[1] Russell, *loc. cit.* Cf. Dedekind, *op. cit.*, 11.

later the recognition will come that this involves *points* related in a certain way, and that there is no escape from this — that points so related *are* one-dimensional continuous extension.

We may conclude in general, therefore, that the modern analysis of space stands quite unimpugned by the type of attack considered in this essay, and also, since arguments have been presented elsewhere which are held to refute other readjustments and reinterpretations, that its results must be interpreted realistically. Points and the specific relations between them subsist quite independently of the knowing or discovery of them. Only one type of attack has any plausibility at all, namely, that which makes analysis lead to the contradictory of the thing analyzed. But this attack does not do justice to the actual analysis made. It selects the terms, the points, and neglects the relations. Consider these, as well as the terms, and the contradiction disappears, and the attack is invalidated. Analysis may lead to terms which are different from the thing analyzed, *and this difference can always be thrown into the form of a contradiction.*[1] *If A differs from B, B can be called non-A.* Were this fact damning, it would damn the very method by which it is discovered. But that it is not damning, and that distinctions can be made which, though convertible into contradictory form, are nevertheless valid, is presupposed, if any analysis whatsoever is made. But the attacking party always uses analysis. If not damning in one place, then it is not in another, until evidence to the contrary be adduced. And so with the analysis of space. Let its elements be points, different from spatial extension. But consider also the relations. Then space *is*, both in its continuity and its extension, the assemblage of these elements related asymmetrically and transitively, and the analysis is adequate. Space *is* just this assemblage. There is nothing left over, as characterizing the whole, which is not these elements *in these relations.*[2]

[1] Cf. Holt, this volume.

[2] This outcome and the considerations leading up to it solve Kant's second antinomy.

3. The Analysis of Time. — At this point I shall consider only those aspects of the analysis of time which might be subjected to the typical attack by means of the argument from contradiction. There is another attack which I shall consider later, that, namely, which is identical with the argument that the analysis of time is contradictory to its very nature *as lived*, — as 'duration.'[1] This last argument is based on the constitutive theory of relations. But at this point we are concerned only with the attack which is directed against an analysis proceeding along quite the same lines as does the analysis of space just presented. Since the two analyses have much in common, except that here we have to do with a one-dimensional manifold of instants, the statement of the results of this modern analysis of time may be made very brief. It is assumed here, since it is justified later, that the analytical separation of time from things in time, like the analytical separation of space from things in space, is valid.

Modern analysis shows that time *as such* is of the following character:

1. Time is a one-dimensional infinite and continuous manifold of individuals, called instants, related by an asymmetrical transitive relation.

2. Instant is, perhaps, indefinable. Instants have all the characteristics which the real numbers have, and more besides. An instant has or *is* a peculiar *quale* which is different from the point *quale*, and is an 'addition' to the real number *quale*. This peculiar *quale* can at best be defined only in terms of that of which it is the *element*, namely, time.

3. The element of space is the point, and space is either a one-, or a two-, or a three-, or an n-dimensional series of points. The reason for so saying is, perhaps, that empirical space seems to be three-dimensional. So, empirically, time seems to be given as only one-dimensional, but *logically* time may be, like space, n-dimensional.

4. A one-dimensional manifold or series may be defined as

[1] See this section, on Dynamics and Duration.

follows: Let there be a transitive asymmetrical relation R and a collection of terms any two of which are such that either xRy or yRx. Then, since by definition R is asymmetrical, xRy is different from and excludes yRx; and, since R is transitive, xRy, yRz imply xRz. Then $\breve{R}$, the converse relation, is also asymmetrical and transitive. It results that any three terms of the series are such that one is between the other two, and the whole collection is a single series.

5. A series of two dimensions subsists, if every term u_1 of a series of which x, y, and z are some terms, is itself an asymmetrical transitive relation which generates a series. The class u_2 of terms forming the field of all the relations in the series generated by R is a two-dimensional series. A series of three-dimensions subsists if each term of u_2 is itself an asymmetrical transitive relation generating a series. In quite a similar way a series of any number of dimensions can be defined.[1]

6. Time, therefore, for empirical, though not for logical reasons, may be said to be a one-dimensional series of instants.

7. The time series, then, has the same properties as has the one-dimensional space series with the difference that in the former the terms are points, in the latter instants. Accordingly the propositions[2] which were made above concerning the space series hold good of the time series, if 'instant' be substituted for 'point.'

8. It results from the four propositions thus made, that between any two instants there subsists an infinite number of instants. In this respect, then, the time series is like the series of real numbers and the space series. A one-one correspondence subsists between the real numbers, the instants of time, and the points of space.

9. In just this respect, therefore, and as thus defined, time is continuous. It is continuous in the same sense as is the number continuum formed by the real numbers in their natural order; that is, it is continuous in the most precise meaning of the term *continuity*. But such continuity subsists only by virtue of *both* terms *and* relations. The terms, instants, are individuals, simples, not

[1] Cf. Russell, *op. cit.*, 374–378.

[2] This section, 183.

further analyzable into terms of the same kind, and external (not spatially) to one another. This logical externality is identical, on the one hand, with the distinctness of the terms, and on the other with the property that, if A and C are two instants of time, there subsists at least one instant B between A and C, and also at least one instant D, so that C is between A and D; briefly, there is another instant D 'beyond' C.

Time, or continuous temporal extension, is, therefore, the domain of an asymmetrical transitive relation, the terms of which are instants. The instants are themselves neither continuous nor discontinuous.

The attack on the analysis of time, so far as it follows the model attack, fails for the same reason that it fails when directed against the analysis of space. And the attack with which we are here concerned does follow this model attack. It grants that time may be validly distinguished from things in time,[1] but holds that even so it is given empirically, by intuition, etc., as a unitary continuous whole. Then it further holds that the analysis of this whole leads either to instants which, as *not* durations or time extension, are the contradictory of the whole, *or* to instants discrete and discontinuous from one another, which discreteness is contradictory to the continuous character of the whole.

Can this argument be refuted? Yes, if justice be rendered the actual analysis, and the relations as well as the terms be considered. The terms by themselves may *seem* to be the contradictory of the originally given whole. But actually they are terms *in a certain relation*. As terms in this relation, they present no contradiction with the properties of the whole. In fact, only through them as terms *in relation* is the whole what it is, — continuous, infinite, extended — unless these attributes be left wholly vague and undefined. The principle of indirect proof may be used to show this. Thus, to assume that the instants are temporally extended, or that there is temporal extension between them, or both,

[1] Cf., *e.g.*, Bergson, Creative Evolution, 46 and 21, 22, 37, 39, 321–337, 341–345 and various other places.

but repeats the problem and so presents only a new necessity for analysis, and reveals the fact that *ultimately* temporally non-extended terms, instants, *in* an asymmetrical transitive relation, are presupposed. Time *is* just these terms in this relation, and there is no characteristic of the empirically given whole over and above *what these terms in relation are.*

Likewise the attack on the second basis fails. The discreteness which analysis or division is held to introduce is exactly the kind of discreteness which is identical with continuity, namely, that whereby the formal 'partition' of a series *by any term* is made.[1] It is not the discreteness of the integers, in which certain terms are *next* to certain others, with no terms between, but it is the discreteness of the real numbers, by which an infinite number of terms is between any two and any term makes a 'partition.' That is, the very condition for that formal division into segments which the attacking party holds to mean the introduction of discreteness into that which is not discrete, *is* that which makes or is continuity in the precise and exact sense of the term.

We may conclude that the attack on the analysis of time *qua* time fails of its purpose completely. Other attacks, such as the pragmatic and the Bradleian are again excluded from consideration here for reasons stated elsewhere. The realistic interpretation of the results of the analysis of time will stand, therefore, if no other attack can be brought against it and succeed. Phenomenalism and idealism make such an attack or interpretation, of course, but these are refuted by the arguments for the general realistic position. There is another specific attack, involved in Bergson's doctrine of duration, but this, I shall presently show, presupposes the very realistic interpretation which it is intended to displace.[2]

4. Motion and its Analysis.[3] — The attack on the modern an-

[1] This section, 187. [2] This section, on Dynamics and Duration.

[3] In this section I am largely indebted to Mr. Bertrand Russell's analysis of motion, contained in Chap. LIV of his Principles, though I depart from his views in certain essentials.

alysis of motion proceeds as follows: First, it is held that any finite motion is given as a continuous whole, definable only in terms of itself. The determination of any specific instance of motion as finite may be arbitrary, or it may not be. If it is, then it is held to be continuous over or through the arbitrarily set limits, and to be a unitary whole, unanalyzable and indivisible[1] *in its character as motion*, through all such limits. However, various aspects of the motion, it is admitted even by the attacking party, can be distinguished and determined by analysis, by science. Its direction or path, its velocity or rate, its constancy or its change of rate, are such aspects. The attack is not directed against the analysis which discovers these distinctions. Now the argument of the attack is as old as Zeno, and yet it is advanced against analysis by Bergson,[2] and with the seemingly willful ignoring of the advance which modern analysis has made since Zeno. Actual motion as experienced is a continuous whole between either arbitrary or natural limits A and B. It requires a certain time, and in that time a material particle or body travels from A to B. It involves space, then, as well as time. But the space and the time are composed of points and of instants respectively. Then the particle or its center is *in* or *at* a point at each instant. But this means that it is at rest at each instant. Rest, however, is the contradictory-opposite of motion. Then that analysis which leads from motion, the whole, to rests, the parts, falsifies. It is not to be accepted as giving realities, but, at best, as being only an instrument which serves our human purposes and action.[3]

This is, as we have seen, the typical attack. It can be extended, in a way analogous to the attack on the analysis of space and of time, to include the contradiction between the continuity of the original motion and the discontinuity (*that which*

[1] *E.g.*, Bergson, Creative Evolution, 304–313.

[2] *Ibid.*, 163.

[3] Cf., *e.g.*, Bergson, *op. cit.*, Index, under Intellect and Action, for reference to a manifold of statements to this effect.

is held to be such) between the rests, and perhaps there are other extensions or variations. But all can be replied to and refuted, if the actual results of the modern analysis of motion be considered in their fullness, and be not misstated.

What are these results? The preceding discussions have prepared the way for their presentation and explanation, so that the precise problem now at issue is whether an exact, a non-falsifying analysis of motion *as* motion, and a definition of motion in terms of that analysis, can be made.

Now such an analysis and definition do not logically involve direction, or rate, or even change or constancy of rate, or cause, although no existential motion can take place without these characteristics, or be empirically discovered without some of them. However, once discovered, it can be analyzed and defined without implying them. That this is the case can be made clear as follows.

To determine empirically that there is motion demands the observation of two points, A and B, the possible specification of these two points by three coördinates as a frame of reference, and the observation, directly or indirectly, of the traveling of a particle or body from A to B. But with this specification the general direction of the motion is also specified. By general observation, its path, its course or curve can also be discovered, while, by means of applied mechanics and further observation, the equation of its curve, its constant or its changing velocity, etc., can be determined. But with all these determinations made, and with some of them necessarily involved in the empirical ascertainment of the fact of motion, the motion can nevertheless subsequently be defined and analyzed without involving them, and even without involving anything such as a *material particle* moving.

So defined, motion is the series of individual one-one relations *correlating* the terms of two series, the time and the space, in such a way that, if x and x' be any two terms of the time series, y and y' any two terms of the space series, and x has the correlating relation to y, that is, xRy, then it does not have this relation to y', nor does x' have it to y. In a manner, then, somewhat analogous to that in

which a two-dimensional spatial series is the domain of an asymmetrical transitive relation R between asymmetrical transitive relations between points,[1] *motion is a series* of complex terms, each of which consists of a one-one correlating relation between a specific term of the space and a specific term of the time series; and just as the terms of each of *these* two series are related asymmetrically and transitively, so are these complex terms and the correlating relations similarly related. In symbols, using r for the correlating relation, R for the asymmetrical transitive relation, we have $\left\{\begin{matrix} xRx'Rx'' \ldots \\ rRr'Rr'' \ldots \\ yRy'Ry'' \ldots \end{matrix}\right\}$ in which $xRx'Rx''$ is the time series, $yRy'Ry''$ the space series, *and the whole is motion.*[2] But further, just as the time and the space series are each continuous, so is the motion series, and all the positive statements which in the preceding sections were made with regard to the continuity of the first two series hold good of the motion series.

Motion is, therefore, a series, the domain of a relation which relates relations which correlate terms in a one-one manner. Briefly, it is a series of complex terms, xRy or pRi (p = point, i = instant, and r = the one-one correlating relation). But it is *not* the complex term, xry, or $x'r'y'$, etc., that is, the correlating relation *with* its correlated terms x and y, or x' and y', etc., of the two series, the time and space. Nor is this complex term *rest,* for rest is logically analogous to motion. Rest is or involves a many-one correlating relation R between *many* instants of time and *one* point of space in such a way that xRy, $x'Ry$, x, x', x'' . . . being different and the y's identical. Quite analogously too, a logical definition of impenetrability and so of matter can be given.[3]

Impenetrability is or involves a many-one correlating relation R between many points of space y, y', y'' . . . and *one* instant of

[1] See 191.

[2] A term can stand in many relations. Cf. Perry, this volume, Section III.

[3] See Russell, *op. cit.*, 467 and 480.

time x, so that xRy, xRy', xRy'', are different and mutually exclusive. Although, now, the correlating relations in each one of these three cases are similar, nevertheless they are *individual* and in this sense different, and that they must be this is implied by the individuality of x, x', x'' . . . and of y, y' y'' . . . respectively.[1]

Rest, then, is also a series of complex terms, namely, of correlating relations with their terms, themselves related asymmetrically and transitively, and likewise with impenetrability. Motion, rest, and impenetrability are each continuous. The possibly surprising character of this conclusion is rendered less so by the realization that neither motion nor rest is either space or time, but that each must be in some way a matter of relation between these entities.

However, these definitions and analyses so far are purely *kinematical*; that is, they concern simply the geometry and arithmetic of motion. They do not involve actual matter, or causation, or velocity, or acceleration, or direction in any other sense than that an asymmetrical relation has or is direction. When these concepts are considered and brought into relation with space and time we have Dynamics and Mechanics, pure and applied. But the definitions and analysis so far given present simply *the logical possibility* of an existential motion, rest, and impenetrability. They show what characteristics an existential motion or rest must have, although these may also have other characteristics. By themselves they show what motion and rest are, whether or not these exist. For, granting that in order to have an existential motion or rest, there must be something, say, matter, at rest or in motion, then motion and rest are not this matter, just as they are not time and space.

These propositions and the position with which they are identical may seem to involve a *degree* of analysis which might well be open to question and to offer a vulnerable opening for attack. But even if this opportunity were improved and were successful, it

[1] Therefore I have symbolized the individual R's by r', r'', etc., in the above formulæ for motion.

would not invalidate our general defense of analysis against a specific type of attack. It could show at best only that this specific analysis and defense is in error, an outcome the possibility of which the most strenuous supporter of analysis would admit.

The supporter of the realistic view of the analysis of motion, etc., can make his defense, then, even though, for example, motion *could not* be defined unless there were something to move. For let this supposition be granted. Let it be granted that there could be no motion, or rest, unless there were a material particle or particles. The fact is that motion and rest exist, for there *are* material particles and bodies. And the actual attack on the analysis of motion concerns the existential motion. The defense, therefore, can be made on the same basis, although it is not necessarily limited to this.

The attack has been stated. It is argued that the analysis of motion leads to rests, and so is false; or, that it leads from continuity to discontinuity, and so, also, is false. This attack gains plausibility, because, once again, there is a misstatement of the actual results of analysis; the character of the terms is misstated, and the organizing relation is neglected. For consider an actual case of motion, that of a body O moving from the point or position A to the point or position B. Some means of measurement is necessary to determine, within certain limits of accuracy, certain quantities involved in this motion, namely, the distance traveled, the time required for this, etc. But once this is done, the following state of affairs is recognized by the analyst. The path, whatever be its curve, is a continuous series of points, and the time a continuous series of instants. And the material particle, or its center of gravity (centroid), serves existentially to correlate each specific point of the path with one and only one specific instant of time. For if there were a correlation of one and the same point with *two* instants, the particle would be at rest. Put in terms of the preceding kinematical analysis, the material particle serves to make existential a certain series of correlating one-one relations between

the points of the space which is the path and the instants of time required. And just as both the space series and the time series are continuous and are in one-one correspondence with the real numbers, so is the series of specific individual correlating relations *with* their terms continuous, with these complex terms related asymmetrically and transitively and in one-one correspondence with the real numbers. The existential motion *is* the material particle making existential the series of one-one correlating relations between the points of space and the instants of time. *It is all this.* Making this series existential *is* the motion of the particle.

It can be shown very clearly, now, that the results of this analysis, which is really identical with the results obtained by applying the calculus to motion, are not open to certain interpretations, namely, *just those* on the basis of which the attack is made. Thus the one-one correlation of specific instants with specific points, by means of the material particle, that is, the correlation of one point y with one and only one instant x and not with this *and* another instant x', is not to be interpreted as rest. It may be said to be an instance of 'occupying,'[1] by one entity, of one point at a time, but this term is somewhat vague and ambiguous, and needs definition. Rest is undoubtedly in some sense different from motion. And the only way to state this difference with precision is to define existential rest as involving the many-one correlation, by a material particle, of many instants with one point. Therefore, if, in the analysis of motion, any *one* of the manifold of complexes, each consisting of a one-one relation correlating one instant with one point, be interpreted as rest, the above definition is presupposed, this one instant itself is implied to be, not one, but many, and a contradiction is introduced. In every case here we are led *ultimately* to terms *not further analyzable* into terms of the same kind. Instants and points are such terms in the case of time and space, and the complex term, xRy, under discussion here, is in the case of motion. The occupying of a point at an instant by one entity is, therefore, not to be interpreted as rest. It cannot

[1] Mr. Russell's term, *op. cit.*, 465.

be, without implying the contradictory, that it is *not* to be so interpreted. The arbitrary attempt discloses that which is not arbitrary, but is ultimate, necessary fact.

But just as little is this complex, this one-one correlation of a point with an instant, the series of which complexes is motion, itself to be interpreted as motion. Sometimes it is supposed that it must be so interpreted. It is supposed that motion presupposes or implies other, partial motions, and these in turn other, smaller motions — no matter how small — and so on. But this involves or is identical with an *infinite regress.* Then motion cannot be defined except in circular terms, or parts other than motions be discovered, unless this infinite regress can be escaped from or avoided. But escape is, by the very nature of the *regress,* impossible.

As we have previously seen, infinite wholes are of two kinds, objectionable and unobjectionable, those involving difficulties, and those not. Any infinite whole or series presents difficulties, if the attempt is made to treat it only by enumeration. *For then, strictly speaking, it cannot be treated in its infinite character.*

Indeed, to attempt to treat an infinite series by enumeration is already to involve oneself in an infinite regress. For enumeration serves to discover or to count only further terms *like* those already enumerated, which further terms imply further similar terms to be enumerated. *An infinite regress,* then, is never completed, and it is impossible on its basis to get other than a circular definition. An infinite regress is for this reason, if for no other, objectionable. Sometimes, however, we find the position taken that the very nature of the infinite is its incompleteness or 'uncompletedness.' *Indeed this definition is sometimes employed in order to attack realism. It is held that realism means, among other things, the completed infinite — of space, for example.* But then, it is argued, the completed infinite is self-contradictory. Therefore the conclusion is drawn that realism involves a specific self-contradiction! Manifestly, however, this argument is based on the tacitly held premise that the infinite can be treated only by

enumeration. Then, it follows that the infinite is never completely treated, that is, is *uncompleted.* The definition of the infinite which follows from the premise assumed illustrates with precision the outcome of that premise, and confirms the initial assertion. That definition is that the infinite is the uncompleted, the *unended.* But this is only a circular definition etymologically obscure and well illustrating the infinite regress which any circular definition involves.

How different from the foregoing definition is the non-circular definition that an infinite whole is such a whole as is similar to a proper part of itself by virtue of both whole and proper part being composed of terms which are *different* from both whole and proper part — *proper part* being defined as a part which *is similar qualitatively* to the whole. Thus, a finite line is similar to a proper part of itself, in that, line and part being one-dimensional spatial extension, both are composed of an infinite number of points in an asymmetrical transitive relation. And the case is the same with any finite period of time, and with any segment of the real numbers. But to deal with the infinite by means of such a definition is to deal with it by implication, by intension, and not by enumeration. Motion does presuppose smaller motions, a line, smaller lines, but in each one of these cases there are also other entities presupposed which are different from the *whole,* namely, the *xRy's* (instant-R-point) in the case of motion, and points in the case of lines, and these entities cannot be discovered by enumeration.

There is a kind of infinite whole, therefore, which is quite unobjectionable, which can be defined by a non-circular definition (thus avoiding the regress), and which is *both complete* and *completed* in just the way indicated by the definition; that is, it is dealt with in such a way that we can discover something about it and something by means of it. Indeed, this infinite is the *only one* which throws any light on continuity. This can be demonstrated as follows: The integers form an infinite series, but they are not continuous, for there is not one integer between *any* two. They can be treated and defined either by enumeration or by intension.

By the one method they are an *endless* series. By the other, they are such a series as implies, for example, that the class of *even* integers has as many members as has the whole class, for the even integers can be put in one-one correspondence with *all* the integers. Therefore the integers are infinite, but they are not continuous, and likewise with the rational fractions. Infinity does not imply continuity, but the converse proposition does not hold. Continuity *does* imply infinity, but not alone that infinity, which, such as that of the integers and rational fractions, *can* be dealt with by enumeration, but also that infinity which, as in the case of the irrationals, *can be dealt with only by intension.* To get at the nature of continuity we must have, therefore, some other method than that of enumeration, some method other than one which gets us into an infinite regress. Motion does presuppose motion, extension, smaller extensions. But to recognize this gets us nowhere, helps us not at all in getting terms which are different from motion and extension, and does not make possible a non-circular definition. Quite similarly it would seem to be a useless interpretation to define a point or an instant as either extended or unextended, in contradiction to the extension of space and time. The use of either the positive or negative term really gives a circular definition. Extension and 'un-extension,' continuity and discontinuity, have nothing to do with points or instants *as such.* Likewise the complex terms, the one-one relations between specific instants of time and specific points of space in the case of any actual specific motion, are neither rest nor motion, neither continuous nor discontinuous, neither spatial nor temporal (in isolation), nor extension. They are what they are, complexes of existential one-one relations correlating the points of a specific finite space and the instants of a specific period of time, the series of such complex terms being motion.

I may now summarize my reply to this first attack on the analysis of motion which claims that the analysis is false because it leads to rests. Motion can be admitted to presuppose smaller motions, but this gets us nowhere, and is identical with treating

an infinite whole only enumeratively — a method which *makes the infinite the uncompleted,* and involves us in a number of artificial antinomies and contradictions. On the other hand, if that method is used which is the only possible method of actually dealing with infinite wholes *in their infinity,* namely, the method of intension, then motion is found to be a *continuous* series of one-one correlating relations *with their terms,* these correlating relations and the complex terms which they form being themselves related asymmetrically and transitively. Motion is, then, the field of an asymmetrical transitive relation whose terms are again relations that are made *existential* by a material particle. The terms are not *prima facie* the contradictory of the original entity analyzed, the motion. They are simply different from it. Neglect the organizing relation between them, and the terms will *seem* to be rests, and some kind of 'transition' from term to term will seem to be necessary. Consider this relation, and observe the true character of the analysis, and the terms are found to be neither rest nor motion. So, too, if the true character both of the terms and of the relation between them is observed, a concise and exact definition and explanation of the continuity of the original motion is obtainable, in a manner quite analogous to the definition and explanation of the continuity of space and of time.

The second argument against the analysis of motion, that it leads from the original continuity to a *discontinuity between the terms,* fails also. For here, as with the points of space and the instants of time, the alleged discontinuity is that very characteristic by which the continuity of a series is defined — the 'partition-definition' of Dedekind.[1]

It must be concluded, that the analysis of motion, as made by modern science, stands unimpugned. It is adequate, and it is not false. It reveals terms and relations which by themselves are different from the whole, but the additional characteristics of the whole are also revealed. There is a creative synthesis; the whole as a whole is different from the terms and relations taken individually,

[1] This section, on Space.

but it *is* these parts *related*. Then the analysis is adequate. And it is not false, since it is not found to lead, when stated correctly, to terms or relations which in any way are the contradictories of the original whole. The terms are not rests, they are not motions, they are not discontinuous from one another, and there is no transition from one to another. They are, *as a series*, translation, motion. But with the analysis *qua* analysis thus vindicated and with the general realistic position assumed to be established, it may be said that both the motion as a whole, and the transitive asymmetrical relations, the correlating relations, and the points and instants involved in that whole, are all equally real, although not the same kind of realities. The analysis of motion, like the analysis of space and time, is a method of discovering entities which are independent of their discovery and of their being known.

5. Velocity and Acceleration. — Just as the one-one correlating relations, themselves related asymmetrically and transitively (which with their terms, instants, and points, constitute motion), are *existing* relations, if the correlation is effected by a material particle, so also are velocity and acceleration *existing* entities under the same condition. In fact, there is no actual motion that does not involve velocity, or a negative or positive acceleration. But these characteristics are not involved necessarily in motion as such, even as motion is not involved in space or in time as such, or these in each other, or both together in logical principles. Analysis reveals a most interesting and peculiar relation, that of logical priority.[1] This relation, as an analytical result, is, of course, attacked, but it can be successfully defended. It involves nothing contradictory if it is treated on a strictly empirical basis.[2] Logical priority may be defined as that state of affairs in which, for example, a proposition B implies or presupposes proposition A, but A does not imply B. A is

[1] Cf. Marvin and Perry, this volume, also Russell, *op. cit.*, 114.

[2] Speculatively, of course, it can be attacked. But such an attack is replied to in Section IV of this essay.

then logically prior to *B*. The instances of this relation are many, and the fact of its subsistence is evidence for a pluralistic universe. Certain *A*'s could exist or subsist without *B*'s, although, conversely, not. Certain important instances of this relation concern us in the present discussion. Thus, *a propos* of the statement just made concerning motion, etc., it may be said that logical principles are logically prior to all else, — to space, to time, etc., — such logical principles, namely, as include the principles of pure mathematics (arithmetic). Space and time seem to be coördinate, but they are logically prior to motion as such. Change, however, is logically prior to motion, and motion is logically prior to its causation and to its constant or changing velocity.

The further examination of the field of this relation of logical priority shows, moreover, that there are certain sciences which are logically prior to others. Thus, letting the order of enumeration stand for the relation under discussion, some of the sciences may be arranged in the following series in order of logical priority: Logic, Geometry, Science of Time, Kinematics, Dynamics, Pure Mechanics, Applied Mechanics, Physics, Physical Chemistry, Physiology, Psychology.

The logic here meant includes not only the logic of propositions, of classification, of definitions, as usually understood in the text-books, but also the logic of relations, of infinite classes, of continuity, of variable and constant, of the status of entities, etc., etc., some of which has been made use of in this essay. Some of the important features of geometry and of the science of time have been presented, and the demonstration made that space and time imply certain logical principles, although the converse is not the case; and the analysis of *motion as such* that has been presented constitutes part of Kinematics, implied by Dynamics, but not conversely. But we are now to consider, briefly, velocity and acceleration. That will take us beyond Kinematics. Motion as such has been analyzed and defined without reference to these entities, but, very evidently, they imply motion. And

existentially, of course, there is no motion which does not involve velocity — either constant or changing. What, now, are velocity and acceleration? Once again, as in the discovery of actual cases of motion and in the statement of what it is, whether discovered or not, a distinction must be made between the *means* of discovering velocity and acceleration *and* these entities themselves. To discover actual motion there is necessary the empirical observation, either direct or indirect, of two points, A and B, of one configuration defined with reference to one set of coördinates, *and* the observation of the traveling of a body from A to B along some path. To discover velocity, not only are these two observations necessary, but also the empirical observation and measurement of the time taken for the body to move from A to B, and of the length of the path AB. We then have two finite quantities, distance traveled, and time taken, and a material body. The motion of the body is, then, that whole which is the series of relations *correlating* the points of this path with the instants of this time. The relation of the distance traveled and the time taken can then be expressed, assuming the measurement to be accurate, in fractional form, $\frac{s}{t}$, and this is velocity as commonly understood. It has a definite numerical value, found through the measurement of the finite time and space involved. So far, then, velocity is an entity, an existential relation between a specific time and space, mediated by a material particle. Although expressed by a fraction, it is *one* entity, though perhaps a complex one, and not *two*, for a fraction, although symbolized by two or more signs, is only one number. But the velocity, or rather its value, is so far only an average velocity, for the same resultant would be obtained if during the time taken for the whole motion there were plus and minus deviations from this average. The velocity would be presumed to be constant provided only, that, if found for any distance Δs, no matter how small, for any time Δt, no matter how small, it would require the time $n\Delta t$ to travel the distance $n\Delta s$, where n is the same multiplier. But this would be only a presumption; any velocity,

$\frac{ds}{dt}$, might be only an average of deviating velocities. For practical purposes, of course, average velocities are quite sufficient. Yet modern analysis is theoretically able to determine velocity for *any instant* of a body's finite motion, and so to show that there *are* deviations, *or* that the velocity is genuinely constant, that is, the same at every instant. The velocity can be shown to be constant, or not, with a greater degree of assurance, by taking any two s's traveled in two t's, passing to the limit of each of the two ratios, and comparing the values thus obtained. In fact, only in this way can it be determined whether the velocity is constant or not. One determination for any one Δs and Δt, whether this be part or whole, relatively small or large, does *not* suffice to do this, but shows only what the velocity is at a certain instant or what its average is for a certain finite space or time. Two determinations, either of the whole and of any partial motion, or of any two partial motions, alone suffice to decide the question, under the above conditions, whether the velocity is constant or not.

But with this question once decided, what are the velocity and the acceleration? Let us consider first the case in which the velocity is constant. In this case the numerical value of the *limit* of any and of all the ratios, $\frac{\Delta s}{\Delta t}$, is *the same for every instant of the time required for the motion.* This value is the *value* of the complex, the one-one relation *correlating* each point of the path with each instant of the time taken. For $\frac{\Delta s}{\Delta t}$ taken at the limit means, *as does the ratio itself*, space-related-to-time. For $\frac{\Delta s}{\Delta t}$, it is finite distance related to finite time; for the limit, it is point related to instant. In the case of a motion with *constant* velocity, therefore, the complexes, the correlating relations with their terms, have values; they are magnitudes, since they can be greater or less than, or equal to *something else* of the same kind, that is, some other velocity; but as constant velocities of one motion they have the

same value, or are the same magnitude, expressed by the same number — whatever this may be. How, then, can they be the *terms of a series*, the field of an asymmetrical transitive relation — which they must be as constituting motion? For does not this relation demand *different* values, values *in order of magnitude?* The answer to the question is that the latter point concerns only the continuity of the motion, and not the constancy of the velocity. The continuity of motion is the same as the continuity of the real numbers, the number continuum. There is a one-one correspondence between these numbers *and* the correlating relations which *with their terms* are motion. Then these complexes have an order. But at the same time, each complex, consisting of correlating relation with its terms, has a value or is a magnitude, and this value in the case of constant velocity is the same for all these complex terms. That value may be expressed by any real number, but, once found for constant velocity, it is the value of the complex, correlating relation with its terms, for every instant.

I must disagree, then, with the statement that "there is no such thing as velocity except in the sense of a real number which is the limit for a certain set of ratios." [1] Existential velocity is the magnitude of the existential complex, consisting of the one-one relation between one instant and one point, when this relation is mediated by a material particle. It itself is not time, nor space, nor matter; but it is involved in these; that is, it exists if there is a real material particle moving and so serving to make the continuous series of correlating relations existential. But there are moving material particles. Then velocity exists, although it is a complex, that is, a relation and its terms. And, existing, it is also a magnitude in that it is equal to or greater or less than other velocities. It is, therefore, both a complex and a magnitude. Once discovered by taking the ratio of small distances traveled to small times required, and passing to the limit, it can, however, be defined independently of this method, even as has been done above. But

[1] Russell, *op. cit.*, 473.

in turn, velocity as such can be defined independently of existential velocities. The latter exist if material particles exist and move. But they would subsist in that the complex referred to is a magnitude. Thus there are possible, subsisting velocities which have not existed, do not exist, and perhaps never will. There is, then, a kinematical definition of velocity as well as a dynamical one.

ACCELERATION

The case with acceleration is much the same as with velocity. Once discovered, it can be defined independently of that discovery, and even independently of *existing* accelerations. The method for ascertaining whether or not there is acceleration, positive or negative, is that of finding out whether there is constant velocity. Two $\frac{ds}{dt}$'s must be obtained on the basis of empirical measurement, and compared; that is, the numerical values of the velocities at two instants must be determined and compared. Let these values be different. Then they are but different values of the magnitude of the complex, correlating relation between a specific point and instant. They exist if the correlating relation is mediated by a material particle. Its mediation of all the correlating relations in a certain finite series is its motion. But if the material particle moves, then there may be a real *acceleration*. To determine, in turn, whether the acceleration is uniform or not, demands methods which, since they are quite analogous to those required for determining whether velocity is uniform or not,[1] need not be presented here. But let it be found that the acceleration in a number of specific instances is uniform. Then the generalization can be stated, and a definition of uniform acceleration be given which is independent of the method of discovery. Uniform acceleration then turns out to be a most interesting entity. Motion is change of position. It is a whole, a series, as has been explained, with its terms complexes which are neither rest nor motion. Velocity is

[1] See this section, on Motion.

a correlating relation *and* its terms, the whole having magnitude. It is identical with any one of the terms of motion in respect to their magnitude. *Acceleration, now, is a whole, a series, a change.* It is the *change* of velocity in time, the second derivative. It involves, then, the *one-one correlation of the terms of a series of velocities with the instants of time.* We have, therefore, a complex term, pR_1i (= velocity, the correlation of a point p with an instant i) in turn in one-one correlation with an instant, thus, — $(pR_1i)\ R_2i$ or vR_2i. Put in symbolic form, and using $r = R_2$, r being the correlating relation, as in the formula for motion[1], we have

$$\begin{array}{cccc} v & v' & v'' & v''' \\ r & R & r' & R\ r'' \quad R\ r''' \quad \cdots \\ i & i' & i'' & i''' \end{array}$$

Acceleration is, then, the *series* of complex terms, each one a $(pR_1i)\ R_2i$, related asymmetrically and transitively. If a material particle mediates this series of correlating relations which is motion, and the velocity changes, then the acceleration is existential. Yet it can be defined independently of the supposition that it is so mediated, as the above discussion makes evident.

Acceleration is, therefore, itself change; it is in this respect, like motion, a whole. Analysis of it shows that it, too, like motion, is composed of complex terms which are neither rest nor motion. They are just what they are — complex terms consisting of a one-one relation correlating each velocity with an instant, each pR_1i with an i. But these terms form a series corresponding to the time series with which they are correlated. That series is, then, continuous, and its terms are infinite. Specific accelerations can, like velocities, be compared and their difference or equality ascertained. All accelerations are, therefore, magnitudes, and so are in one-one correspondence with the real numbers, for all accelerations are possible, though not existential. A specific uniform acceleration is, then, a continuous series of individual velocities, but of

[1] See the previous section.

all velocities between certain limits, and these velocities would *ipso facto* have, between such limits, the natural order of the real numbers with which they are in one-one correspondence. If the acceleration is uniform, then, if there is an acceleration of finite amount a in the time b, in the multiple time nb there will be a change of velocity of amount na.[1]

With reference, now, to the attack which might be made on the analysis both of velocity and of acceleration along the same lines that it is brought against the analysis of motion, it is evident that it is invalidated in the former case for the same reasons that it is in the latter. Velocity is the complex term composed of the correlating relation between a specific point and a specific instant, together with the magnitude of this relation. It is, then, neither rest nor motion, so there is no opportunity for the attack here. And just as motion is this continuous series of complex terms, themselves related asymmetrically and transitively, so is the constancy of velocity only the constancy of the magnitude of all the terms of this series. The constancy is a continuity of magnitude. The terms together with the asymmetrical, transitive relations define this continuity with precision and adequacy. Thus defined, there is no more opportunity for introducing a discontinuity of terms or of 'partitions,' and so of claiming contradiction and falsification, than there is in the case of motion, where the opportunity is found to be negative.

The case with acceleration is similar. Acceleration is change of velocity. Uniform acceleration is *continuous change* of velocity, but in neither case are the *terms* either change or rest. They are complexes, velocities in one-one correlation with specific instants of time. But no one such complex individual is either change or rest. The change of velocity, the acceleration, *is* the *series* of such terms related asymmetrically and transitively, and involves a one-one correlation with the instants of the time series. Absence of acceleration, or what might be called 'resting velocity,' is analytically a many-one correlation of one velocity with many

[1] Cf. this section, on Numbers.

instants. In no way is there opportunity here for the typical attack. Further, the usual typical claim that this analysis introduces that which is discontinuous into the continuous, in that it makes the terms discrete or allows of a 'partition,' is but another way of stating the very continuity of uniform acceleration.[1] The attack fails here also, and the analysis is to be accepted as precise and adequate, and is to be interpreted realistically. Acceleration, like velocity and motion, is not a mere number.[2] It is a *series* — of complex terms; it *exists* if a material particle moves with a velocity which is not constant, otherwise it subsists. All accelerations, like all velocities, are logically possible, though not all are found in or implied by our existential world, as existing or even as possibly existing.

DYNAMICS AND DURATION

It has been shown in the above discussion of the analysis of motion, of velocity and of acceleration, that these entities, once discovered, can be defined in a purely logical way without introducing existential conditions into the definitions. The science which treats of these entities as so defined is Kinematics. Such entities do, of course, exist in an extremely large number of specific instances, but the treatment of them concerns not only the existential, but also the subsistential cases. Kinematics is logically prior to the sciences of existential motion, velocities, and accelerations.

The preceding discussion puts us in a position to advance to the consideration of what is the next logical step in the grouping of the sciences under examination, and to get a basis for the refutation of still another attack on analysis, namely, that attack which Bergson presents in his doctrine of duration.[3]

Motion, velocity, and acceleration have been discussed. Thus far, however, there has been no discussion of causation. Yet existentially, in the specific cases where these entities are discovered,

[1] See this section, on Motion and on Space.

[2] Cf. Russell's dissenting statement, Principles of Mathematics, 473.

[3] Creative Evolution and Matter and Memory in numerous places.

causes are found to operate — causes for motion, for a change of velocity or of direction, etc., etc., — in fact, causes in general. Here, however, I am not concerned with all causes or even with the principle of causation, but only with one type, that, namely, which is made the pivot in the specific attack which I wish to confute. That type of cause is that one in virtue of which *an effect at any time whatsoever*, past, present, or future, near or remote, can be inferred or discovered. The position taken by the attacking party here is, that this means that the whole temporal series of events, that is, the kind of temporal series to which analysis leads, is given all at once, *now*, but that this contradicts the very nature of time as lived, as experienced, as related to, and so as *constituting things in time*. As lived or experienced, etc., the attack continues, time, or 'duration,' as it is called, is not given all at once — *now;* but life and experience are immersed in it, and it is immersed in them, in such a way that it is only a *now* and a *now* and a *now* that is actually lived, although each *now* is an accumulative effect of all that has gone before. Since the time with which analysis deals is held to contradict *in this way* the time as lived, and the latter is held to be reality, the attacking party concludes that analysis falsifies the original nature of time. The argument is not different in form, then, from the other specific attacks which we have considered. Thus it attacks the realistic interpretation of time which discovers *in it* an entity that is absolute and not relative and that is genuinely independent of existents. I shall show, however, that this specific attack presupposes this very realistic interpretation and so contradicts itself. To that task I now set myself.

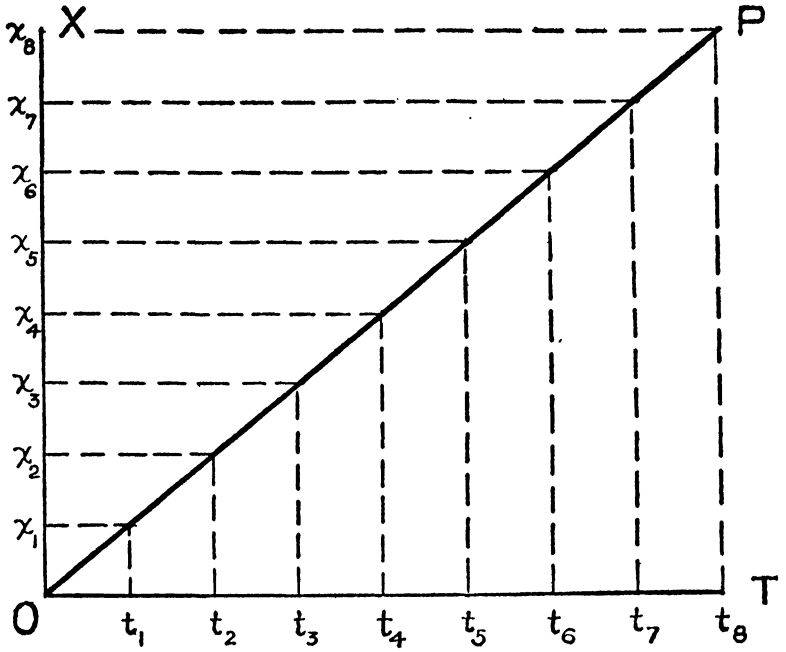
First, let us consider in some further detail the position which is attacked. That position is one which introduces into, or adds to the analysis which we have so far considered, the concept of causation and even of change in general. The attack is directed, then, against that body of analysis which is called Dynamics. Or, indeed, further than this, the attack is made also on that body of analysis which introduces still more specific causes and conditions than does Dynamics, namely, Mechanics.

Motion may be vaguely said to be change of position — in time, of course. But this change of position can be accurately and adequately analyzed. There are, however, other kinds of changes, as, for example, change of velocity and qualitative changes. In fact change in general is not only *genus* to any specific type of change, but is logically prior to it. Any specific type of change, such as chemical reactions, electrical and thermic events, involves time, and can be referred to it as the independent variable.[1] Put in familiar scientific terms, this means that, with any qualitative change measured, and the time in which it takes place also measured, the average velocity of the change can be determined, and the whole process treated in perfect analogy to the treatment of motion. Thus, the average velocity of a chemical reaction is the limit, $\frac{dx}{dt}$, of the ratio $\frac{\text{amount of new substance produced,}}{\text{time taken for this}}$ that is, $\frac{x_1 - x_2}{t_2 - t_1}$. To make certain that this is not simply an average, but is a constant velocity holding good for any instant of time, or to ascertain that there is a uniform acceleration here, demands the same observations, etc., as for motion.[2] Once ascertained, however, the change, the velocity, or the acceleration can be defined without introducing these conditions into the definition. Further, and important, exactly the same interpretation of all these 'non-motion' changes must be made as is made of change of position. The terms are neither rests nor changes. They are complex terms of one-one correlating relations between the instants of time and some qualitative entity (which may in turn be complex) — with these complex terms themselves related asymmetrically and transitively. The whole series, with all its terms and relations, is the change.

In customary scientific language any finite change x is, then, a function of a certain specific time t as the independent variable, and can be graphically represented by the 'time chart':

[1] See this section, on Relations.

[2] See the three previous divisions of this section.



Not only can the first derivative, $\frac{dx}{dt}$, that is, the velocity of any change, be thus represented, but also the second derivative, $\frac{d^2x}{dt^2}$, the change of this velocity, and, theoretically, the higher derivatives, $\frac{d^nx}{dt^n}$, although those beyond the second are seldom used.

All this is important as leading up to the presentation of the meaning of a dynamical system and of making clear the position which is attacked by the doctrine of 'duration.'

The 'time chart' makes use of only two coördinates, and these are all that it needs. But to determine one of these coördinates, x, three or more coördinates may be necessary. Thus, to determine the *extent* of any specific motion, three coördinates forming one 'frame of reference' are necessary, although, once determined, this extent can be represented on one coördinate, referring the motion, with either its constant velocity or acceleration, to time. Suppose

such a determination to be made for any specific change whatsoever, for example, for any qualitative change, or for the change of velocity of any such change; that is, let the amount of the change be determined and represented on the 'time chart.' Then, on the assumption that the objective change, represented by the chart, is *continuous* — and this is the supposition at this point in our discussion — the state of affairs at any instant t_2, before, after, or between the instants t and t_1 is determinable, and the objective change is, of course, determined or caused. This gives a view of causation which differs quite radically from the traditional view.[1] Briefly, it means that in a continuous change of any kind, implying the one-one correlation between the instants of time and the points of space, or of that which, *as specified by coördinates*, is the equivalent of a point, namely, a configuration, any five terms of the group of terms, C, C_1, C_2, t, t_1, t_2, determine a sixth. Presented as a formula this means that $C = F\ (C_1, t_1, C_2, t_2, t)$.[2]

All this may now be made somewhat clearer. First, a distinction must be made between the cognitive determination or specification of the value of the terms concerned, and the causal determination. Thus, in the above formula, if the terms to the right are known, C can be ascertained. But the knowledge will be correct, provided only there is a genuine objective causal determination, of the kind above defined, between the configurations at any two times and that at a third time. It is the objective thing that we wish to consider now, distinguishing it from the knowledge of it. Making this distinction, and adhering to it, the statement made just above concerning causation can be expanded as follows:

1. In the case of a material particle moving with constant velocity, the velocity at any instant is determined or caused by the velocity at any other two instants.

2. In the case of the *uniform* acceleration of the motion of a body, both the motion and the acceleration for any finite time be-

[1] See Russell, *op. cit.*, LIV, LV, LVI, LVII *et passim.*

[2] See Russell, *ibid.*, 486.

tween any two instants, $t_1 - t_2$, is determined by the acceleration for any other finite time, $t_x - t_y$, before, after, or within $t_1 - t_2$, where x and y are definite and specific.[1]

3. Exactly the same statement holds of changes which are not motions, and of their velocities and accelerations; or, since acceleration is change of velocity, the statements hold good of *change in general, provided it is continuous.* If it be continuous, no matter what its nature may be, the principle of causation which we are discussing may be expressed in the above formula.

The simplest existential case of such causation is the motion of a material particle, but all sorts of complex cases are also possible, and the same principle holds for them. For, no matter how complex and varied the factors in a state of affairs may be, they can be specified by the use of coördinates, and these coördinates determine what is logically equivalent to a point. That a complex state of affairs can be so specified presupposes that it is objectively specific in some such sense as the coördinates indicate.

Now there are actually a great many other factors involved in the objective specification of a system of the kind we are considering; but we need not examine these in any detail in order to make our point against the attack to which we are replying. Suffice it to say, that a very complex system can in due time, by means of the composition of vectors, the Hamiltonian principle, etc., be specified by three coördinates.[2] A change in these coördinates, representing a change of any kind, can be represented subsequently on the time chart *as if* it were a change of position.

With the distinction between the object known and the knowing granted, and with it also granted that there is an objective causal determination of the kind just defined, in reality complex, yet capable of a simplifying treatment, it follows that, if the numerical value of the configurations at two times be known, the configuration at any other time, be it ever so complex, can also become

[1] The acceleration is *determinable, i.e.*, known, however, *only if x and y are known:* then *three* quantities or values will be determinable.

[2] Cf., *e.g.*, Webster, L. G., The Dynamics of a Particle, 1908.

known — if, as is assumed, the change is continuous. *It is by dealing with things in this manner, therefore, that time does seem to be defied* in some way, even as the attacking party claims, and that at the *present moment*, as it were, we can reach out indefinitely into both past and future, so that everything is given *now*. And this does seem to furnish a marked contrast with experiences in our own lives which we must wait upon with infinite patience and self-control, or which are irrevocable. But there is a serious ambiguity in the contrast, and so, also, in the conclusion drawn from it,— for it is on the basis of this contrast that the specific attack under consideration is made. The analysis which leads to this bringing of the past and the future into the very present, and which in this sense seems to do away with all real time distinctions, can only be a falsification, the attacking party holds, of real time or duration. We shall shortly demonstrate, however, that this attack involves much confusion and is quite easily refuted.

That analysis, however, which is thus accused of foreshortening both past and future to the confines of the present, contains many elements, and these, in accordance with the previously presented series of sciences, may now be distinguished to advantage.

The science of numbers, of time, of space, and of motion have each been considered in detail. Motion can be defined, it has been found, in a purely logical manner, and the science of motion thus defined is Kinematics. Kinematics is *applied* when there are actual particles of matter moving, but pure Kinematics is logically prior to such an application. In Dynamics, to distinguish it from Kinematics, causation and configurations of entities are taken into consideration. The configurations might in pure Dynamics be limited to positions and motions, or to some kind of equilibrium or change, or to any combination of these, and then, by specifying any two of these at the times t and t_1, a third at t_2 would be specifiable, if the change were continuous.

But in applied Dynamics the configurations would only be of a certain type, each configuration, specifiable by coördinates, being correlated with a specific instant of time, itself specified in

relation to our actual existent world; that is, the configurations would be only those which we find empirically in our actual world. *But here the changes are not continuous*, or, rather, not unlimited, although they are continuous between certain limits, so that, were the inference made that at a certain time t_2, beyond a certain finite period between t and t_1, a certain configuration would be determinate and discoverable, *this inference would be in error*.[1] The existential world does not seem in respect to all of its attributes to be of a uniformly continuous character. Rather, there seem to be discontinuity, critical points, both in the temporal series of natural and artificial processes and in formal synthesis. Thus, for example, an organism presents at certain stages of its development seemingly quite new characters, a physico-chemical substance goes through critical points in passing from the gaseous to the liquid and solid states, and the synthesis of chemical compounds out of components leads to the appearance of new properties.

Pure Dynamics, however, finds no place for these discontinuities. It introduces the concept of cause, and adheres to the principle of continuity. It can construct any number of dynamical systems; but only one of these accords with the actual world, and this is one which allows of the *application* of pure Dynamics only within certain specific ranges whose limits are empirically determined.

Thus, with Dynamics introducing the concept of causation, the next step in the series of sciences is the specification of the types of causation. If these are made the attraction and repulsion of material bodies,—attraction in the inverse square of the distance, repulsion in accordance with the 'laws of motion,' we then have the Newtonian Mechanics. Make the law of attraction in some other ratio, that is, *allow for any ratio*, and we have a generalized, a pure Mechanics. But the law of inverse squares, for example, is found empirically not to hold for all distances; thus, it does not apply to intramolecular distances. Such limitations bring us to the realm of Physics. With certain limiting points, and, therefore, *ranges* of qualitatively different phenomena empirically

[1] Cf. Montague, this volume.

determined, Arithmetic, Geometry, Kinematics, Dynamics, and Mechanics are applied, and are presupposed, each by each, in the inverse of the order named. But, conversely, each one of these does not imply the propositions of the subsequently named science. Each of these sciences is a science of a certain stratum of reality, as it were. Each stratum has its peculiar characteristics which can be discovered only empirically, and cannot be deduced from the characteristics of the *preceding* stratum, but each of the logically, and, possibly, *also* temporally subsequent strata is compatible with the existence, or subsistence of the prior strata, and so allows of the application to its phenomena of the sciences which treat of the prior phenomena.

In this way we might continue, and consider the character of Chemistry, of Physiology, etc., in their relation to the sciences which we have considered, but for our purposes we do not need to do this. Suffice it to say of the relation of these sciences to the ones already discussed, that they presuppose the facts which these other sciences treat of, but are not implied by them. Each science in the order given is presupposed by the facts of the subsequent ones, but their facts are not implied by its facts. Certain of the facts of each science are peculiar to it, and can be discovered only empirically. But once discovered, not only are these facts found to presuppose other facts, and so to demand the application of the preceding sciences, but they set limits to this application. Specific laws hold good only within certain ranges. Phenomena within these ranges are arithmetical, spatial, temporal; they sometimes are changes with velocities and accelerations; they are caused, and they are continuous. But the continuity is limited by the limits of the range. At these limits there is discontinuity, between them continuity. *This seems to be the actual status of the existential world.* Phenomena exist or take place in different strata. Laws are limited in the range of their validity, because the continuity of phenomena of which they are laws is limited. There is, then, an existential pluralism. Certain phenomena presuppose others, which in turn do not imply them, but can be conceived

and discovered as lacking them. The former limit the range of the validity or application of the laws of the latter, the latter apply within a certain range, because they are presupposed. Thus we get a logical or an ontological pluralism, with different strata of *entities*, — numbers, points, instants, logical motion, material particles, causes, specific kinds of causes, etc.

The fact, however, that the actual world of physical, chemical, and physiological fact is neither *purely* kinematical, nor dynamical, nor mechanical, etc., but is discontinuous at certain points, does not do away with the possibility of the attack which we are considering. For the *discontinuities can be bridged empirically*, — this is part of the task of analysis, — and the relation between two discontinuous ranges of phenomena ascertained. Then, on the supposition that this functional relation always holds good under the same conditions, the claim can be made once more that past and present and future, to an all-inclusive extent, *are given now*, at the *present* time. For example, the vapor pressure of a solid increases at a continuous rate with rising temperature, until, at its melting point, the pressure suddenly increases at a new rate. This is the critical point, and is constant if the external pressure compensating the internal is constant, though it varies as the latter varies. *The derivative,* $\frac{dp}{d\theta}$, *has two values at this critical point.* The ratio between these values remains constant, or changes continuously, according as the external pressure remains constant, or changes continuously. Or, at least, the ratio is assumed so to remain. On this basis, notwithstanding the discontinuities in nature, we can reach out into the past and future and have them given *now*, quite as well as if all nature were continuous without limit. We have only to say, Continuity up to a certain point, discontinuity at that point, continuity beyond it, and the ratio remaining the same, or itself changing continuously, in order to bring a discontinuous field of future or past phenomena within our present ken as readily as we could an all-inclusive continuous field. Only, if there are these existential discontinuities, they cannot be discovered deductively,

but only inductively, which means that there are existential reasons which necessitate an inductive procedure.

Reply can now be made to the specific attack on the analysis of time, and to the claim that *duration* is the real entity. Through analysis *future* and *past* do seem to be given *now* — in some sense. That must be admitted. In fact, both attack and defense do admit it. But the attack claims that for this reason the very nature of time (as duration) is vitiated and contradicted, in fact that it is thus 'detemporalized' and falsified! For, it is held, time as lived, etc., that is, as duration, cannot be so manipulated. It, real time, demands that we wait with patience for the occurrence of that which we desire. Time manipulates us, not conversely. In just this sense it forms an integral part of the actual course of events, to be separated from them only at the cost of falsifying its real nature.

Now in this attack the validity of the specific analysis of time into instants is not directly impugned, or, at most, it is attacked only subsequently to the specific attack now under consideration. I shall show, however, that that very analysis is presupposed by this latter attack. Indeed, that there is a certain difference between time as analyzed out and time as lived must, I think, be admitted, though it may not be a difference in time *qua* time, but only one between specific, individual periods of time. The attacking party admits *this* difference in the distinction which he grants and emphasizes between processes which, he insists, having taken place in the past, are organically incorporated or summarized in the *present*, or which *will* take place, *and* those which are taking place and being lived *now*. But this makes it evident that he finds no difficulty in *somehow* getting into some parts or periods of a time series which are different from, or other than the present, and clearly, he must grant the same privilege to the defending party. In fact this distinction is implied in identifying the present as the present. But this distinction, which the attacking party insists upon, is only the distinction between perceptual time and conceptual. He himself grants both of these kinds of

time in making his attack, but argues and concludes that the former alone is real, the latter falsification.

In reply to this I shall show that that very characteristic which is most emphasized in this attack, namely, that which, put concretely, is called the *living now*, and, put abstractly, is the 'unmanipulatableness' of time, *really demands the validity of the analysis of time out of the complex of things in time, and, further, the analysis into instants, and the realistic view of time.* Stated briefly, this can be done by showing that it is only the realistic view of time and this twofold analysis that account for the very characteristics and attributes which the attacking party is emphasizing. For, assume the hypothesis (to see how it works), that time is an entity which subsists independently of things in time, and that accordingly it can be analyzed out of the complex, 'things in time'; then it follows that there is a very interesting and important difference between the whole time series as treated conceptually, *and* certain time periods as experienced now, — call these duration. For, by this assumption, this very difference, this very characteristic which is so emphasized in the *living now*, this compulsion on us to be patient and wait for things to develop s ep by step, *arises from the one-one correlation of specific events with those specific instants or periods (in the larger time series) which are the now.* The *now* is just this specific time period, consisting of these, and *not those* specific individual instants in a larger time series, and in this sense cannot be manipulated. This is equivalent to saying that the same hypothesis accounts for the distinction between perceived time and conceptual time — a distinction which the attacking party tacitly insists upon and uses. But the *time as time* in the two cases is not different. It is only the periods or the individual parts that are different. For analysis shows time to be a series, its terms to be instants, its relating relations to be asymmetrical and transitive. It is absolute and not relative. It subsists whether anything exists in it or not, and whether it is known or not. This is the realistic view of time. Assume this hypothesis, and then, if specific existential events take place, they take place in correlation with specific individual in-

stants constituting definite individual periods of time. This correlation is fixed, it cannot be altered. If the events are those of a conscious organism, then they are to be lived *now* with waiting, with patience, preceding their arrival at a fixed period of the time series. If they are *now past* events, they are also fixed in the time series, with a definite temporal distance and a causal relation between them and existential events now, and so, also, if they are future events. The assumption accounts for the very things most emphasized by the attacking party. But knowing can reach out to this past and future, can, within certain empirical limits of accuracy, get at the many events in them in the temporal order, while the living, the perceiving, as an event, is limited to the *now*. The two are different, the distinction *is* justified. But it is accounted for, and along with it the Bergsonian doctrine of duration, *only* by the hypothesis of an independent time series, in fact, by the whole realistic view of time. Time is an independent series. It can be analyzed out, because it is already *out*. It is not an integral part of a complex which cannot be analyzed without falsification. Things are in time, but it is not in them except in the sense that existents are correlated with specific instants. Their temporal position is fixed as a configuration C correlated with a present time t, and in a many-one relation with this t and two configurations C_1 and C_2 correlated with t_1 and t_2, past or future. This is really an analytical statement of Bergson's doctrine of duration. The latter presupposes for its own explanation the very view of time which it purposes to attack — presupposes the validity of the very distinction which it itself is compelled to make.

I conclude, then, that that attack on the analysis of time which claims that the time analyzed *out* is detemporalized, spatialized, falsified, etc., is itself false. The discovery of time as an entity which is independent of things in it and of its analysis into instants stands as valid. In fact, *only* this realistic interpretation both of time as a whole and of its analysis accounts for those very features which are emphasized in this specific attack against such a discovery and analysis.

6. Other Classes of Individuals, Atoms, etc. — My general scheme now brings me to the consideration of a new type of whole lying within this class of classes which are composed of individuals, a type, namely, whose analysis to a large extent is experimental, although not exclusively so. This type of whole is well illustrated by any finite quantity of any pure chemical substance. Such an actually existent whole in any specific instance is not identical with the class-concept which denotes the class of which it is a member. The concept iron is not iron, the concept mercury is not mercury, any more than the class-concept number is a number. The defense of the analysis of wholes of this type constitutes, among other things, a defense of the atomic theory and of those theories which, like the molecular and electron, are allied with this.[1]

I need not relate, indeed, not even classify all the experiments which can be made in the laboratory, and all the additional evidence, experimental and other, which shows that a chemical substance consists of parts called atoms. I shall consider such experiments and evidence only so far as is necessary in order to make a defense.

The proposition that each pure chemical substance consists of atoms is a conclusion which is reached through a hypothetical syllogism of the general form: If p *alone* implies q, *and* q is, then p is; that is, if p is the *only* hypothesis which explains q or a number of q's, and these exist, then p exists.[2] This seems to controvert the usual rule for the hypothetical syllogism according to which the affirmation of the subsequent does not imply the affirmation of the antecedent; but in reality it does not. The assertion of the subsequent carries with it the assertion of the antecedent *provided* an *unequivocal* connection between antecedent and consequent is established whereby it is shown that, although many p's might explain one q, *only* one p can account for may q's. The

[1] This essay, Section V.

[2] Cf. Marvin, W. T., The Existential Proposition, *Jour. of Phil., Psychol., etc.*, 1911, 8, 447–491.

conclusion that p exists, if it explains existing q's, is valid, if other hypotheses are excluded through the fact that *one and only one* p accounts in the present state of our knowledge, for all the known facts, for all the q's. This is the type of reasoning which we have, now, in the establishment of the atomic theory. Experimental analysis reveals many q's, many existential facts. The only hypothesis which explains them is the atomic, which means an analysis of the whole into parts called atoms.

For the sake of making my presentation specific, I shall state some of the important facts [1] which the analysis into atoms explains:

(*a*) Pure substances combine in constant mass-proportions, no matter how small the quantities are which are worked with experimentally. This would be explained if larger masses are only multiples of some ultimate units between which the same mass-proportions hold.

(*b*) Certain substances combine in more than one proportion, but these proportions are rational or integral. This would be explained if there are parts between which rational ratios hold. But such ratios imply finite quantities — though these be very small.

(*c*) Certain substances combine with other substances in minimum ratios. This would be explained by the hypothesis that there are ultimate units which are the smallest that can enter into combination with the units of other elements.

(*d*) Substances which can be gasified exert pressure on the walls of the containing vessel, — the same pressure on each wall. For equal volumes this pressure varies directly with the temperature. These facts are explained by the hypothesis (1) that there are parts, acting as wholes, in motion, and striking the walls of the vessel with a certain momentum, and (2) that the velocity of each part, and so the momentum, varies with the temperature. These parts might be either ultimate units or simple multiples of these.

(*e*) Equal volumes of gases at the same temperature exert differ-

[1] Cf., *e.g.*, Jones, H. C., Elements of Physical Chemistry, 1907.

ent pressures. This would be explained if the gases consist of moving parts, — the same in number in all gases of equal volumes at the same temperature, —which are of the same mass in any one gas, but of different mass in different gases. Then the velocity would be the same. These different masses might be in the same ratio as are the combining proportions of the substances in question.

(*f*) Equal volumes of gases at the same pressure are of different temperatures. This would be explained if the gas consists of moving parts, the same in number in all gases of equal volume at the same pressure, but with motions of different velocity. The masses would be the same.

(*g*) The data of (*e*) and (*f*) are together explainable *only* if in different gases at the same temperature and pressure both the masses and the velocities of the parts are different. The velocities must be if the masses are. And the masses are different — as 'combining proportions' show.

(*h*) That the volumes, pressures, and temperatures of two gases should be the same, but the masses and velocities different, is explainable, if equal volumes of gases, at the same temperature and pressure, contain the same number of parts, either ultimate parts, or complexes acting as units. (Avagadro's hypothesis.)

(*i*) That equal volumes of gases (in certain cases), at the same pressure and temperature, combine in definite proportions is explainable by the same hypothesis.

These examples of the actual analyses which are made by way of establishing the atomic and molecular theories are sufficient to make my point clear. The data cited are themselves analytical results. They involve the distinction between volume, pressure, temperature, between different substances,[1] etc., etc. But *these specific* distinctions are seldom attacked. The analyses cited and their results lead to or demand another analysis, that of a pure chemical substance into parts called atoms, or, all taken together, they are this analysis.

[1] Cf. Section IV of this essay.

Put in the form of our schematic syllogism, the data discovered by analysis, that is, the data of definite proportions, of pressure, etc., are a set of 'existential q's.' They are facts, and in that sense are affirmed or asserted. But their assertion carries with it the assertion of the *one* hypothesis which, in the present state of our knowledge, is the *only* one that will explain them all. Any other hypothesis is excluded, since no other one hypothesis will explain the manifold of data, found independently, and to be explained. Then the entities, the atoms, which that hypothesis denotes, are to be accepted as real in exactly the same sense as are the data which they explain.

But this outline of that analysis which leads to the atomic theory, and, as the realist would say, to the discovery of atoms, is typical, as is also the kind of whole which is analyzed. This kind of whole is found in any actually existing pure chemical substance. Such a substance or whole is made up of particles, of molecules, of atoms, and perhaps, finally, of electrons. A current of electricity, the cathode rays, the α, β, and γ emanations from radium, etc., would also seem to be such wholes — wholes whose parts are all alike. And the analysis outlined is typical of the various specific analyses which are made. The *existence* of various data found by experiment is explained *only* by the *existence* of certain parts.

Now in the case of certain analyses previously considered the typical argument has been advanced against their realistic interpretation, that the parts or terms to which analysis leads are the contradictories of the whole, and that accordingly the analysis falsifies. This attack has been found to fail in every case so far examined. Does it fail here also in the case of atoms, electrons, etc.?

The reply is, that in this case there is scarcely opportunity to make this typical attack. Molecule, atom, electron do not seem *prima facie* to be the contradictories of the whole of which they are the parts. They may be made so, artificially, of course, for any two terms, A and B, distinct from one another, can be thrown into the contradiction-mold, A and *non-A*. But this process generates

no difficulties, for it presupposes the very absence of difficulties in the data with which it starts. A and B are compatible, though different, and, therefore, so are A and *non-A*, if *non-A* = B. Contradiction must have a fulcrum in order to be damaging, it must turn on some eccentric.

But, although not contradictory to the whole, molecule, atom, electron, may be different from the whole of which they are parts. In fact there is evidence that they are, especially in some cases. But this is not damaging either. It shows neither that the analysis is false, nor that it is inadequate — although it may be incomplete, or may in fact be in error, — to be corrected subsequently. The latter possibility must, of course, be admitted of any analysis. Consider the actual state of affairs which is revealed by this modern physico-chemical-electrical analysis. There are the wholes to be analyzed — pure chemical substances, let us say. And there are the parts revealed, — particles, molecules, atoms, and electrons. But there are also the organizing relations. These are revealed by the analysis just as much as are the terms. These relations may at the present time offer many further problems, they may be of many different kinds, they may not be the ultimate relations involved, but at the present stage of scientific development they are the relations which are revealed, whose field is the terms disclosed by the analysis, and which, together with these terms, constitute the whole. The terms *in relation* may not constitute the whole in an additive manner; few wholes are so constituted; few properties so result. They may not be the whole, for example, in quite the same way that points related asymmetrically and transitively *are* a line. But they are the whole in some of its distinguishable aspects, just as the points in relation *are* the line, and they are not the whole in other aspects. The whole has properties which are different from the parts and the relations. Analysis, then, by subtraction if you will, reveals these properties. The specific properties of the whole *plus* those which are the terms in relation, *plus*, of course, the relations, exhaust the whole. The analysis, then, is adequate. But it may not be complete. Pos-

sibly it can be driven further. But, on the basis of what it is now, it is adequate, and certainly presents no opening for the introduction of the claim that it leads to contradictions and so falsifies.

At the present stage, then, in the development of science, those entities, such as electrons, atoms, molecules, etc., and the relations between them, which together *exclusively* account for certain existential phenomena, must be accepted as existing in quite the same sense as do the entities which they explain.

IV

PERCEPTUAL AND CONCEPTUAL ANALYSIS

We now come to the third kind of whole, that whole, namely, which, being itself a class, is analyzed into subordinate classes. Is this analysis falsification?

Let us take an example. Fluorine, chlorine, bromine, and iodine are grouped together as the *halogen* elements. They are so called, of course, because of the similarity of their compounds with those of chlorine, such as NaCl, common salt.[1] Halogen, is, then, the class-concept. The actually existing things are specific quantities of fluorine, chlorine, bromine, and iodine — actually existing in some specific place in each case. The class-concept, halogen, is none of these. But neither are fluorine and chlorine, as class-concepts, themselves fluorine and chlorine.

Let us consider first the actually existent entities, the real fluorine, chlorine, etc. Specific quantities of chlorine would, as specific, be distinguished from one another, — analyzed, if you will, from one another, and yet they would be found to have common characteristics by virtue of which they are all chlorine, and quite similarly with specific quantities of fluorine. Yet there is another distinction which the actual analysis makes, for example, that between a specific quantity of chlorine and one of

[1] Modern chemical investigation shows that these substances have further properties by virtue of which they belong together in Group VII of 'The Periodic Law.' Strictly speaking, they are sub-group A of this Group.

fluorine. Put two such quantities side by side in the laboratory under certain conditions, and make suitable tests and observations. The two quantities are spatially distinct. But they are also found to be qualitatively distinct in many ways, at the same time that they are similar. Now it is this type of analysis that I wish to examine, the type by virtue of which different *kinds* of entities are discovered. It is this analysis, of course, by virtue of which, in both common sense and science, the great manifold of kinds of things, events, etc., are classified and systematized. Is this analysis attacked? We have only to turn to M. Bergson's 'Creative Evolution' to find an affirmative answer: "Our perception, whose rôle is to hold up a light to our actions, works a dividing up of matter that is always too sharply defined, always subordinated to practical needs, consequently always requiring revision. Our science, which aspires to the mathematical form, over-accentuates the spatiality of matter." [1] "What is real is the continual change of form: form is only a snapshot view of transition." "Our perception manages to solidify into discontinuous images the fluid continuity of the real." [2] Manifestly this attack is made from the standpoint of a position that is obtained by considering the predominance of dynamic concepts in modern physical science. Most 'things' are changing, either rapidly or slowly. That is to be admitted. M. Bergson draws his evidence from many such sources. And finally, by so doing, he arrives at the position that everything without exception is change, flux, evolution, with such an interpenetration of parts (if there are parts) that there are no lines of separation, that there is only One great viscous or mobile fluid.[3] With this the case, it is clear that his attack on perceptual analysis comes under the usual form. The whole is a continuous, flowing, trembling jelly. Perception introduces discontinuity, rest. It selects this object, that object, this quantity and that, and makes them static. Then it falsifies, serve though it may the practical purposes of our action. This is the attack. Can it be met?

[1] *Ibid.*, 206. [2] *Ibid.*, 302. [3] This essay, Section I.

I think that it can be, and, indeed, in two ways. First the major position from whose standpoint the attack is made is constructed by applying the constitutive theory of relations to any and all relations between any and all things.[1] If there is a universal interpenetration of all things by virtue of their being related, then there are no *things*, no thing is any one thing, nothing is itself, and everything is something else. But the fallacies and difficulties of this view we have previously examined. Change may be very prevalent, although not universal. Or it might even be admitted for the sake of the argument to be universal for *existing* entities. But from that admission it does not follow that there is only One Change or Evolution with no place at all for typical and individual changes. Conceivably there might be only One Change, qualitative and quantitative, *or* there might be many changes, qualitatively and quantitatively distinct. Then analysis, discovering which is the case, would be valid; for the analysis which I am discussing here is not limited to 'getting at' the statical. It can also get at the dynamical, the evolving, the changing quite as well, as has been shown. Bergson, for example, himself tacitly admits and presupposes this in distinguishing three kinds of changes which we perceive and for which we have concepts, namely, qualitative, evolutionary, and extensive.[2] Every opponent of analysis or of pluralism admits it in so far as he uses concepts denoting different *kinds* of change.

Accordingly it can be admitted that the things, the qualities, etc., which we perceive and distinguish in concrete cases are not genuinely statical, but are changing, slow though this process be, *and yet* that this perceptual analysis is quite valid. Different concrete entities, whether or not further analysis show them to be processes or just plain 'things' — equilibriums if you will — can be perceived, and they can be perceived as different, whether the difference be only a spatial and temporal one, or also a qualitative one. In the former case the two or more entities are perceived as instances of the same qualitative complex, and the possible

[1] See Section I.

[2] *Op. cit.*, 303.

existence of still other cases is implied. In the second case it is implied that other instances, similar respectively to *each* of the two or more qualitatively different complexes, may be found. Then there are two sets of cases, each case individual, but each set also differing *as a set* from the other set. The individuals of each set are simply different spatially and temporally, one or both, but they are individuals or instances of a certain complex of qualities, other instances of which can be conceived. But in any case, whether found to exist or only conceived, they differ qualitatively from the individuals of another set.

All this is trite. It is but another way of saying that among certain individuals which are numerically distinct, qualities or groups of qualities are found which are numerically the same, and of which other instances can be conceived. There are qualitatively different 'states of affairs' of different groups of individuals, the individuals of each group forming that group by virtue of being instances of the same state of affairs. Then there are *states of affairs* which differ qualitatively and are themselves numerically distinct. Briefly, there are different *concepts* revealed by analysis. What, now, is the character of these states of affairs? Briefly, it may be said (1) that the state of affairs, the concept, is not the printed or spoken sign, the word. It would subsist, did the signs not exist. (2) It is not the knowledge or idea of the state of affairs, for again there would be a real state of affairs even if it were not known. (3) It is not identical with the individual cases, whatever these be. Number is not any one number, man is not a man, etc. (4) It is not necessarily even physical or mental, even when the individual cases are physical or mental existents. Thus the state of affairs, indivisibility, is not itself an indivisible, nor is mentality itself mental. Further, there are states of affairs *of* entities which are neither physical nor mental, that is, which do not exist; for example, arithmetical continuity.

Analysis, so-called conceptual analysis, reveals, therefore, qualitatively different and numerically distinct states of affairs or concepts. They may be the states of affairs regarding change, for ex-

ample, the laws of change, as well as regarding entities which, like points, do not change. Is, now, the analysis which gives or is identical with these concepts open to attack? Suffice it to say that it is attacked. Says M. Bergson, "Concepts are outside each other, like objects in space; and they have the same stability as such objects, on which they have been modeled." "They are not the perception of things, but the representation of the act by which the intellect is fixed on them." "They are, therefore, symbols." [1] "The intellect is not made to think evolution, in the proper sense of the word — that is to say, the continuity of a change that is pure mobility." [2]

The attack here is in part at least a variation of the typical attack which we have found to be made in every case so far considered. Concepts are characterized as statical entities, solid-like 'things,' external to one another, etc. How, then, can they relate or refer to that which is not statical, but is concrete, actual process, change, evolution? This is the variation of the typical attack. What is its central principle? Briefly, it is this, That only *like* entities can be related. Therefore the concept, which is static, cannot be related to or refer to that which is not static, but *is* process, change, etc. The concept by its very nature is inadequate to draw out or present the character of that which is its contradictory in nature. Or, if the concept be admitted to be the state of affairs, the law, or what-not, of a process, then it falsifies; it in some sense makes static that which is not.

This, then, is the attack. Can it be met? It undoubtedly can be, and first by an argument both *reductio ad absurdum* and *ad hominem*. Any party making this specific attack invalidates his own attack and tacitly accepts the validity of conceptual analysis in talking about evolution, process, and change. These are concepts, and whether they are statical or dynamical, they are capable of meaning and of referring to that which is — well, just what they designate, namely, change, evolution, etc. If the concept be dynamical, then we have like entities related; if it be static,

[1] *Op. cit.*, 160–161. [2] *Ibid.*, 163.

then unlike things. But in either case *it is related* to that of which it is the concept. The attacking party tacitly grants, then, that there is nothing in the nature of a concept which prevents it from being a concept or state of affairs of other entities, whether these be like the concept or not.

With this point cleared, it can also be readily seen that on the basis of a similar argument the attacking party can be forced to grant the validity of that further conceptual analysis which is identical with distinguishing different states of affairs. He himself distinguishes different kinds of change. Then he admits that the general principle of having *kinds* is valid. The further analysis of some of these kinds may be difficult. But the analysis of the larger whole into these types is quite valid. In fact, it is presupposed by the attacking party to be. Then further similar analysis may also be. I conclude, then, that this specific attack is not to be taken seriously, but that it is made under the influence of analogy and of misleading figures of speech.

The other aspect of the attack on conceptual analysis is not a variation from the type. It is practically the same as the attack on perception. Perception, so it is held, falsifies by breaking up into statical and sharply separated parts that which is really *one* concrete universal change. Conception, it is also held, falsifies by making statical that which is not. Here the defense, then, is the same as against the attack on perception. The validity of conceptual reference and analysis is presupposed by the attacking party himself in his distinction of *different kinds* of evolution and change. Each of these kinds has many instances. Each would be a genuine state of affairs, which, though related to other kinds, would be just that kind. Then he has accepted the principle that valid conceptual distinctions or analyses can be made. That is all that is necessary to refute his attack, for his attack is on the principle, and not on the details of any specific conceptual analysis.

I conclude, therefore, that conceptual analysis *qua* conceptual is quite valid. Just as there are individuals, whether these be things or processes, which can be validly distinguished in per-

ception, so there are *types* of individuals, which types, although they are similar to one another to a greater or less degree, are also different and distinct. The individuals may be of the most various kinds; they may be physical or mental existents, complexes or simples, relations or terms, motions, or rests, or qualities, or things; they may be entities which, like the numbers, are neither physical nor mental, but are subsistents. Thus we are already distinguishing types. But, whatever be the concrete individuals, the state of affairs, the type, is, as a state of affairs, only subsistent, and is identical with itself. It is just that state of affairs, whether individuals corresponding to it exist now or not; it retains its meaning as these individuals may come and go. Further, as a specific state of affairs, it may differ from other states of affairs; in fact, although related to them, it may be quite independent of them. What the relation of different states of affairs is, is for analysis to determine. That is the problem which the attacking party always admits to be solvable, although his solution is different from that of the defending party. For the latter, analysis solves this problem, with the outcome that certain types are quite independent of others. Thus, numbers as a type are independent of instants, of points, of material particles, of acts of counting, in the sense that all these imply the numbers, but not conversely. There is a certain hierarchy of types. Certain types could subsist, or exist, without others, though not conversely.

In summary, then, I conclude that that kind of analysis in which the whole analyzed is a type or class with subordinate classes, or finally a class with individuals as terms, is not invalidated by the attack, but remains a method whereby entities are discovered which are as real, and real in the same sense, as are those wholes to which the attacking party alone attributes reality.

V

THE ANALYSIS OF ORGANIC WHOLES[1]

I NOW come to the examination of the analysis of the fourth kind of whole, illustrated by any specific finite quantity of any specific chemical compound and by an organism. The character of the analysis which I wish to defend, as well as the character of the wholes analyzed, will be made clear by a definite example, that of the analysis of water. Water is shown by analysis to be a compound. As water, it has certain properties, some of which are found in other compounds, others not; in the latter case the properties are specific. All the properties are classified as either chemical or physical. The chemical properties are those which are involved in the fact that water *reacts* or *combines* with certain other compounds and with certain elements. Among the important *physical* properties are specific gravity, refractive power, boiling point, electrical conductivity, absorptive power, and elasticity. Water as a whole has these two types of properties.

By electrolysis, however, and by some other supplementary modes of experimentation, water is actually split up or analyzed into two substances, hydrogen and oxygen, which are gases under normal conditions. Investigation of these shows that each has many of the same kind of properties as has water, although with numerical values different from the values in the case of water. Properties common to hydrogen, oxygen, and water are all the above enumerated physical properties. But the chemical properties of the three substances are different. However, in the case also of the physical properties, the numerical value of certain properties of the whole, water, namely, the last four, is not simply the *additive* result of the values of these same properties in the parts. In the case, then, of both kinds of properties, chemical and physical, there would seem to be something in the whole which is not in the parts, and conversely. If the whole be experimentally synthesized out of the parts, then something new appears as properties of the

[1] Cf. Pitkin, this volume.

whole, something which is new qualitatively as well as quantitatively. On the other hand, if an experimental analysis be made of the whole, then the whole is also found to have properties which the parts do not have. These properties are put 'in relief' by the analysis; they are a residuum, characteristic of the whole as a whole, and revealed by an analysis which at the same time reveals the parts or elements, and, through its ramifications, the *organizing relations.*

This fact, that in the actual synthesis, artificial, or natural and developmental, of existential wholes out of parts, new properties or new values appear, is a matter of great importance. It is a fact, too, which is accepted by authoritative investigators. Says Professor Nernst,[1] "A large number of physical properties have been shown to be clearly additive; that is, the value of the property in question can be calculated as though the compound were such a mixture of its elements that they experience no change in their properties." Examples are the volume, refraction, magnetism, and heat of combustion of organic compounds. But other properties are not additive. "The kind of influence of the atom in a compound is primarily dependent upon the mode of its union, that is, upon the constitution and configuration of the compound. Such non-additive properties are called constitutive." Examples are the absorption of light, the rotatory power, the melting point.

Now modern physics and chemistry, physics chiefly, carries this typical analysis of water further; it analyzes the two constituents of water, hydrogen and oxygen, to discover that these in turn consist of parts related in certain specific ways. In fact, at no stage of this physico-chemical analysis are the organizing relations unrevealed. Hydrogen and oxygen, and presumably all the elements, are shown to be composed of electrons, that is, of negative electrical charges in a positive electrical field. Further analysis shows that these electrons are in very rapid orbital motion, and that their mass is a function of their velocity. The atom turns out, then, to be a mechanism, — an electro-mechanism,

[1] Nernst, W. (Lehfeldt, R. A., trans.), Theoretical Chemistry, 365.

however, just as the molecule is a mechanism whose parts are atoms, and the particle a mechanism whose parts are molecules. But with the atom an electro-mechanism, the analysis can be pushed further. The electron is itself an electrical field of force. It is, then, a three-dimensional manifold of elements which are intensity-points forming an ordered series. But the electrons are in motion. Then their motion can be analyzed after the manner previously presented.[1] Clearly, various laws, arithmetical, dynamical, mechanical, as they have previously been presented, have an application to the entities within the molecule. From these laws, however, no specific molecule with its specific characteristics can be deduced, yet, conversely, any specific molecule is found to imply these laws.

However, we do not need to go so far as to take into consideration the analysis involved in these laws in order to establish an important point. Let us stop with the analysis of the atom into electrons, and compare the properties of the latter with those of the former. Electrons as individuals have certain properties which atoms have, namely, a volume, a specific gravity, a mass, an attractive power (whatever this may be), but they lack refractive power, rotatory power, electrical conductivity, absorptive power, which properties the atom has. Similarly, any finite quantity of atoms, as atoms and not as molecules, for example, vaporized mercury, has, as a whole, properties which the individual atoms do not have, and likewise with the molecule. At each stage in the synthesis of wholes out of parts which are in turn wholes until we get to the intensity-points of that field of force which *is* the electron, there are properties of the whole which are not found among the properties of the parts. But analysis reveals what these wholes are, what their parts are, what the properties of each are, and what the organizing relations at each level are. It allows for a whole which is not merely the sum of its parts, and which, with its properties, cannot at the present stage of science be deduced from those parts. Yet it also allows for the empirical ascertainment in

[1] This essay, Section III.

many cases of the functional relation between the properties of the whole and those of the parts.

Can this analysis be successfully attacked? The question is most important, for it is just this kind of analysis that is identical with the experimental procedure of many sciences. Thus would physiological chemistry analyze organisms and their parts; thus do chemistry and physics proceed.

The attack is undoubtedly made. However, there is no opportunity for introducing that typical attack which we have considered elsewhere. Here, part and whole do not seem to be contradictories. The only opportunity for attack, then, consists in the claim that, in a whole which is constituted by interpenetrating and causally interacting parts, no part can be experimentally removed without altering it.[1]

The reply is that perhaps it cannot be — in the instance of the kind of whole we are now considering. There do seem to be wholes which consist of parts, which, related, do modify or influence one another, or which, perhaps, are constituted by virtue of their relation to one another. At least, this is one hypothesis. Such wholes are well illustrated by an organism, and for this reason are called organic. As wholes, they do seem to have properties which the parts have not, properties which are not derived *additively* from those of the parts. Let the parts be brought together in a natural process, and we have both creation and evolution. Let them be brought together in the laboratory, and we have creation accompanying synthesis. In either case there is a creative synthesis, natural or artificial. But organisms are not the only kind of whole which presents this synthesis. Non-living things do also, quite as well. Chemical compounds do, atoms do, every physical complex does. Both part and whole in every case may be arithmetical, dynamical, mechanical, etc., but in each case also they are more than this in that, for example, the mechanical laws which apply are limited by the peculiar qualitative constants which render each whole and part specific.

[1] This essay, Section I.

With reference, now, to the actual experimental analysis of these organic wholes there are two hypotheses, each of which is compatible with the realistic interpretation of analysis. The one hypothesis is, that when the parts are analyzed out they are changed in certain respects. This would not necessarily be the case with all the properties of the parts. For example, in the case of water, certain properties, such as the specific gravity and refractive power of hydrogen and oxygen, would seem to be the same, both when these substances are in and out of combination. But with other properties, especially the chemical, the case is different. Some of these seem to be gained by the parts when analyzed out, and to be lost when the substances are combined, with the supplementary gain by the whole. Analysis and synthesis are, then, complementary processes. Each also is a natural process. Both create. In each, relative to the other, new properties appear, and there is a genuine creation which is not explained away by saying that that which appears as new has been potential all the time. By this first hypothesis, then, the parts when *in situ* in the whole will be actually constituted by virtue of their relation to other parts.

By the other hypothesis, the parts, whatever these may be, electrons, atoms, molecules, particles, remain quite the same, quite unmodified whether they are in or out of the whole. But then, to accord with fact, it must be granted that new properties arise for each successive whole. By this hypothesis, with electrons combined to form an atom, the electrons remain just what they were before they were combined, yet the combination as a whole has properties which the electrons lack, and similarly with the combination of atoms into molecules, molecules into particles, and so on upward, as it were. Both hypotheses, however, recognize a non-rational element in nature, — at least so far as our present knowledge goes. The time may come when the new properties of the whole can be deduced from those of the parts, but at the present time this deduction is impossible, and it is an open question as to whether this impossibility is due to the structure of existence, or to our ignorance.

Both hypotheses are, however, perfectly consistent with the realistic interpretation of analysis. In neither case does analysis lead to parts which are the contradictory of the whole. The analysis is itself a process, an event. By the first hypothesis, that which is taken out, or put in, is altered. But in each case analysis reveals what the alteration is, and in each case the resulting properties are real. Analysis is itself simply a process from which real properties result, by which real properties are changed.[1] By the second hypothesis, that which is taken out and put in is not altered, but remains the same entity. Yet when this synthesis takes place, the parts become related as they were not before, new organizing relations are instituted, and a whole with new properties is formed. But here also analysis reveals these properties, the organizing relations of the parts, and the parts with their properties. Both analysis and its complement, synthesis, are processes, the former revealing parts which remain what they are even when their relations change, the latter instrumental in causing new properties to arise. Neither, however, furnishes any opportunity for the claim that either the parts revealed, or the properties and whole produced, are not to be interpreted quite realistically, or as in any sense contradictory and so falsifying. Change is a fact. That it is, is one of the attacking party's chief arguments against analysis. Then most assuredly that party cannot consistently attack experimental analysis on the ground that it itself is a process and brings about changes. The attack could be made only as regards the character of the changes instituted, and this is, as we have seen, the principle of the typical attack on analysis — that it changes the whole to parts which are the whole's contradictories. But here there is no opportunity for this claim. Molecules are not the contradictory of particles, nor are atoms of molecules, nor electrons of atoms.

I conclude, then, that, like the other analyses examined, the analysis of organic wholes stands unimpeached by any attack which

[1] It has been previously shown, of course, that change presents no insuperable difficulties to analysis. Section III.

has as yet been made upon it. These wholes are, more clearly than any others which we have considered, not simply the additive result of their parts. They have new properties, properties which the parts lack. All physical and chemical wholes, both living and non-living, are of this sort — excepting, of course, the ultimate simple. The analysis is adequate. It reveals the parts, the organizing relations, and the properties of the wholes themselves. Valid also is this analysis. It may change that which is analyzed out, as by the first hypothesis, or it may not, as by the second. But in either case the part is to be accepted at its face value in accordance with the fundamental realistic postulate. For there is nothing in change *qua* change which runs counter to this postulate.[1] Change *qua* change does not prejudice the reality of either the terminus *a quo* or the terminus *ad quem.* That is admitted both tacitly and explicitly by the opponents of analysis. Then they cannot hold a brief against analysis on the ground alone that it involves change — as this specific kind of analysis does in distinction from analysis *in situ.*

ORGANISMS AND THEIR ANALYSIS

Organisms are the kind of whole, and their analysis is of the type just presented. The recognition of this throws much light on the question as to what the nature of the organism is, what the nature of life is. It clarifies the issue between the so-called vitalist and mechanist in biology. All the evidence, now, shows that the organism consists of cells, of colloidal particles in solution, of molecules, of atoms, and of electrons. At each level, as we go upward synthetically, new properties appear. Going downward, analytically, there is on the whole a loss of properties. There is a tendency toward simplification. In general all this is admitted by all parties. By all, the organism is conceded to be this kind of whole. The question at issue, however, is, is it more? Now a physico-chemical complex is a whole in which there are parts,

[1] Cf., *e.g.*, Bergson, Creative Evolution, and Time and Free Will.

molecules, atoms, etc., each one of which is in turn a whole. Well-known laws apply to these various wholes and parts, but only as qualified or limited by certain 'constants' expressing the numerical value of the properties at each level. Thus, for example, the principle of the Conservation of Energy, the principle of D'Alembert, the Second Law of Thermodynamics, the Laws of Motion, etc., apply to the physico-chemical complex, but only under conditions which are expressed in the formulæ in such a way as to give, by integration, values which are confirmed experimentally. In this sense, then, the complex is a *mechanism.* But it is not a *pure* mechanism, that is, its laws are not those purely mechanical laws which are obtained by eliminating all constants by successive differentiation. But it is mechanical in the sense that the electrical current is mechanical, namely, with purely mechanical laws qualified by limitations obtained by measuring electrical phenomena. All this can be granted, and the *admission still be made,* that every chemical compound is peculiar and specific, different in some respects from every other compound, and with properties, as a whole, which do not characterize its parts.

Is the organism, the individual organism of any species or variety, plant or animal, anything *more* than just such a *specific* physico-chemical complex, specifically different, of course, from other physico-chemical complexes which are organisms?

Vitalistic theories are not many. One traditional vague theory, that of the older vitalists, holds to the existence in an organism of a vital force or energy, but this entity has never been discovered experimentally. However, quite evidently, did it exist, it would not make the organism non-mechanistic. For *energy* is subject to mechanical principles. A vital energy would at best add only one more mechanistic element to that complex which is the organism. Another theory makes a mental factor universally parallel with the physiological factors. Then, if the latter be mechanistic (which is the question at issue), the former, as *parallel,* is also. A third theory, distinctively non-parallelistic, places a psychical

entity 'in control,' as it were, of the discharge of that potential energy which, according to the theory, it is one of the distinctive features of the organism to store up in greater amounts, perhaps, than do inorganic complexes. Thus various ends or purposes, 'entertained' by this entity, could be accomplished by varying the direction of the release of the potential energy. Once released, however, the specific energy discharged would take place in accordance with the usual principles of inorganic events. Now this is a theory which, if it be true, *does mean* a real difference between the organic and the inorganic, for by it the organism as a whole would present in its behavior a range of *variations* under the *same* conditions which it would not do if it were simply and only a physico-chemical complex. Under the same conditions the organism would now do one thing, now another. The holding of this theory to be true would have an important influence on the biologist's attitude. It is, in fact, nugatory of scientific biology, and if the theory were true, vitalism would have a distinctive meaning, differentiating it from mechanism. However, the theory is not supported by facts. The organism, even in the case of those phenomena which, like regenerations, restitutions, variable morphogenesis, etc., are held by some to support a vitalistic theory, *is found to do the same thing under the same circumstances.* That, however, which these phenomena are held by others to show is, that under *different* circumstances the *same* end or outcome is accomplished or gained. This gives a *fourth* theory, according to which there is in every organism a psychical entity which, in the midst of varying circumstances, succeeds in bringing about a definite end.[1] This is the hypothesis. However, the physically observable fact is, that that which by the hypothesis is an end is *prima facie a later stage* in the development or behavior of the organism. It may also be more than this, that is, even as it would be interpreted by the hypothesis under

[1] This is Driesch's Neo-vitalism and doctrine of the Entelechy. Driesch, Hans, The Science and Philosophy of the Organism, Gifford Lectures, 1907, 1908, and other works.

consideration, it may be a consciously held and purposed end, aimed at *now*, and accomplished in the *future*. But even if this were the case, its primary status as 'later stage' would not be altered thereby. In fact, to be a 'held' end that *is accomplished*, it must also be at least an end in this sense, namely, a 'later stage'; it could be the latter without being the former, but not conversely. But if the end be an end in this sense of 'later stage,' then, whatever else it may also be in certain cases, it is the kind of end that inorganic physico-chemical complexes also present. In general, among these complexes, the same effect, or what within certain limits is the same effect, can be produced by many causes. Thus a specific chemical compound can be synthesized in many ways. Further, as wholes, these inorganic complexes present properties which the parts do not have; they are mechanisms, though not machines. These two features are, now, so far as the ascertainable physical facts are concerned, all that the organism is. If, however, a special entity, like Driesch's Entelechy, were brought in to explain *these* facts in the case of inorganic complexes, not only would it be superfluous and not explain, but the facts themselves would not be altered thereby. The complex would be quite as mechanistic with the entity as without it. But for these complexes there is no necessity for bringing in such a special entity. The only difference which its presence would make would be the difference between presence and absence.

If, then, vitalism is defined in accordance with the fourth hypothesis, it is a position which is meaningless in the sense that it does not succeed in making that distinction between the organic and the inorganic which it aims to. For if such a special entity be put into living things, there are the same reasons for putting it into non-living. But with either its presence or its absence common to both realms, no distinction between these can be drawn or found on its basis. But this is not to say that a consciousness or awareness of some specific character may not be admitted to arise in certain organisms under definite conditions. It may. But such an awareness does not demand a vitalistic interpretation of the

organism. It does not explain the end in the sense of 'later stage,' but only makes of this a 'held' or 'purposed' end, to be accomplished in the future. The 'later stage,' as well as the 'creative synthesis,' as actually occurring and so observable, is explained and accounted for *sufficiently* in connection with and in relation to earlier stages. The hypothesis of a supervening awareness adds no explanatory element to this account. This awareness may occur, and it is good realism to admit that it may, but, if it does, it is to be distinguished from a special entity like an 'entelechy,' which is held to persist and control and direct, and to *explain* both accomplished end and 'creative synthesis.'

A difference in specificity is, then, the only difference between the living and the non-living, but this difference furnishes no ground for holding a vitalistic as opposed to a mechanistic theory.[1] Those vitalistic theories which by definition do mean something different from mechanism are not confirmed. Others only add an hypothetical entity which makes no difference to the facts discovered. Both realms, the organic and the inorganic, are mechanistic at the same time that they are specific. This means that neither realm is *purely* mechanical. Each furnishes an opportunity for applying mechanics by introducing into mechanistic formulæ the constants found by measuring the specific properties of each complex. Therefore, if this view be called vitalism, there is no difference between vitalism and mechanism. Vitalism is but another word for not-pure mechanism. Both theories mean, of course, that the organism can be analyzed experimentally and formally. I cannot agree then with M. Bergson's attack on the analysis of the organism or with that peculiar vitalistic theory of his which makes all complexes unanalyzable, and which would make everything vitalistic.[2]

[1] Cf. a discussion between Messrs. Ritter, Jennings, and Lovejoy in *Science*, 1911, 34, Nos. 847, 851, 857, 859, 864. For a fuller exposition of the position taken in this section of this essay, see my paper, The Energy of Segmentation, *J. of Exp. Zoölogy*, 4, 2, 284–315.

[2] Creative Evolution, 162 and 225 *et passim*.

A REALISTIC THEORY OF TRUTH AND ERROR

A REALISTIC THEORY OF TRUTH AND ERROR

By Wm. Pepperrell Montague

INTRODUCTION

Reflection upon the fact of error has been the principal cause for the abandonment by philosophers of the standpoint of *natural* or *naïve realism*. According to that view, consciousness is conceived after the analogy of a beam of light which reveals the nature of the very world of which it is itself a part. And as the objects revealed by a light in no sense depend upon it but rather does the shining of the light depend upon them, so do the objects revealed in consciousness in no sense depend upon consciousness but rather does the occurrence of consciousness depend upon them. When it is found, however, that some of the objects revealed in consciousness — such as the events of a dream — have no place of their own in the spatio-temporal system of interacting beings, but appear to be active only in the individual who experiences them, there arises a doubt as to whether consciousness ever directly reveals any other objects than the states of the one who is conscious. Instead of being viewed as analogous to light, consciousness is now regarded as analogous to a photographic plate on which objects external to the knower are represented or symbolized by the 'ideas' which they produce. This *epistemological dualism*, however, becomes unsatisfactory as soon as it is realized that we can ascribe to the external objects inferred as the causes of our percepts no locus or nature other than that of the percepts themselves. Because of this, the copy theory of knowledge gives place to the theory of *epistemological idealism* or *subjectivism*, according to which the world in which we live is conceived as a product, fashioned by consciousness from the raw materials of its own states. The internal contradictions of each variety of this third theory,

the manifold difficulties in the way of reconciling any form of it with the procedure of common sense and of science, and, finally, the pathetic dependence of consciousness upon the very objects which it is supposed to create — have brought about the realistic revolt. And as the departure from realism was due to the subjectivistic interpretation of error, so the return to realism must be based upon a realistic interpretation of error, and hence of its correlate truth. I shall treat the subject under three main heads: I, The Meaning of Truth and Error; II, Causality and Consciousness in a World of Pure Fact; III, The Genesis of Truth and Error.

I

THE MEANING OF TRUTH AND ERROR

1. *Definition of True and False.* — I shall use the term 'truth' to connote 'true knowledge' and the term 'error' to connote 'false knowledge'; hence the definition of truth and error will resolve itself into the definition of true and false. I hold that *the true and the false are respectively the real and the unreal, considered as objects of a possible belief or judgment.* There is, that is to say, the same difference between what is real and what is true as between George Washington and President George Washington. President George Washington refers to Washington in a certain relation to our government. George Washington denotes precisely the same individual without calling attention to the presidential relation.

2. *The Meaning of Real and Unreal.* — Having defined the true as the real in so far as it is an object of an actual or possible belief, we seem called upon to go on to define the real and to define belief. I am not sure that we should not be justified in refusing to comply with this demand on either one of two grounds: (1) that 'real' and 'belief,' so far as their connotation is concerned, are ultimate and indefinable terms and that any attempted definition would be circular; (2) that their definition would be super-

fluous in the sense that whatever definition was adopted, the true would always be found to be formally and denotatively identical with the real. That is to say, I might permit the reader to adopt his own view of the meaning of real — whatever that might be, and then without criticising it at all, challenge him to show any difference between what he regarded as real and what he regarded as true. I will not, however, avail myself of this plea, further than to say that my definition of the real, if it be rejected, should not be taken to invalidate my thesis as to its identity with the true.

I shall use the term 'subsistent' to denominate *any one of the actual and possible objects of thought.* The subsistent, as thus defined, is the only class, if class it can be called, which has no negative, as is at once evident from the fact that if we formulate in the usual way what should be its negative, viz: 'what is not a possible object of thought,' we have — if our words mean anything at all — merely another 'object of thought.' In short, the subsistent makes an absolute *summum genus.* Moreover, every subsistent has as an inseparable aspect of its meaning an 'is' relation to some other subsistent; hence *every subsistent is or involves a proposition.*[1] Now there is one great group of these subsistent objects or propositions which is easily distinguishable from the rest. It is the space-time system. It has for its elements what I will call 'events' — that is, *groups of qualities standing in the ultimate relation of occupancy to one time and one place.* This use of the term 'event' may be criticised on the ground that what we call events usually take a certain amount of time and hence include in their meaning the notions of duration and change. Nevertheless I can think of no better word than events to indicate the *elemental particulars* of the existing world. These ultimate particulars must

[1] That every subsistent is or involves a proposition should not be interpreted as incompatible with the self-evident truth that the terms which stand as subjects and predicates of propositions also subsist. I mean only that as no term subsists apart from an identity-complex or proposition, the totality of terms denotes the totality of propositions. I shall use the word 'object' as equivalent to term-complex.

be the *terms*, themselves changeless and durationless, between which the *relations* of change and duration obtain. They are the occupants of single spaces at single moments, the temporal cross-sections of single objects. The ordinary units of physical analysis are enduring things, spatially simple but temporally complex, like atoms or electrons, which are spoken of as 'changing,' 'acting,' 'causing,' etc. So deeply rooted in thought and language is this usage that it is difficult to avoid, and in this article I have often relapsed into it. And yet, but little reflection is needed to show that we have the right and indeed the duty of dividing the world not only 'vertically' in space into *substance-units*, but, also 'horizontally' in time into *phase-units*.

Now because of the *qualitative* complexity of these event-elements, each one of them constitutes in itself at least one proposition, — proposition being taken, as above, to denote a complex, in which may always be distinguished two terms related by some tense and number of the verb *to be*.[1] Thus the occurrence of an explosion at a given time, in a given place, is an event and may be expressed in the proposition — "The matter-and-motion complex of qualities (called 'explosion') *is* what occurred in the spatio-temporal region, s_1,t_1." The momentary qualitative state of a resting or moving body could in the same way be made the subject of a proposition whose predicate would be 'occurred in a given time and place.' Besides the events themselves and their internal identities just mentioned, there are in the spatio-temporal system the spatial and temporal relations between specific events. These, too, can obviously be expressed as propositions as, for example, "The death of Socrates is a thing that happened before the death of Kant." When the temporal aspect of an event is not of especial interest the proposition will be a relation not between

[1] The verb *to be* when used as a copula in a proposition indicates absence of duality of denotation, or position, combined with presence of duality of internal nature, or connotation. Thus when we say, "Iron is useful" we call attention to the fact that the connotative duality of iron and useful is combined with denotative unity. (Cf. my article on The Meaning of Identity, etc., in *The J. of Phil., Psychol., etc.*, 3, 127.)

events but between 'enduring things or beings.' (An 'enduring thing' may be defined as a temporally continuous series of events which are more or less the same in quality and which do not at any one moment occupy discontinuous regions of space.) "Cæsar lived before Napoleon," or "Cæsar resembled Napoleon," would be examples of such propositions. Now the propositions so far considered all deal in one way or another with elements of the spatio-temporal system or with groups of these elements. They are what are usually called existential propositions. But there is another class of identity relations to be found in the spatio-temporal system, viz., relations between parts or aspects of different events. Now as all the qualities (including the generic spatial and temporal qualities themselves) which are exemplified at various times and places — may be exemplified equally well at other times and places, the relations of identity that hold between them will have a reality that is independent of any particular existence. These relations constitute our 'universal' and so-called 'non-existential' or 'merely valid' propositions. Examples of such propositions would be "Orange resembles yellow more than green"; "7 + 5 = 12"; "What is true of a class is true of each member of a class," etc. These relations are presupposed or implied by the spatio-temporal system of existent objects. So we can say that *the real universe consists of the space-time system of existents, together with all that is presupposed by that system.* And as every reality can be regarded as a true identity-complex or proposition, and as each proposition has one and only one contradictory, we may say that the remainder of the realm of subsistent objects must consist of the false propositions or unrealities, particular and universal, which contradict the true propositions comprising reality.

And now as to the definition of *belief* — I will say merely that it is the attitude we take toward any proposition that *appears* to be true or real, and that it carries with it a tendency to act on that proposition. But what it means for a proposition to 'appear' to be true, and how false propositions can appear true,

we shall have to consider in the later sections of our discussion.

3. *Objections to the Definitions. The Verbal Fallacy of Psychophysical Metonymy.* — An objection to this identification of the true and real now presents itself. True and false, it will be said, are adjectives which apply to beliefs, that is, to the acts or states of an individual. We do not call objects true or false; we call them real or unreal — beliefs alone are susceptible of truth and falsity. To which it may be replied that *true and false only apply to beliefs in a metonymous or borrowed sense, i.e.* in virtue of the relation of the act of believing to the object believed in. There would be no sense in calling an act of belief as such either true or false. It is always because of what is believed that the belief is true or false. Belief borrows its truth or falsity from its object or content. When we speak of a belief as true we mean that the thing believed is a fact, is real, is so, is true. Language is full of similar instances in which words that properly apply only to objects in a certain relation are used as if they applied to the relation itself. When we say — "What a fine sight!" we do not mean that the act of seeing or process of seeing is fine; and yet the word 'sight' to which the adjective 'fine' was applied does mean, primarily, the act of seeing. We have used it metonymously to indicate the *thing seen.* I call a neglect of this ambiguity the *verbal fallacy of psychophysical metonymy.* The ambiguous use of the word 'thought' offers another example of it. Thought means primarily the act of thinking, yet when we say, "A penny for your thoughts," we do not desire to know about the acts or processes of thinking that are taking place in our neighbor's organism, but about the things or objects of which he is thinking. As it is with 'thoughts,' 'sights,' and 'beliefs,' so it is with *judgments* which are the expressions or utterances of beliefs. Judgment, like belief, is originally a name for an act or process on the part of an individual; both words have come also to be used to denote *what* is believed and *what* is judged, *i.e.* the proposition or identity-complex asserted.

Truth and falsity never attach to judgments or beliefs in the first sense, but only in the second. In other words, they attach to propositions or objects, and not to judgments as acts. If the thing believed is a fact, the judgment expressing it is true; if not a fact, then the judgment is called false. But in case any doubt on this point still remains in the reader's mind, let me put this question: If we wished to know whether certain beliefs that we held about the properties of triangles were true or false, whom should we consult? The psychologist? Certainly not. We should go to the mathematician. But why? The psychologist is supposed to be an expert on mental processes, and if the adjectives true and false were to apply to beliefs as mental processes, he would be the one to settle our difficulties. We should go to the mathematician, however, because our desire to know whether our beliefs about triangles were true or false could be satisfied only by one who knew about triangles. So with all cases of doubt as to truth and falsity, we go to the person who knows about the things believed rather than to him who knows about the processes or acts of believing. That true and false apply to belief in the objective sense will appear still more clearly if we realize that there are many *other* adjectives that apply to belief in its subjective sense. If, for example, instead of being interested in the truth or falsity of a belief we were interested in whether it were comforting, inspiring, or healthy, then we should, very likely, go to the psychologist rather than to one who was an authority on the subject matter of the belief.

4. *First Consequence of the Verbal Fallacy of Psychophysical Metonymy.* — Besides obscuring the true meaning of the true and the false (as denoting the real and unreal respectively), this confusion of the subjective with the objective senses of such words as belief and judgment has had two consequences so important for the understanding, or rather misunderstanding, of the realistic position, that I wish to consider them even at the cost of digressing from our immediate issue.

The first of these consequences of the 'verbal fallacy of psycho-

physical metonymy,' is well illustrated by the principal Berkeleian argument for idealism. That argument, as I have elsewhere stated,[1] consists in a seemingly valid syllogism in *Barbara*, whose middle term 'idea' has, however, the same kind of ambiguity as the term belief. The argument may be expressed as follows: *Ideas are incapable of existing apart from a mind. Physical objects in so far as they are perceived or known at all are certainly 'ideas.' All physical objects are, therefore, incapable of existing apart from a mind.* Now this syllogism is formally valid, and each of the premises is materially true. Its conclusion has been accepted, albeit with reluctance and anger, by many generations of students of philosophy. The argument appears irrefutable until we notice that the middle term 'idea' is used in the major premise to denote the act or process of perceiving, while in the minor premise it is used to denote the object of that act, *i.e.* the thing or content that is perceived. Each of these uses of the term idea is familiar and justifiable in itself; it is only when they are identified with one another that the absurdity arises. Now a more modern and widespread form of this fallacy consists not in a play upon the word idea, but in a play upon the word 'experience.' Experience has a good concrete flavor and is much affected by empiricists. It is a term more comprehensive than idea, and less suggestive of the over-intellectualism of the eighteenth century psychology. It is regarded as such an ultimate sort of concept as to need no definition. It is self-luminous, and everything is to be defined in terms of it as constituting our ultimate universe of discourse. Disliking to lay hands on so popular a fetish, I must yet point out that, like belief, thought, and idea, the word experience, which means first and primarily an act or process which an organism performs or undergoes in becoming conscious of objects, has come by metonymy to be used also in a quite different sense, denoting not only the process or state of being conscious but the objects of which we are conscious. Now taken in this latter sense, we may say that no objects exist outside the world

[1] Program and First Platform of Six Realists, see Appendix.

of experience. For the only world that we can know or discuss is the world that we experience. But to say this is very different from saying that experience in the first sense, *i.e.* as a conscious *process*, is *a sine qua non* of real objects. If we allow ourselves to play fast and loose with the word, we get a theory which is in reality thoroughgoing subjectivism but which has the appearance of a sort of scientifically empirical compromise between realism and subjectivism. If we ask of those who use the word in this double sense for some statement as to what they have in mind when they say "experience," we may be told that experience is that which polarises itself into pairs of correlative and mutually reciprocal opposites, such as subject and object, physical and psychical, individual consciousness and social consciousness, knower and known; and that these terms and their relations are all within experience, and constituted by it as its functions. When we ask for some example of what this primordial stuff called experience is, we shall doubtless be referred to tables, chairs, stars, mountains, and such-like familiar objects. Suppose we ask further whether these pieces of so-called 'experience' are not what common sense means by 'things,' and whether the behavior of the things which we experience does not clearly indicate that they antedate and even condition our experience of them and are consequently quite capable of existing independently of such experience. We shall probably be told that the only things we can know are experienced things, that an experienced thing is in so far forth an experience and that, as you cannot of course have an experience which is not some sort of a conscious process, therefore objects cannot in any intelligible sense be believed or even imagined to exist apart from consciousness. We may then bring up various examples of 'external relations,' *i.e.* relations which are not necessary to the existence of the terms related. We may cite the relation of pointing, where it is quite clear that the thing pointed at does not in any way depend upon the fact that it stands in that relation, and then ask whether the experiencing or cognizing of an object may not be analogous to pointing; from which it would

follow that the thing experienced would not more depend on the experiencing of it than a thing pointed at depends on the pointing at it. To which we shall be told that there is no analogy between pointing and experiencing and that it is essentially absurd to distinguish between things known and the knowing of them. The situation amounts to this: the constant use of the one word *experience* to denote both an *experiencing* and an *experienced* has produced in the mind of the idealist a curious delusion that these things are connected, not merely verbally in his own mind but materially in nature, and in such a way that the objects that we experience can only exist at the moments when they are experienced. Thus the consequence of the verbal fallacy of psychophysical metonymy has been to create an atmosphere and a terminology that makes this experientialistic idealism seem not merely true but axiomatic — indeed almost a matter of verbal definition. Under such circumstances it is hard to get even an understanding of what realism is. It appears indeed to these experientialists so false as to be meaningless; and those who defend realism are actually charged with raising an issue that is artificial. The only type of realism that possesses any meaning in the eyes of the experientialists is the old Cartesian dualistic theory of a system of objects wholly outside and beyond the world of which we are conscious. But it is the distinguishing feature of the new realism to maintain the independent existence not of hypothetical objects which we do not experience, but of the very objects that we do experience. And the comprehension of this doctrine is impossible to any one who refuses to distinguish between a thing that is experienced and the experiencing of that thing.

5. *Second Consequence of the Verbal Fallacy of Psychophysical Metonymy.* — The second consequence of the verbal fallacy of psychophysical metonymy consists in a misconception of the 'laws of thought' and hence of the meaning and subject matter of formal logic.

A law is a relation between things that is true or real, if not at all moments, at least at more moments than one. These laws

differ in generality. Some laws hold of things only in so far as they are extended; other laws hold of all things in so far as they are quantitative, irrespective of their possessing extent. Finally, there are a few laws like the principles of non-contradiction, and excluded middle and the *dictum de omni*, that hold of all things alike, whatever their particular natures may be. These laws are sufficiently important and distinctive to be the concern of a special science — the science of logic. Now every law of things is a law of thought in the sense that thought about those things will be true or not according as it does or does not conform to their laws. And in this sense the laws of chemistry and botany are laws of thought. The laws studied in logic because of their absolute generality are presupposed by the more concrete laws. And as they hold good of every subject or topic to which thought can be directed they must be taken account of by all thought regardless of its more specific subject matter. It is only on account of this universality that they have come by their misleading name of "laws of thought." There is absolutely nothing psychological about them. They are in themselves as independent of our consciousness of them as the more concrete relations between the elements of physics.[1] And yet, it may be said, psychology does enter into every treatise on logic to some extent and in some way, and our conception of the purely objective and extra-mental nature of the subject matter of logic would seem not to allow for this. To which we may reply that psychology enters in the same purely subsidiary way into the proper learning and teaching of any other branch of knowledge. It is necessary not only to learn the laws pertaining to any group of things but to learn also the particular mental tendencies that aid or hinder our mastery of those laws. Just as the astronomer, in order to pursue effectively his study of the objective properties and laws of the stars, must have some knowledge of the technique of the telescope, the camera, and, finally, of the 'personal equation'

[1] For a more extended demonstration of the non-mental nature of the laws of logic, *cf.* Marvin, *supra*, 54 *seq.*

or peculiar features of his own mentality which are likely to distort his observations, so the logician, in order to understand and obey the objective laws of logical implication, must have some knowledge of the mental habits and tendencies which are likely to interfere with his conforming to those laws. In short, the psychological study of general types of fallacy is a necessary but purely subsidiary adjunct to logic, just as the psychological study of more special types of fallacy is a necessary adjunct to the chemist or the statistician. Logic, like every science, has its special psychology and its special pedagogy as parts of its technique. But to infer from this that logic is a mental science would be as wrong as to infer that astronomy was a branch of the science of optics.

6. *Summary.* — To sum up this first section of our discussion: I have tried to show (1) that truth and error are respectively the belief in what is real and the belief in what is unreal; (2) that by real, or true, is meant the totality of propositions comprising the spatial and temporal system of interrelated 'events' or 'elemental particulars,' together with all that may be presupposed or implied by this system; and that by unreal, or false, is meant the totality of propositions, which are contradictories of the above, and which comprise all the actual or possible objects of thought that neither have a place in the spatio-temporal system nor are implied by it; (3) that the objection to identifying the true and the real is based on the failure to realize that when true and false are used as adjectives modifying belief, the word belief is used in the physical or objective sense of 'thing believed' rather than in the psychical or subjective sense of 'believing'; (4) that this 'verbal fallacy of psychophysical metonymy,' which consists in the confused identification of the objective and subjective senses of such words as belief, thought, idea, experience, has resulted not only in the erroneous notion that the true is mental in its nature and different from the real, but in the formulation of a proof of idealism which, though seemingly axiomatic, is in reality grossly equivocal; (5) that as a further consequence of this fallacy of

metonymy there has arisen the false notion that logic is a branch of psychology, and that the 'laws of thought' relate to our thinking instead of to what we think about.

II

CAUSALITY AND CONSCIOUSNESS IN A WORLD OF PURE FACT

1. *Space, Time, and Quality as the Ultimates of Factual Analysis.* — We have now to discover the meaning and place of consciousness in the world of its objects, and to this end we must examine again and more closely the nature of that world. First of all, the world is a spatial system. Its groups of qualities are exemplified in a three-dimensional reversible manifold of positions, each of which is outside of every other. But secondly, this spatial system is not merely spatial, it is also temporal — each position 'extends' infinitely into the past and future. This temporal manifold, if for purposes of analysis we abstract from its asymmetrical or irreversible character, can be regarded quite as though it were a fourth dimension of space, and as each spatial position or point extends infinitely in time, so does each temporal position or instant extend infinitely in space. Looked at in this way the existent world can be characterized as a four-dimensional manifold of quality-groups, the units of which would be the qualities actualized in any one place at any one moment. It would be easy from this point of view to describe as functions of space, time, and quality various less fundamental concepts. For example,

(1) One quality-group, one space, one time = event.

(2) Same qualities, different spaces, or different times = qualitative identity; similarity; species; class.

(3) Different qualities, same space, same time = numerical identity; coinherence of attributes in one thing; 'isness.'

(4) Same qualities, in same space at continuously different times = duration; rest. (Russell.)

(5) Same qualities, in same space at discontinuously different times = succession, time interval.

(6) Qualities partly same, partly different, same space, different times = one thing undergoing change of state.

(7) Same or different qualities, same time, continuously different spaces = one extended thing.

(8) Same or different qualities, same time, discontinuously different spaces = plurality of extended things, distance.

(9) Same qualities, continuously different spaces, continuously different times = moving thing. (Russell.)

(10) Qualities that change with change of space and time relations = mere states; accidents.

(11) Qualities (if such there be) that remain unchanged through all change of space and time relations = ultimate elements of quality; permanent substances.

Now if the reader will overlook the schematic and incomplete character of this analysis, he will perhaps admit that it serves to describe fairly the world of sensible objects. So far as I can see there is no merely objective situation but what can be adequately described as some function or complex of our three ultimates — space, time, and quality. But there are two categories that we are accustomed to recognize in our world which we do not find in the system just portrayed. First, no place can be found in this system for 'causality,' *i.e.* for a thing *determining and being determined by* other things. And secondly, no place can be found for 'consciousness,' *i.e.* for a thing *cognizing and being cognized by* other things. The system before us is purely descriptive and purely objective and contains no trace of the productive or the subjective functions. That both causality and consciousness are real *in some sense*, none will deny. That an otherwise adequate description of the world which leaves one of them out should leave out the other also, is, as I shall try to show, profoundly significant of the relation between them. But before considering their relation, we had best consider them separately.

2. *The Antinomy of Causality — Substantist 'Thesis' and Positivist 'Antithesis.'* — We find as a matter of observation that there are a number of uniform connections between the event-elements

composing our spatio-temporal world. Each of these event-elements, it will be remembered, was defined as a quality-group occupying some one space at some one time. In the simple continua of space and time and in the dual continuum of space-time or motion these events were all *external* to one another and contingently related in the sense that there was no reason why any event should not be related in any one of these continua to any other event. And yet we find, with respect to any specific quality-group, that there are two other specific quality-groups that respectively precede and follow it, usually if not always; *e.g.* fire usually burns wood, water usually quenches fire. Now, as far as our space-time system goes, all sequences should be determined by chance, and the probability of wood-in-fire being followed by smoke-and-ashes would be at least no greater than the probability against it. In fact, as there are always fewer ways in which a complex can happen than in which it can fail to happen, the probability that any given sequence of events would *regularly recur* is indefinitely small. And yet sequences do regularly recur, and indeed the more we know of nature the more uniformities we discover. It is clear then that in our analysis of the existing world we have so far omitted to take account of a certain relation which is not spatial, temporal, spatio-temporal, or qualitative. It is the relation of determining and being determined by, of cause and effect. Each event-element has over and above its own qualities and its own position in space and time, something which implies or refers to other events. It is both an agent and a patient of what is not itself. Let us call this agent-patient property of a thing its potentiality or power. The simplest examples as well as the most useful of this category of power are to be found in connection with the atoms, ether, and energy of physical science. The ideal atoms or corpuscles of physics are things, all just alike, of little or no extent, that preserve whatever properties they may have unchanged from moment to moment of time and from point to point in space. The primary function of the atom would seem to be the power to give, receive, and maintain motion. The ideal ether of

physics would be one permanent medium of great or infinite extent, the primary function of which would seem to be the power to produce, receive, and transmit electro-magnetic oscillation. Energy could perhaps be defined as that power in moving atoms or ether which causes their motion to persist or at least to recur unchanged through time. The great achievement of modern science consists in the correlation of the various kinds of heterogeneous qualities and qualitative changes with the continuous and homogeneous relations and changes of relation between these perduring qualities or substances. The system of their space and time relations, functions as a common denominator to which the incommensurate qualities of matter and energy can all be reduced, and so compared one with another. It is consequently very natural that under such circumstances power should in some sense be ascribed to these all-important elements, but there are two fundamentally opposed methods of interpreting the nature of that power. These two methods or attitudes I will call the *positivistic* and the *substantistic.*

The positivist recognizes the value of attributing causal power to these substances when describing the actual world of qualities, but he says their sole reality as powers is methodological. They are 'useful fictions' or 'shorthand formulæ' by means of which we can describe, predict, and control the routine of qualitative changes in actual concrete objects. They are permanent possibilities of what is real, but they are not real themselves. They are, in short, merely subjective. To this the substantist replies that it is absurd to relegate to the status of methodological fictions the very powers in terms of whose activities the whole realm of qualities can be expressed. It is rather the manifestations or appearances of power which should be regarded as unreal or merely subjective, or as at best, mere 'epiphenomenal' states of the interacting substances. As to what further nature these substance-powers have and as to whether they differ in kind, the substantists differ from one another. Historically, there seem to be four main types or schools of substantism, which I will briefly enumerate:

(1) *Materialists* — Those who content themselves with postulating the existence of power only in the kind of substances useful in physical science, the atoms, ether, etc., of which we have been speaking.

(2) *Spiritualists* — Those who postulate the existence of power in certain obscure but perduring elements of self-consciousness which thereby become 'souls' or 'egos,' *i.e.* powers, which manifest their efficiencies primarily in the psychical and only secondarily in the physical quality-groups.

(3) *Dualists* — Those who attribute power to both kinds of substances — to those which interact in space to produce 'states' of matter and to other entities which act upon those of the first kind and perhaps upon one another to produce 'states' of mind and of spirit.

(4) *Energists* — Those who reduce their hypostatization of power to a minimum and merely affirm the existence of a *force* or *energy* associated with each momentary quality-group such that it tends regularly to produce a certain other quality-group as its effect.

To all four of these schools of substantist doctrine, we may imagine the positivist to reply in somewhat the following manner: "Your hypostatized powers differ from one another only in that some of them, such as the atomic, are useful methodologically, and others, such as the psychic, are not. Whether useful or useless, whether many and elaborately different, or whether reducible to one type, in any case you can say nothing about their specific nature, except in terms of their behavior or effects. The cause *is* nothing but the permanent possibility of its effects. The meaning of a power's *own nature* is nothing but the sum of its consequences. The 'cash value' of any kind of potentiality is the totality of its manifestations. Because it is methodologically useful to name a thing in terms of what is to follow from it, we must not delude ourselves into thinking that the potentiality of consequences is anything objectively real. Causal power is not a subtle property hidden behind the actual qualities of a thing; it is simply

a convenient expression for our expectation that the future consequences of a thing will resemble its past consequences. There is absolutely nothing *in* any one thing that determines, necessitates, or produces any other thing."

Apparently the only answer that the substantist can make to this presentation of the positivist position is to reiterate his statement that unless there were actually resident in each event something which determined or implied other events, the uniformities of nature would be miraculous and we should have no right to expect them. For to deny the objective reality of causal power would mean a purely chance distribution of events in their relation to one another. And as we have seen, if mere chance held good in the world, the probability of any sequence being regularly repeated would be infinitely small.

The situation amounts to this: As long as the substantist maintains that causal power or, more generally that the self-transcending implication resident in events is not merely subjective, his position is impregnable; while as long as the positivist maintains that this potentiality or implicative reference of an object can never be found among the *qualities* of that object, *his* position is impregnable. Let us leave our two opponents to continue a quarrel which, from the nature of the case, must be interminable, and turn to the consideration of the second defect in our spatio-temporal system of events — its failure to provide any place for consciousness.

3. *The Main Antinomy of Consciousness — Panhylist 'Antithesis' and Panpsychist 'Thesis.'* — There are two opposing ways of meeting the problem before us — neither of them satisfactory. One of them is called panpsychism, and the other I shall call panhylism.

The panhylist declares that the only things that are actually real are physical or objective things. What we call consciousness or the psychical is for him not a true existent, but either an epiphenomenon, a shadow or mirage that accompanies brain processes, or else a mere possibility of the concomitant variation

and 'togetherness' of events that are not together in any other sense. The first form of panhylism is dualistic, the second monistic. Their main agreement consists in a kind of psychophobia, a hatred of consciousness and a determination to drive it out of the world of real existence. The dualistic form of the doctrine tries, as we have said, to accomplish this derealization of the psychical by relegating it to the status of an epiphenomenon, or passive correlate of the cerebral events. And yet, were it such, it could neither sustain cognitive relations to the objects it appears to know, nor causal relations with the stimuli, sensory and motor with which it appears to interact. To say with this theory that the psychical is the 'other side' of the physical, or 'parallel' to it, is to use categories which by their definition apply only to relations between objects and not to the relation between objects and something that is not an object. It is only because of its supposed methodological necessity for physiological psychology that the view is tolerated at all. To accord any other than this epiphenomenal status to the psychical appears to violate the physical continuity and homogeneity of organic action and with it the doctrine of the conservation of energy.

But if the dualistic form of panhylism is bad, the monistic is worse. For according to it the psychical is not even a helpless epiphenomenon. It is simply a possibility that a living organism possesses of varying with, or behaving towards, certain objects at a distance from it in time and space. There are several varieties of this doctrine, no one of which appears to me very intelligible. The trouble with all of them is that they deny the existence of that which is more certainly real than anything else, viz., my awareness of objects. I have the experience, let us say, of perceiving a chair. I am, however, forbidden by the monistic form of panhylism to describe the experience in this way. I must not say it is a case of 'my perceiving a chair.' I must only say it is a case of 'chair.' But now my consciousness of chair cannot be merely a case of chair, for there was and will be a case of chair before and after my being conscious of chair.

Obviously there is a difference between my consciousness of objects and the mere objects, for my consciousness of them comes and goes according to conditions in my brain. But they do not depend on my brain processes. Moreover, if the consciousness of objects is just objects, how shall I deal with a case in which you perceive one thing occupying a given place in the spatio-temporal series and I perceive another and contradictory grouping of qualities in that same place and time? If two contradictory sets of qualities could occupy the same space at the same time, we should have no legitimate way of distinguishing between the real and the unreal. In the effort to get rid of the subjective we should have got rid of the objective.[1] Perhaps the panhylist at this point invokes the confused and vicious concept of 'true for me.' It is *true for me*, he will say, that the thing is round and *true for you* that the thing is square. The thing itself is both round and square. But even if we allowed the panhylist to fill his now thoroughly Protagorean world with round squares, and noisy silences, his notion of true for me and false for you would still not avail, for in that world there could be no 'me' and no 'you' for things to appear to, nor any meaning to the word 'appear.' There would exist nothing but a stew and welter of contradictions. In short, it is futile for panhylism to deny the reality of the psychical and to treat consciousness either with Huxley and Haeckel as an epiphenomenal shadow of physiological processes or with Hume as a mere possibility of relativistic and mutually incompatible fields of presentation.

A recent and very piquant form of monistic panhylism is the

[1] I regard the acute criticisms advanced by Professor A. O. Lovejoy (*J. of Phil., Psychol., etc.*, 8, 589, *seq.*) as perfectly valid *insofar* as they bear against the theory, apparently held by certain English realists, that hallucinatory objects exist in the spatio-temporal system. So far as I can see the only way to escape (without falling into either epistemological dualism or subjectivism) the 'ultra-realism' or 'monistic panhylism' which Lovejoy attributes to the New Realists, and which I have been attacking, is to adopt the theory of the genesis of error and the non-existent though objective *subsistence* of its objects, set forth in the third division of this study under the title of the Epistemological Triangle.

identification of consciousness with *behavior*.[1] The study of animal psychology has shown the uselessness of trying to guess what may be in an animal's consciousness, and the importance of concentrating on the study of the animal's behavior, which is something actually observable. Moreover, the students of human psychology have come to an increased realization of the importance of studying the behavior of man, not merely as a means of inferring what he is conscious of, but as something in itself profoundly significant of his real nature and character. A study of purely objective behavior does indeed in many cases afford a better insight into the nature of human faculty and the means of controlling and training it than could be yielded by any amount of mere introspection. Not content with developing this new and splendid branch of psychological inquiry as coördinate with the study of consciousness, there have been some investigators who, like Professor Singer, have allowed themselves to be so carried away with enthusiasm for it that they have proposed actually to identify consciousness itself with behavior. Against this latest form of monistic panhylism the following objections seem to me to hold valid: (1) Behavior is only one of many purely objective processes. We can be conscious of behavior as of anything else. But if behavior is itself consciousness, there seems nothing left in terms of which we can define the consciousness of behavior. In short, we have here the same sort of difficulty that confronts the crude materialist who would identify consciousness with motion. Motion has an actual qualitative nature of its own, which is obviously different from the nature of consciousness. (2) Behavior is always a movement or chain of movements in space either of the organism as a whole or of something in the organism, such as a neural current. As such it could at best only be correlated with the consciousness of bodily movements, and with what entered into them as their constituents. Now the square root of minus one is not a bodily movement nor does it

[1] (Cf. the paper entitled Mind as an Observable Object, by Professor E. A. Singer, Jr., *J. of Phil., Psychol., etc.*, 8, 180, *seq.*)

enter into such movement in any intelligible sense. I cannot move towards it or away from it. And the same is true of past events. I do not see in what sense my consciousness of such things as the life of Julius Cæsar can be identified with any specific behavior or movement of my body. (3) All that is visible or profitably observable as behavior relates to movements with which it is physiologically impossible for consciousness to be identified or even directly correlated. For physiology teaches us that consciousness depends upon, or is immediately and directly bound up with, neural currents which are always intra-organic, if not intra-cortical. Now what we observe as behavior in a man, a bird, or a rat, is never the flow of neural currents, but only the gross movements of the body and its members. These latter can by no possibility be the physical correlates of the consciousness involved. Still less can they be identical with it. (4) Finally, consciousness does at each moment of a train of conscious behavior have for its contents past incidents of the behavior that *are* no longer and future incidents that *are* not yet. But it is obvious that with respect to the behavior itself all its incidents are successive and so outside one another in time, the past and the future never being present together. Let us note finally that most of these arguments against identifying consciousness with behavior would apply with equal force against any attempt to define consciousness in terms of a physical movement, reaction, relation, or any objective process whatsoever.

Let us now consider the opposite theory of the relation of consciousness to the world of objects — the theory of panpsychism.[1] The panpsychist might be defined as an idealist with a scientist's conscience. He begins by recognizing the spatio-temporal order of physical events. He takes particular account of the facts of physiology. He observes that wherever and whenever certain

[1] Panpsychism really connotes two distinct theories: (1) the positive view that all matter has something psychical about it; (2) the negative view that all matter is nothing but psychical. With the first of these views I am in entire sympathy. It is only against the second or negative doctrine that I shall argue.

types of brain processes occur there is *reported* a consciousness of events other than those brain processes. His own brain he cannot observe, but his own consciousness he knows, and this leads him to his great discovery, that the actual or 'in itself' reality of the brain process is the consciousness associated with it. But if there is nothing except what is mental, why does everything appear as physical? In short, *why should the mind have a body if there is no body for it to have?* To this question he answers by saying that minds appear to one another as material; that matter is the form a mind takes when perceived externally by another mind. My brain exists as such only as a state of your mind, your brain exists as such only as a state of my mind. I will not consider in detail the various forms which this doctrine has taken. Leibniz, Schopenhauer, Clifford, Paulsen, Dr. Morton Prince, Professor C. A. Strong and, just recently, Dr. Durant Drake, have all presented theories which are essentially panpsychistic in that they treat every material element of the world as in itself mental, their materiality being nothing actual, but only the guise or disguise in which they appear to one another. Professor C. A. Strong has presented the view most plausibly in his book, "Why the Mind Has a Body"; and so far as I know, he is the only member of the school who recognizes the obligation to answer the question *why* in a world in which nothing is material everything should appear as material.[1]

I shall note briefly what appear to me to be the three principal objections to panpsychism.

(1) The view offers no explanation of one mind's consciousness of another mind as such. If every mind has to appear to another mind under the form of matter, how happens it that we all of us, and notably the pansychists, can think of, believe in, and talk about other minds as minds?

[1] Despite the fact that this question, picturesquely formulated, makes the title of Professor Strong's book, it is not in the book itself but in a paper published later that we should look to find his answer. Cf. *Archives de Psychologie*, Nov. 1904. And for my criticism of the argument there presented, cf. *J. of Phil., Psychol., etc.*, 2, 626.

(2) The view discriminates arbitrarily between the forms and qualities of the physical world. It denies the reality external to the knowing mind of the colors, sounds, densities, and shapes of the objects known, but it admits the independent and external reality of the space-characters of position and distance. Its elements of mind-stuff exist and operate not only in time but in a three-dimensional medium identifiable with the space of material objects. Why should the panpsychist reduce known matter and its qualities to the idealistic status of mere sensations of the knower, and yet allow the spatial and temporal properties fundamentally constitutive of that matter to go scot free and maintain a realistic status of independence of the knower?

(3) Panpsychism is what Spaulding calls a 'self-refuting system,' in that its conclusions contradict the premises from which they are derived. For the panpyschist at the beginning of his argument takes his stand firmly on the facts of physics and physiology, thereby proudly differentiating himself from the ordinary idealist. By appealing to these facts he demonstrates that the objects of which we are conscious and which seem to be real externally to us and independent of our knowing them, do in some sense vary concomitantly and immediately with our cerebral processes. They are, in short, only perceived by virtue of the ether and air vibrations which they project upon the organism and which in their turn produce nerve currents in the brain. On the basis of this he asks us to admit that the objects immediately known are not really external, but internal — identical with the cerebral processes of the knower. Very reluctantly and with a sense of bewilderment we may consent to admit this, violating our common sense out of our respect for the physical and physiological evidence which he has adduced. Then of a sudden the panpsychist makes a complete *volte face* and cooly informs us that the ether and air vibrations and the brain and its currents do not exist in themselves at all, but are mere appearances in consciousness. *My brain*, in which I have just consented to locate my entire objective world, turns out to be merely a group of actual or possible sensations *in*

your mind. Now it is bad enough to have to locate my world of objects in my brain considered as a thing actually existing and receiving effects; but it becomes preposterous to ask me to locate that world of my objects in what turns out to be not my own brain at all but another person's state of mind. What shall it profit a man to lose the whole world if he cannot gain, or retain, even his own brain, — the one reality for the sake of which he had made the sacrifice? Moreover, the whole physical and physiological mechanism, on the validity of which the panpsychist argument was based, assumes a most anomalous position when once the panpsychist conclusion is attained. For in place of a world of bodies sending forth vibrations to one another, we must now assume a world of naked consciousnesses which interact in an utterly incomprehensible telepathic manner, the resulting content of each being the unreal appearances of the others. The best possible status that we could accord to physical processes in such a world would be to describe them either as permanent possibilities of sensation or as the epiphenomenal or shadow accompaniments of mysterious psychical interactions. Yet, once more, it was only by assuming that these same permanent possibilities or epiphenomenal shadows were not mere possibilities or shadows at all, but a real material world, that the argument could get under way. I do not wish to offend, but the whole procedure of the panpsychist in invoking physiological facts to prove the unreality of the physical is comparable to that of the man who climbs upon the shoulders of a friend only in order that he may stamp upon his head.

Panhylism and panpsychism have proved themselves equally futile in that they each degrade one aspect of things to a mere possibility or shadow of the other. Yet, they are, after all, honest attempts to explain the known in terms of the known; and bad as they are they are far better than the dualism and agnostic monism which are their only rivals. An agnostic monism which defines the physical and psychical as the miraculously parallel attributes or manifestation of a substance or power whose nature

is otherwise indefinable, solves no problems, either scientific or metaphysical. What the substance is, why it is manifested as other than what it is, and how its attributes are related as they are — to these questions it makes no answer. To explain the two realities that we partly know, it asks us to postulate a thing of which we can know nothing. As for a dualism of the ordinary kind which regards the world as made up of two ultimately separate and perfectly heterogeneous entities, — objects and consciousness — it not only offers no explanation of their interaction, but by its very terms it makes of such interaction something that is miraculous, if not impossible.

4. *A Supplementary Antinomy of Consciousness. Are perceived Objects inside or outside the Brain?* — The world in which we began our quest for consciousness, was a world which contained nothing but events or quality-groups partly similar and partly different, each group occupying its own spatio-temporal position and related spatio-temporally to other groups continuous or discontinuous with it. The objects of this world were all as external to one another as are the points in space and the moments in time. Now what we denote as consciousness is *prima facie* repugnant to such a system precisely because whatever else consciousness may be it is the condition by which objects at a distance from one another in space or time or both may be in some sense 'present to' or 'in' or 'together with' one another. To illustrate, I here and now am 'perceptually' or 'immediately' conscious of a noise that occurred two or three seconds ago, and of a color two or three feet away; and I am 'conceptually' or 'mediately' conscious of Julius Cæsar in ancient Rome and of the baby Emperor in Pekin. And here I wish (by way of taking account of a supplementary antinomy of consciousness) to call attention to four factors in this situation, two of which make it necessary to regard these apprehended objects as in me here and now, and two which make it necessary to regard them as outside of me here and now.

(1) The objects of which I am conscious are in some sense di-

rectly effecting changes in me. They produce feelings of doubt as to their appropriateness as illustrations; they make me perceive and think of other objects more or less related to them which would scarcely have come to me except for them; they influence the particular movements of my hand as I write of them.

(2) I have every reason to believe both from my experience of dreams and imaginings, and also from what I learn from physiological psychology that '*what objects*' I shall perceive or conceive depends primarily and directly not upon the existence and activity of those objects, but rather upon the existence and activity of my brain. If the skull could be laid open and if by artificial stimulation there could be produced in the brain and nervous system the same processes — periodic waves, vibrations, stresses, or what not — that are ordinarily produced by the energies that proceed from extra-organic objects, then those objects would be apprehended quite irrespective of whether they existed or not. For these two reasons it would certainly seem as though the things of which I am conscious, but which appear as being at other times and places, are nevertheless in me or in my nervous system here and now. Yet (3) the things of which I am aware — such things at least as I have chosen for the illustration — cannot be within my brain because their immediate and incontrovertible intent is otherwise. A color two or three feet away from my organism is not in my organism. The occurrence of a noise two or three moments ago is not the occurrence of anything now at this moment. The emperors of Rome and of China are not nervous processes of a person in New York. To regard the things as inside me, which by definition are outside of me, would be flatly self-contradictory. (4) Moreover, all this aside, there is a second reason that makes it impossible to identify the things known with the processes occurring here and now by virtue of which I know them. If you could look into my brain and see (and hear and touch) everything that was actually there at a given moment, you could not find there the things mentioned of which I was aware at that moment. You might find, and, indeed, I believe you

would find, visual and auditory simulacra of the things known, 'specifically qualified energies' streaming through the sensory central and motor paths of the nervous system which would resemble more or less closely (according to the transparent or distorting properties of the media through which they had passed) the specific qualities of the extra-organic objects from which they proceeded.[1] But these cerebral effects, however closely they might resemble the objects known, and in spite of the fact that they are in some cases the effects of those objects, and in all cases the immediate determinants of our knowing them, could not possibly be the known objects themselves. If this followed from nothing else it would follow from the fact that the parts of space and time are mutually exclusive or external, and that the objects perceived occupy spaces and times other than the spaces and times of the brain process by which they are perceived. Here is certainly a strange dilemma. Two factors in the situation seem to make it necessary to regard the field of consciousness as 'in' the brain and two other factors seem to make it necessary to regard that field as not in the brain.

5. *Consciousness and Causality. Hylopsychism as the Reciprocal Solution of the Antinomies.* — In perplexity one naturally casts about for analogies. Is there anything other than consciousness that exemplifies the paradox of events in one space and time being somehow in another space and time? Yes. There is the case of the causality relation. In considering that we found ourselves confronted with the same absurd situation in which an event in one place and time seemed to belong to or be determined by a different event in another place and time. There were, we may remember, two ways of viewing this causality paradox: first the way of the substantist who insisted that the self-transcending implications or potentialities of events

[1] The evidence adduced by Holt in his criticism of the doctrine of specific energies would seem to show that that very essential property of stimuli — their periodicity — suffers little or no change in the passage from the merely physical to the physiological medium. Cf. *infra*, 325 ff.

were actually real in themselves over and above their specific natures, and second the way of the positivist who insisted that these potentialities were *mere* potentialities, nothing actually real in themselves, but only our expectations that events would happen in the future as they had in the past. When the substantist was asked to tell *what* the potentiality actually was he could give no answer, and when the positivist was asked to explain how a *mere* potentiality or subjective expectation could explain nature's routines and uniformities which in a system devoid of real causality and implication would be infinitely improbable, *he* could give no answer. And, as we have seen, the quarrel between the panhylist and the panpsychist is as interminable as that between the positivist and the substantist. The only essential difference between the two quarrels would seem to be that substantist and positivist refuted one another, whereas panhylism and panpsychism seemed capable only of refuting themselves. The truth is that the attempt to find a place for causality in a world of pure facts leads to one kind of antinomy and the attempt to find a place for consciousness in that world leads to another. The last chance of attacking the problem successfully would seem to lie in the possibility that these antinomies if matched against each other might, like the two equally unintelligible halves of a picture puzzle, dovetail together and reveal a clear and harmonious whole. Let us try this. The substantist declared that a cause-effect implication resided in each event, but the positivist has shown that such potentiality could not be any new kind of quality. *Suppose that this cause-effect potentiality, which from the objective point of view can only be defined indirectly as a possibility of other events, were in itself and actually the* CONSCIOUSNESS *of those other events.* Then causal potentiality would have been made actual or real as the substantist has proved it must be, while the positivist could still maintain that this potentiality was not any new and illegitimate type of object. The essential claim of each party to the quarrel would have been vindicated, but in such a way as not to conflict with

the claim of the other. As to the second quarrel — that between the panhylist and panpsychist — an equally satisfactory result would have been reached. The panhylist could still maintain that consciousness could be defined as the possibility of the objects constituting its *field* and that as such it was not another real object existing along with the objects revealed by it — while, on the other hand, the panpsychist could claim that consciousness was so fundamentally and immediately real that objects themselves could be defined as permanent possibilities of perception. In short, the *positive* claims of each party would have been satisfied, and only the negative claims, which alone had brought about the conflict, would have been rejected. Thus, the panhylist could no longer say that consciousness was *nothing but* the possibility of objects or *nothing but* an epiphenomenal correlate of the brain process, for consciousness would have been made actually real though in such a way as not to duplicate or interfere with the continuity of physiological processes. And the panpsychist, for his part, could no longer say that physical objects were *nothing but* appearances in consciousness, for a way would have been found for the physical to appear in consciousness without prejudice to its intrinsic reality as physical. Finally, as for the 'supplementary antinomy' which turned on the reasons for and against locating the objects of which we are conscious in the brain processes which determine that consciousness, the matter would have been cleared up in a manner equally satisfactory. For we can say that with respect to their actual objective or physical being the events that compose the world are as external to one another as the spaces and times which they occupy, and in particular that the events known are outside the brain events by which they are known; while with respect to their potential, subjective or psychical being the events that compose the world are, in so far as they are all causally related, *internal* to one another in the sense that any or all might be present in each, and that in particular the events known are 'inside' the brain events that know them, though only as the latter's potentialities or implications. In short, the

relation between the brain-event and the object it knows would be analogous to the relation of a word and its meaning. The meaning is 'in' the word and yet the thing meant may be something wholly outside of and different from the word.

This is, I believe, the true theory of the nature of consciousness and of its relation to the objective world which it reveals and in which it abides, and because I believe so firmly in the truth of the theory I wish to give it a name that will both distinguish it from other solutions of the same problem and also show its peculiar relation to those solutions. I will call it "Hylopsychism" after the analogy of hylozoism — to indicate the especial synthesis which it purports to effect between a hylistic or materialistic account of things and a psychistic or (ontologically) idealistic account. By hylopsychism then, I mean the theory that — *The potentiality of the physical is the actuality of the psychical and the potentiality of the psychical is the actuality of the physical.* Or, to put it in the form of a definition of consciousness: *Consciousness is the potential or implicative presence of a thing at a space or time in which that thing is not actually present.* That there is much in this formulation that is in need of further elucidation and proof I am, of course, keenly aware. And there are several rather palpable objections that must be considered. The arguments thus far advanced have been mainly indirect — attempts to prove what consciousness is by eliminating the various things which it is not. That this indirect evidence needs to be supplemented by evidence that is direct, I admit, and I believe there is an astonishing amount of such evidence to be found by any one who is willing to look for it. Some small part of it I shall try to bring out in what follows.

6. *The Three 'Directions' of a Potentiality.* — Each event is (1) an effect of earlier events, (2) a cause of later events, (3) in reciprocal interaction with the contemporaneous events externally continuous with it in tri-dimensional space, which means that each event *faces* in three ways — backward into the past, forward into the future, and outward into space. If we were right

in identifying consciousness with the cause-effect potentiality or self-transcending implication functionally resident in events, then we should expect to find the above-mentioned triplicity of direction instanced in consciousness; and of course that is just what we do find in what are called memory, expectation, and external perception. Consciousness does at each indivisible instant of its existence possess in greater or less degree a retrospect of the past, a prospect of the future, and a perspective view of external presence.

7. *A Certain Difficulty in Terminology.* — The foregoing analysis seems to afford a suitable opportunity to explain a certain looseness or ambiguity which the reader may have noticed in my use of the words 'implication' and 'potentiality.' I have used these words as though they were synonyms, gliding unscrupulously from one to the other as best suited my purpose. But this is, I believe, more the fault of the terminology at my disposal than of the thought itself. The fact is, 'potentiality' expresses one aspect of my meaning and implication the other, and each is by itself inadequate. There is no one recognized word for the threefold self-transcendent *reference* of events to their causes, effects, and interacting contemporaries. The word 'reference' is itself defective in that it seems to beg the notion of consciousness which I am trying to define. 'Potentiality' is bad because it is too narrow, meaning primarily simply the reference of a cause to its future effect, and never, or hardly ever, the equally self-transcending reference of effects to their causes. The word 'implication' suffers from the opposite defect to that of 'potentiality,' being too broad. It can be used equally well to designate the reference of an event to its cause and to its effect, but it is also used to designate the apprehended references of objects to one another in a field of consciousness, and again to designate the relation of the premises of an argument to its conclusion. Now, needless to say, I do not mean to identify consciousness with implication in either of these latter senses. A glass of water can suggest to me the quenching of my thirst, without being

itself conscious of the use that I can put it to; and the major and minor premises are as little conscious of the conclusion they imply. In these cases the implicative relation holds between complexes of events and not between the simple events themselves. Water only implies thirst-quenching extrinsically as part of a complex composed of instincts and memories; and again, the premise or premises only imply their conclusion in virtue of their membership in complexes that are more or less elaborate. These logical implications of inference always obtain between relations, aspects or complexes of event-elements and not concretely intrinsically and synthetically between the simple events themselves. Because of these terminological difficulties I must ask the favor of being allowed to continue to use (as an equivalent of the cognitive function) the word 'implication' in the artificially narrow sense in which it applies to the cause-effect relation, and the word 'potentiality' in an artificially broadened sense to denote the backward reference of an event to its cause as well as the forward reference of a cause to its effects.

8. *The Three Levels of Potentiality.* — Hylozoism is the theory that all matter is instinct with life. By hylopsychism I wish to denote the theory that all matter is instinct with something of the cognitive function; that every objective event has that self-transcending implication of other events which when it occurs on the scale that it does in our brain processes we call consciousness. Now the reader will naturally take fright at the idea of postulating anything like a human consciousness in the movements of dead matter. And I hasten to say that the theory that I am advocating will in no way obliterate the pragmatic differences between the mechanical, the physiological, and the mental. Science has fought hard and long to free her explanations from the incubus of teleology and to gain the right to treat nature as a spatio-temporal mechanism; and there would be a strong presumption against any theory which would conflict with the depersonalized austerities of physical law. And yet along with the conquering advance of the mechanistic idea

has come an increasing sense of the continuity of all natural processes — from the blind movements of an atom to the far-seeing actions of man. Our enterprise must be to find a place for teleology in nature, not as a substitute for spatio-temporal change, but rather as a special and higher type of such change.

There are in nature at least three fundamentally distinct types of causal process, the mechanical, the vital, and the sensory. In the mechanical process, the dominant characteristic is spatio-temporal change. The position of a body at a given moment implies and is implied by its own or another body's position at another moment, and its 'consciousness' would be of that and only that. It would have a purely spatio-temporal content. In the vital process, however, the dominant characteristic is change of organic form and chemical pattern rather than mere change of place. A living organism at each moment of its life contains as its potentiality or implication organic forms that it has had and will have, together with the potentiality or capacity of assimilating or adapting to the chemical pattern of its own tissues the appropriate matter which as food may come within its system. Its potentiality expresses itself in inheriting, developing, and assimilating; and its 'consciousness' would have for its content organic forms or chemical patterns which it had undergone and was about to undergo.

In the sensory process which constitutes our consciousness the implications are neither of mere notion nor of inherited metabolisms, but of specific qualities of the objects outside our organism and causally related to it. That is to say, the nervous system grows up within the organism as an apparatus for transmitting energy-forms from one part of the organism to another and so from the things outside to the brain inside. Most of the cerebral energy thus produced is continuously passing over into motor currents initiating behavior, but an infinitesimal part is dammed up, or stored in the cortex. The continuous currents contain the immediate moment to moment consciousness of sensations and feelings, while the part that is stored up as potential energy has

for its implications at each moment the system of extra-organic objects occupying other times and places; thus it is the principal function of the brain to receive and retain in something of their separate specificities the energies that have come from distant objects; and it is the self-transcending implications of these brain-states that constitute our consciousness of the spatio-temporal world in which we live.

We might, indeed, compare the sensory mechanism of the nervous system with the merely vital mechanism of protoplasm in general somewhat as follows: Protoplasm is an apparatus for ingesting, digesting, reproducing, and excreting matter and the chemical energies associated with matter. The nervous system, on the other hand, takes its energy neat. *And in perceiving, remembering, imagining, and reacting it is respectively ingesting, digesting, reproducing, and excreting those free energies dissociated from matter which in the form of vibrations of various kinds have proceeded from distant objects through the sensory channels to the brain, where they constitute by their implications a consciousness of those objects and make possible an intelligent and purposive adjustment to an environment extending in time and space immeasurably beyond the field of mere chemical and mechanical contacts.* All this, of course, is very light handling of important and intricate matters. But it may suffice as a hint of how the theory of hylopsychism could meet the criticism that by its identifying consciousness with causal implication it had unduly minimised the differences between mechanical, vital, and rational processes. The three grades of potentiality here discussed retain all their characteristic distinctions. We have neither anthropomorphized the laws of physics nor reduced to a blind and mechanical process the activities of the human spirit.

9. *Summary.* — The main purpose of this second division of our discussion has now been accomplished. Our definitions of truth and error as the consciousness of the real and the unreal forced upon us an ontological excursus or metaphysical inquiry into the nature of mind and its relation to the world of its objects. The analysis

of the existing world in terms of space, time, and quality brought us face to face with the antinomies of causality and consciousness. As a joint solution of the two seemingly insoluble problems presented by those antinomies the theory of hylopsychism was propounded. The last sections of the chapter have been devoted to an exposition and defense of that theory and to a brief account of its bearing on the psychophysical and the biophysical problems. We are now free to return to the more directly epistemological question of the nature of truth and error.

III

THE GENESIS OF TRUTH AND ERROR

1. *The Epistemological Triangle.* — Physical objects send forth waves of energy in various directions and of various kinds, but all in some measure characteristic of the objects from which they proceed. These energies impinge upon the organism, and the sensory end-organs and the nerve fibers then transmit to the brain the kinds of energy to which they are severally adjusted or attuned. The final effect is the resultant of these sensory energies modified by the reaction of the brain. This complex cerebral state is something quite physical and objective — as much so as the extra-organic object which is its partial cause. It is a natural event with its own qualities and its own position in the space and time order. As such it possesses the threefold self-transcending implication or cause-effect potentiality which we have seen to be the property of every natural event, and which we have declared to constitute in itself that event's consciousness of other events. The cerebral state, whether initiated from within the organism, as in spontaneous thought and in hallucination, or whether initiated from without as in perception, will be conscious of such objects as it implies or of which it is the potentiality. What will these implicates or objects be? My answer is that *they will consist of the events which would most simply have caused the cerebral state and of the*

events which the latter would produce as effects if it acted alone and uninterfered with. Now we know that if we single out some one event and inquire as to its cause, that we shall find a plurality of possible antecedents, any one of which if it had not been counteracted would have produced it. This is the principle of "the plurality of causes." It follows from this that the implicate, or conscious object of any brain state may be, but need not be, an event which actually exists. When the implied possible cause actually exists, then there will be consciousness of a reality which, as we have seen, constitutes true knowledge or *truth;* when, on the other hand, the cerebral implicate which is the simplest or most natural of the possible causes happens not to have been the actual cause, or happens not to exist, then we shall have apprehension of what is unreal, which is false knowledge, or *error.* The brain event is the 'knower' and what it implies is the 'known.' Perry[1] has amply shown that the implied is not dependent on the implier, and hence the fact that the brain event implies its actual or possible cause as the object in consciousness does not mean that the latter in any way depends on the former. Even when we consider the case of the forward-facing, or prospective implication, the object will not of necessity depend upon the knowing (or expecting) it. For just as there may be more than one cause capable of producing an effect, so there may be more than one effect produced by a given cause. And because an earlier event is the potentiality of a later event, it does not follow that it will inevitably produce it. This statement, however, may seem to require some defense. It may be said that if A is truly a cause of B then whenever A exists B must exist. Now, of course, the word cause can be defined to mean whatever events the occurrence of which universally determine the existence of a later event called the effect. And this is, I admit, the ordinary conception of cause in philosophy. But it is not the common sense conception of cause. According to common sense the cause is not something that necessarily produces its effect, but only something that *tends* to produce its

[1] Cf. *supra*, 112.

effect. The fact that the strict or philosophic conception of cause does not allow for and even renders impossible and meaningless the notion of the counteraction of a cause is in itself sufficient to decide against that conception. If *A* could only be called the cause of *B* when it was the universal antecedent of *B*, then it could by definition never be counteracted. And yet, we often speak of a cause being prevented from realizing its effect; and I shall therefore accept the lesser meaning for the word cause as that which tends to produce and if unhindered would produce its effect. Taking the matter in this way we can see that the implicates or objects of an existing brain-state, whether those implicates are its causes, its effects, or the contemporaneous and reciprocal combination of the two, do not themselves certainly exist, but only probably. Or to state the same truth in another way: The consciousness that an event has happened or will happen in the past or future carries with it not the certainty, but only the probability that the event has actually happened or will actually happen. But while the probable truth of the past event which we are conscious of as having occurred is not in any sense dependent upon our will, yet the probability of the actual occurrence of a future event which we expect does often depend on the amount of voluntary effort expended by ourselves or others. That is to say, a potentiality will bring about its own future actualization only when unimpeded. If there are other rival tendencies at work, it will be necessary to counteract them by use of the will.

Perhaps I can best sum up this account of the genesis of the consciousness of real and unreal objects by symbolizing the three elements involved. We have (1) the actually existing external object which I will call *Oe*; (2) the cerebral state itself which may be denoted *Oc*; (3) the object perceived or apprehended, *Op*. In the simplest case, *Oe* will be the cause of *Oc* and in every case *Op* will be the implicate of *Oc*. These are the three corners of the epistemological triangle. We might compare them in their relations to a luminous object, *Oe*, its impress upon the surface of a mirror, *Oc*, and the virtual image seen behind or

through the mirror, *Op*. Now, sometimes the virtual image may be identical with the luminous object, both in quality and in position, as when, for example, a luminous object is placed behind a mirror and then by means of a larger secondary mirror with an appropriate curvature of surface behind the observer the light from the object is reflected back into the surface of the first mirror. A virtual image of the luminous object will then appear having the same qualities and the same position as the object itself. In the same way, the object *Op* revealed or implied in the brain-state *Oc* may be exactly identical in position and quality with the actually existing external object, *Oe*, or on the other hand it may not. In the former case the object is apprehended as it is, in the latter case as it is not.[1]

2. *The Two Kinds of Truth and Error.* — If truth and error are generated in the manner symbolized in the 'epistemological triangle,' it follows that there will be two ways in which each may arise. In the case of *truth*, in which the real event *Oe* is identical with the perceived event *Op*, the result may be due (1) to the fact that the medium through which the energy has been carried from the external object to the brain has not altered the character of that energy, in which case the cerebral event *Oc* will be the same in quality as *Oe* and the local and temporal signs of the former will be of such a kind as to imply the real time and place of *Oe*; or (2) the medium between *Oe* and *Oc* may have qualitatively, temporally, and spatially distorted or modified the energy proceeding from *Oe*, but the brain through inherited capacities or through memory-traces will have neutralized and corrected this distortion so as to make the ultimate determining brain-state *Oc* so congruent spatio-tempo-

[1] The reader must guard against a possible misinterpretation of the simile of the triangle which I have used to illustrate the process of perception. No two vertices of a triangle are ever numerically identical, whereas we have seen that in so far as perception is true the perceived object and the real object are identical. *Oc* is the effect-function of *Oe*, and *Op* is the implicate-function of *Oc*. And just as any given n^{th} root of a^n may or may not happen to be a itself, so the implicate *Op* of the effect *Oc* may or may not happen to be the actual cause *Oe*.

rally and qualitatively with *Oe* as to make it implicative of it. This second kind of truth is, I think, the more frequent type, especially in the case of the perception of external objects. In vision, for example, the retinal image is notably different from the real object, in being dualized, in being inverted, and in being otherwise distorted, and yet whether instinctively (as the nativists would hold) or by past experience (as the associationists would say) the brain succeeds in neutralizing these distortions and giving a perceived object which is often more truly identical with the real object in all its attributes than a single effect even if wholly undistorted could have revealed. Take for example the case of the square table perceived as square. The retinal images are rhomboidal and the first cerebral effects are probably proportionately uncharacteristic of the external cause, but, repeated experience has served to generate a condition in the brain (purely physical but otherwise analogous to the 'apperception mass') made up of traces of the various visual impresses and the motor attitudes excited by them, which complex condition is implicative of the true form and position of the table. The cerebral implication may in short be either of the direct immediate sensory type or of the indirect mediate and apperceptional type. Probably the only case in which the first or sensory kind of truth occurs is in what is called the 'consciousness of our own states'; that is, the consciousness at each moment of the brain processes and implications of the just preceding moment. In this way and in this way only can we be conscious of consciousness or self-conscious. The brain-state of a given moment is never conscious of itself as object, but it can be conscious not only of extra-organic objects, but also of the brain-states just preceding it. And in this intra-organic consciousness, where the self-transcending implication 'reaches' only to the next moment, there would seem to be no chance for error. In other words, the general impression that we can be more certain of our own thoughts and feelings than of anything else would seem to be well-founded.

Before going on to consider the corresponding types of error,

it would be well to consider briefly the difference between an inferred or conceived object and one that is perceived or directly apprehended. I believe that the distinguishing characteristic of indirect or conceptual consciousness is *the spatial and temporal discontinuity of the apprehended object and the organism.* When we perceive an object we are conscious not merely of it but of the space and time which intervenes between it and ourselves. This brings with it a motor attitude and a tendency to immediately react, which constitutes our reality-feeling. In the case of the conceived imagined or inferred object there is no accompanying consciousness of the intervening space and time connecting it with our body, and consequently no such definite immediate machinery of motor adjustment is set up.[1]

Let us now consider the two kinds of error. We can deal very briefly with them. They both result, as we have seen, from a distortion of the real object in producing its effect on the brain. The distortion may be (1) physical or peripherally physiological, in which case we have the so-called sensory illusions, or (2) it may be central, due to the cerebral apperception mass, in which case we have the error of inference. Of course we may have both kinds of error together. And moreover, between the two kinds there is no hard and fast distinction. You can say if you like that "the senses never lie" and that even the so-called perceptual illusions are illusions of inference. But this amounts to nothing because it will immediately be necessary to add that the element of inference is present in all perception, and that a sensation that contains no content beyond the moment, or no element of self-transcendency and no tendency to action, is an unreal figment of the psychologist's imagination. The distinction between perception and inference is a valuable one, but not of such a character as to rob perception of its own kind of self-transcending reference. When a child clutches at and misses the stick which he perceives as bent in the water, he does not *infer* from an internal

[1] Cf. J. McK. Cattell, in Essays Philosophical and Psychological in Honor of William James, 569.

sensation or image of a bent stick to a bent stick existing outside him. But rather, the image of the bent stick which is cast upon his retina (as it would be cast upon a photographic plate) produces a purely physical brain-state which directly 'implies,' or has for its 'meaning' or 'potentiality' an external bent stick. The implicate of the brain-state, however, happens in this case not to exist, and therein consists the error. The other type of error results when the deliberate inference made from a correctly perceived object to another object not perceived, is incorrect, in that the object normally implied by the situation happens not to exist.

The two kinds of truth and error which we have been considering might be summed up and classified with reference to the place in which the stimulus is distorted or corrected as follows:

(1) Absence of physical or peripheral physiological distortion combined with absence of cerebral distortion = immediate or sensory truth, as exemplified in feeling and introspection.

(2) Physical or peripheral physiological distortion, corrected by cerebral and apperceptive reaction = mediated truth, as exemplified perceptually in the apprehension of a square surface as square, and conceptually or inferentially in the knowledge that a thing is not what it appears to be.

(3) Physical or peripheral physiological distortion without any corrective counter-distortion by the brain = immediate or sensory errors and illusions and, when initiated from within the organism, hallucinations.

(4) Cerebral or apperceptive distortion combined with absence of physical or peripheral physiological distortion = mediate errors of conception and inference, which when persistent, constitute the delusions of insanity.

3. *Attention and Belief.* — Why is the brain not conscious at each moment of all the implicates or potentialities of the sensory-motor currents and traces of currents which it contains? or why is the mind not always aware of its entire stock of knowledge? And, again, why are we always *more* aware, or more keenly conscious of certain objects than of others? I believe that our conception of

consciousness makes possible a comparatively simple answer to these questions. The motions and stresses in the cortex in so far as they are in interaction must form a single system and set up a condition analogous to that of a single body acted upon by many diverse and opposing forces. A body in such a situation has at each moment a dominant tendency to move in the direction of the *resultant* of the forces acting upon it. The intensity of this dominant tendency or controlling bias will vary with two factors: (1) the absolute total intensities of the forces; (2) the degree of unity of direction of the forces relatively to one another. Now we shall not need to commit ourselves to any elaborate system of psychodynamics to recognize that attention is 'absorbed,' or 'drawn,' in a given direction not only by the intensity of sensation, but also by the extent to which there is absence of rivalry. There is both an absolute and a relativistic factor in the situation. Now the objects that we are conscious of at any given moment will be the implicates of the *resultant* of cortical forces acting together. And just as a body cannot move in both a northerly and southerly direction at once, so for the same reason it will be necessary for some of the cortical tendencies to be absolutely counteracted, or eclipsed by the others. This would, I think, explain why a large part of what is 'in the mind' must be extruded absolutely from the consciousness of any one moment. But while one cortical tendency may completely suppress another, it may also only fuse with it, dominating it not absolutely, but only partially, and then we should have the implicate of the dominant tendency as the central and most prominent object in the field of attention with implicates of the lesser but not absolutely counteracted tendencies figuring as objects in the more marginal parts of that field. And from this it would follow that except in unified and systematized complexes, the intensity of attention would vary inversely with its extensity. The mechanical analogy of the forces acting upon a body is imperfect, mainly because it applies merely to movement in tridimensional space, whereas in the field of cortical forces we have not merely tendencies to movement, but all sorts of tenden-

cies correlated with the higher derivatives of space with regard to time. And the field of implicates or objects of consciousness constitutes as it were a multidimensional manifold incomparably richer than the mere system of space and time relations.

And now as to *belief:* it seems probable that the primary condition of consciousness is a condition of acceptance of cerebral implicates or conscious contents at their face value as real and as bases for action. Disbelief and doubt are sophisticated or secondary attitudes which we take towards a content only when it is contradicted by another content or by the system as a whole. A person believes a thing or accepts it as real and tends to act on it just in so far as there is no content present which suggests actually or hypothetically a counteraction. In hypnotism we seem to have a case in which the ordinary associations are cut off and there is nothing to inhibit action in accordance with what is suggested. The mind thus relapses to its primary naïve attitude of belief in the reality of all its objects. But the field of belief at any one moment will normally be much narrower than the field of attention at that moment, for the same reason as that which makes it possible for a body to tend to move in several directions so long as they are not actually opposite, but prevents it from actually moving in more than one direction. So we may entertain and compare a number of contradictory proposals without contradiction, but we could not believe them all for the action based on any one of them would contradict or preclude action based on any other.

4. *The Material Fallacy of Psychophysical Metonymy.*— In the first division of our essay we discussed the fallacy of identifying the thing experienced with the experiencing of it, simply on the ground that by metonymy, the same word 'experience' was used to denote both the psychical act and the physical object of that act. And we found that the two consequences of that fallacy were first, a false but seemingly axiomatic proof of idealism and second, a false conception of the nature of logic and the laws of thought. Now there is a somewhat similar fallacy with similar

consequences which is based upon a misconception of the relation of consciousness to its objects. But this fallacy is not verbal, but material. We can state it briefly as follows: *Which objects I shall at any moment be conscious of depends upon my own processes and states,* therefore *the objects of which I am conscious depend upon my own states and consequently cannot be real apart from them.* This argument, like the one considered before would, if it proved anything, prove too much, for it would mean that other minds, as well as physical objects, would depend upon being known. But we may waive this point and content ourselves with a direct refutation of the argument. It is true that 'what objects' or 'which objects' I am conscious of depends upon my cerebral processes, but this does *not* imply a causal relation of dependence between those objects and my cerebral processes. There is indeed precisely the same concomitant variation between the movements of my finger in pointing and the objects pointed at. No one will deny that 'which objects' I point at will depend on how and where I move my finger. But no one will affirm that therefore the things pointed at depend on my pointing and cannot exist apart from it. In the same way, 'which objects' I write about will depend on the words I use, but no one will say that therefore those objects depend upon their own names. Now the relation of the cerebral state as implier to the apprehended object as implicate, with which relation we identified consciousness, is in this matter of concomitant variation and dependence precisely analogous to the relation of the pointing finger to the object pointed at or the relation of a name to the object of which it is the name. The relation or act is in each case selective and not creative or constitutive in any manner or to any degree. In short, we cannot infer from the dependence of 'which objects' to a dependence of 'the objects.'

The first consequence of the material fallacy of psychophysical metonymy is of course the one implied in the exposition just given. It constitutes the principal proof of idealism; and as an argument it seems less axiomatic, but more solidly empirical

and convincing than the verbal fallacy of the same name. The subjectivist presses his eye-ball and sees a chair that moves where formerly he saw a chair that was stationary. This should suffice to convince him that how you see a thing depends on how you see it; but not content with this modest inference he jumps to the conclusion that the things which he sees depend on his seeing them, — which is different. And, as we have said, he never stops to consider that the *other minds* in whose independent reality he believes are relative in just the same sense to the processes by virtue of which he thinks of them.

The second consequence of this fallacy of metonymy consists in a far-reaching and widely prevalent misconception of the nature of the thinking process, and especially of the judgment process. Judgment is the utterance or expression of a belief, (tentative or certain) in the reality of an identity-complex, or proposition. An utterance is an act that takes a certain amount of time. The symbols of its expression have to come in a certain sequence, *e.g.* subject, copula, predicate. The judgment is often the outcome of many other acts, and usually involves effort and activity of various kinds on the part of the one who makes the judgment. Now all this belongs to the biography of the one who judges. *The fallacy in question reads this chapter of the thinker's biography into the biography of the object of his thought.* We start out with the judgment, A is B; finding this untrue, we make a new judgment, A is C; perhaps this leads us to believe that A is not only C, but is also D and E. All of which may be very interesting and important for us, and may constitute a profound alteration and enrichment of our natures; but it is not interesting and important for the object, and it does not constitute any alteration or enrichment in the nature of the object. It is our privilege to learn, sometimes suddenly and easily, and sometimes with much time and effort, the nature of the real things about us; and it is our misfortune that sometimes we fail to discover reality and succeed in discovering only its contradictory or shadow, *i.e.* the unreal and false. But all this is neither a privilege nor a misfortune for the reality that we do or

do not discover, except of course in the quite indirect sense that our judgments may lead to behavior which may later effect the objects discovered. Our judgments can remain unchanged even when they refer to objects as changing as fire, or they can change and evolve even when their objects are as changeless as the Sphinx or the square root of minus one. And yet it is often assumed that the world can be proved to be dynamic and changeful because our judging process is that. There is no inference possible from the changing or static nature of our judgments to the changing or static nature of what is judged about. We do not break up the living flux of reality when we conceive of its various phases and aspects. Conception does not dirempt reality, and judgment is not the process of pasting its pieces together. Conception and judgment are, like all cognitions, not constitutive, but selective. To *conceive* is to apprehend simply one quality or group of qualities, and to *judge* is to apprehend an identity-relation between different qualities or groups of qualities.[1]

5. *Degrees of Truth and Error and the Fallacy of Internal Relations.*—All or almost all of our cognitions are partly true and partly false. Expressed in our own terminology, the brain states at any moment have, for their self-transcending implicates, objects some of which are real and some of which are unreal or merely subjective.[2] The cause of this is, as we have seen, the fact that our cere-

[1] For a more systematic demonstration of this theory that judgment (like all other forms of consciousness) is purely *selective* and never constitutive *cf.* my discussion of Dr. Schiller's Humanism in "May a Realist be a Pragmatist" *J. of Phil., Psychol., etc.*, 6, 565–6. With reference to the manner in which 'anti-intellectualism' by neglecting this view confuses the relations between the symbols used in making judgments with the propositional content asserted by the judgment *cf. J. of Phil., Psychol., etc.*, 7, 153–4.

[2] Anything in so far as it figures as an object in consciousness may be called 'subjective' in the broad sense; but the word is more commonly used in the narrow sense of 'merely subjective' to denote objects of consciousness which are unreal or non-existent, such as the events in a dream or the content of a hallucination. There is nothing that is of necessity mental or psychical about these subjective objects. But the fact that as non-existent or unreal subsistents they have no proper place of their own in the spatio-temporal system and hence act only on and through the mind that knows them led to their being treated as mental in the same sense as de-

bral states are in part, and only in part, the effects of the objects external to them and known by them. The physical medium and the brain itself is always partly responsible for the cerebral state. And the aberration thus effected is probably never entirely corrected. The source of error in other words is due to the plurality of causes and to the counteraction of effects. Now the understanding of the source of error at once suggests the means, not indeed for its complete cure, but for an indefinitely progressive amelioration. The more effects we have of things, the less ambiguity there is in their joint implication; and though each one may have been partly modified, yet these modifications may be neutralized by one another. A great number of pretty bad photographs of a person might suffice better to give us an accurate idea of his appearance than one fairly good photograph. The *totality* of a thing's effects, even though each had been interfered with, would not, indeed, be themselves *identical* with the thing, but they would be exactly and adequately *implicative* of it. And the more effects we get of a thing, the more nearly adequate is our knowledge of it. If the stick partly immersed in water could effect us only through our eyes, and from only one point of view, we should never discover the error of regarding it as bent. But it effects us from many points of view, and through touch as well as vision, and thus the error of immediate perception is discovered and rendered innocuous. In this way we can test our knowledge and attain ever more and more probability of truth.

From this standpoint it might be well to consider errors of quality as distinguished from errors of position or numerical identity. We may perceive a thing in the right place and time, but the quali-

sires and volitions are mental. This natural confusion was the first stage in the evolution of subjectivism. It reduced all non-existent objects to the realm of mind and led naturally to the view that all objects *in so far* as they were known thereby became *states* of the knower. The truth is simply this: Real objects have two sets of consequences. They effect other objects continuous with them in the world of space and time and they also affect whoever knows them. Unreal objects, however, have no effects or consequences of any kind except upon the persons in whose consciousness they figure.

ties which we perceive it to have may never occur in it. They may be qualities such as are only correlated with or produced by energies peculiar to our nervous system. There would be real error involved in such a situation, but it would not of necessity result in harm to us. As long as the qualities really present in the objects varied in one-to-one correspondence with the qualities apprehended, we should be well enough off for practical purposes. I may here remark that this may be our plight with regard to the secondary qualities (though not with regard to the primary qualities whose reality is vindicated indirectly as well as perceptually). The problem of the external reality of the secondary qualities is neither solved nor intrinsically insoluble. The way and the only way we could settle the matter would be to gain exact knowledge of the primary energies occurring in, or on the surface of, the external bodies, and an equally exact knowledge of the primary energies in the appropriate sensory cerebral tracts, and then compare them. In so far as they were the same or different, we should be certain that the secondary qualities of things were or were not as we perceived them.

Now if we allowed the fact that every object of consciousness was partly true and partly false to make us believe that therefore the real world might be in every respect different from what we perceive, we should commit the fallacy of internal relations. For that fallacy consists in the assumption that the nature of the parts of a complex depends upon the nature of the whole complex, and consequently, that knowledge of merely a part of the truth must as such be false. Spaulding has refuted this fallacy in his defense of analysis. We do not have to have all truth in order to have some truth. I can misapprehend some qualities of an object without misapprehending its other qualities. And because I erred in perceiving its qualities it would not follow that I erred as to its position and relations; nor if I erred as to its position need I err as to its qualities. The complex of real and unreal elements which makes up the object of consciousness may be analyzed and tested part by part. Failure to attain certainty or to remove

error in one respect will not make everything false or even doubtful.

6. *Summary.*— Our effort in this third and final division of our inquiry has been to explain the conditions under which truth and error arise. Presupposing the conception of the meaning of truth and error outlined in the first division, and proceeding on the basis of the theory of consciousness set forth in the second division, we have attempted to demonstrate in terms of the 'epistemological triangle' how the resultant system of cerebral currents and memory traces may sometimes and in some respects imply real things and relations outside itself, and how it may at other times and in other respects imply the unreal contradictories of these.

As we said at the outset of our discussion, the problem of truth and error has a peculiar bearing upon the controversy between realism and subjectivism. Realism flourishes naturally as long as man attains truth. It is the fact of error that has led to subjectivism. Indeed we might say, without intending an impertinence, that subjectivism is founded upon error and that realism is founded upon truth. Error is as real as truth, but its reality is not incompatible with the reality of the world.

THE PLACE OF ILLUSORY EXPERIENCE IN A REALISTIC WORLD

THE PLACE OF ILLUSORY EXPERIENCE IN A REALISTIC WORLD

BY EDWIN B. HOLT

ILLUSION, hallucination, and the erroneous experience in general, we are told, can have no place in a universe where everything is non-mental or real: and they cannot be satisfactorily accounted for by realistic philosophy. Such is the challenge that has been repeatedly thrown out from the idealist to the realist camp. And although it has recently been taken up and admirably answered in two all but impeccable articles by Professor Alexander and Mr. Nunn,[1] I propose to take up the issue once more and to add something if possible to the measure of satisfaction already vouchsafed by these two gentlemen. A closer definition of the terms used in the dispute is not necessary at the outset, for they are offered and may be accepted as the current names for fairly unambiguous phenomena. Sharper definitions, however, for these and other terms will emerge in the course of the argument.

I

ILLUSIONS OF PERCEPTION AND THOUGHT

Erroneous experiences have been assumed to come under four heads, according as the error is one of space, of time, of ('secondary') quality, or of judgment (thought).

1. *Errors of Space.* — An object is frequently seen as nearer or farther, as larger or smaller than it really is; it may be seen inverted in position or distorted in shape, it may be seen double or triple (spatially reduplicated); and the same frailties attach to the senses of hearing and touch and to other modes of appre-

[1] Alexander, S., On Sensations and Images. *Proc. of the Aristotelian Soc.*, 1910, N.S. 10, 1–35. Nunn, T. Percy. Are Secondary Qualities Independent of Perception? *Ibid.*, 191–218.

hension, such as that, for an instance, in which the semicircular canals are a contributory factor. The person sees what is not there, hence the act of seeing is constitutive in the case, hence the illusory object (however it may be with a correctly perceived one) is essentially mental and subjective. Thus if the two eyes are sharply converged and then one eye is closed, near objects (far ones are now out of focus) are seen as both nearer and smaller than ordinarily, or than they really are. ('Really are' just happens not to be a realist's phrase, as shall be explained later, but I shall use it and still refrain from quotation marks out of deference to the opponent, who, to judge by his actions, is unable to state his case against realism except he be granted handy access to some things that 'really are.') Now there is a machine for manufacturing the lasts on which shoes are made. A model last is placed in contact with one end of an arm and the machine at once carves out of a block of wood a second last which is like the model. The machine at work has quite the air of seeing its model. Indeed, the comparison between duplicate and model has an uncanny resemblance to the subject-object relation. However that may be, there is an adjustment which can be effected such that the duplicate last is turned out *smaller* than the original, but otherwise still like it, and the same adjustment brings any point that shall be geometrically defined as the center of the last *nearer* to the important part of the machine, the cutting edge. I forbear to press the analogy: the essential point is, merely, that a mechanical manipulation of the eyes which *brings things nearer and makes them smaller* argues nothing for mentality or subjectivity, for there is another machine at hand which can be as readily manipulated with the very same effect. And in the shoe-last machine I imagine that our opponent, so far from discovering the subject-object relation and so forth, will even feign to evade the comparison.

However, our next case is his own favorite out of a not too-varied repertory. If a person presses one of his eye-balls out of place, and keeps both eyes open, he will see double. He sees,

for instance, a second mare's nest which isn't really there. This demonstrates a remarkable creative function inherent in mental process. A too literally-minded person might ask if it did not somehow depend on there being two eyes, and this the more as the direction given for setting this creative function of mind in operation was distinctly physical, *i.e.* a jab on the eye-ball. Indeed, it could almost be said to be directed on the eye rather than addressed to the mind. This notion becomes even more plausible when one remembers that the stereoscopic camera habitually sees double. The notion becomes a certainty from the circumstance that in the case of a person with two eyes of which one is blind, with, however, a creative mental apparatus equal to any the best you may find, — in such a case the charm works not at all. (It does not work even if a normal-sighted person closes one eye-lid during the experiment.) This is proof by the Baconian canon, so long as our opponent adduces only two factors — the pair of eyes and the mental process. Or, to return to concrete experience, I will ask the opponents of realism this: Do they indeed think that of the two images of one object which are given in the stereoscopic camera one of the images is 'illusory' because but one outer object is really there? Does the camera lie? If not, why is one of the two images on occasion given in human vision, any the more illusory? "Ah, but," is the reply, "no one asserts that the image in the camera *is* the object out in front." To which I say that realism asserts just this, — the image *is* genuinely (a part only, but a true part, of) the object photographed. The professional photographer asserts it, saying, in the manner of his trade, "We have caught your exact expression, Madame." And we all speak, as Robert Louis Stevenson spoke, of "just that secret quality in a face that is apt to slip out somehow under the cunningest painter's touch, and leave the portrait dead for lack of it" ("An Autumn Effect"). The physicist or astronomer absolutely asserts that his photograph of a spectrum *is* integrally the spectrum under study. Now the realist contends that when we say such things we mean them;

the opponent, that we do not. Yet everybody except this perverse school of philosophers continues to assert the same in any case whatsoever of 'reproduction' in art or craft; and the philosophers of that school assert it the instant they have doffed their professional perruque and descended from the cathedra. Whether they admit this or not, the point which they must admit is that *reduplication*, if only of 'images,' is a common feature of purely physical systems, and that therefore the occurrence of reduplication as a function of the human organs of sense argues nothing for subjectivity lying behind that sense. The relation of 'image' to the object and then to knowledge we shall presently examine.

Or again an astigmatic eye distorts its object; so does a roughly cast glass lens, and so do the innumerable facets on the surface of troubled waters. A stimulation of the two sacs in the inner ear translocates one part of perceived space within an otherwise perceived space; just so every mirror and other reflecting surface makes a new translocated space, which is in all ways geometrically viable and is within the original real space: and so on for every one of the spatial illusions and hallucinations.

Our opponent must withdraw from his citation of cases in which the organs of sense yield multiplied or distorted images, because of the invariable parallel to strictly physical systems. And he must stand on a ground further back; which would be, as several of our opponents have indeed made their particular point, that not the distorted image as such, but the distorted image which *asserts itself to be*, or which *the realist asserts to be* the real object, — that this is the crux for realism. In order to be fair I hasten to add that not a few of the opponents of realism have not to retreat to this ground, since it is their original position. And I am only too eager to meet them there, as I shall do in due course. Meanwhile many of our opponents have undertaken to occupy the ground which I claim that we have just covered, and all opponents are to be reckoned with. Indeed, it remains true that in nearly every case where the idealist has ventured within the somewhat untamiliar and ticklish region of the concrete,

he has brought against realism the charge which I have just partially refuted. I say 'partially,' not because I account the physical parallels of illusion as inconclusive, but because we have so far considered only the spatial cases. We now proceed to the next group.

2. *Errors of Time.* — An object is not only frequently, but invariably seen at a moment of time later than that when it had the position and other circumstances which it still has in our vision of it. The illustration hallowed by the tenderest association for the idealist seems to be the case of seeing the sun or other heavenly bodies some millions of years behind time, or indeed millions of years after it may have ceased really to exist. But now what advantage over us has the photographic plate, as plainly physical and as little mental or illusory as we all grant that to be? And if it be paradoxical and for realism ominous that we can see a real thing long after it has ceased to be real, how much more paradoxical and ominous must it be for physics if it is obliged to concede that each smallest physical object remains under the direct and real influence of other physical objects which have not been existent or real for millions of years. It seems to me that this argument proves either all or nothing. It may, I fancy, open up magnificent vistas to theosophists and clairvoyants; but my imagination halts when I try to conceive what it can open up to a sane and sober philosopher. Nevertheless such a passage as the following is characteristic of the greater number of writers who are just now so superbly stooping to take notice of realism. "The 'real' object always exists earlier in time than the perceived object, which we hastily assume to be the 'real' object, yet which is really but an element in our own experience, and not the object, or eject, which exists in and for itself." [1] Succinctly stated, the astonishing argument is that the mental image is not a part of the real world, but is distinctly non-physical and non-real, and belongs intrinsically to another, the subjective order of being,

[1] Drake, D., The Inadequacy of 'Natural' Realism, *J. of Phil., Psychol., etc.*, 1911, 8, 371.

because it lags in time behind the real order of things: and this is urged notwithstanding the fact that every case of image which can be cited from the strictly physical world lags in exactly the same way behind its real physical prototype.

Some of our opponents, as in the previous case of spatial illusions, stand on the safer ground of affirming that not the delayed image as such, but the delayed image which *asserts itself to be*, or which *the realist asserts to be* the real object, — is the crux for realism. Thus one critic affirms that "In the face of intervening machinery (of sense-perception) and the lapse of time, realism cannot persist in saying that the very object thrusts itself in amongst the contents of consciousness." We shall consider this latter argument in due course, but for those who find something in the former argument I wish to suggest an illustration which they may find useful in their future animadversions on this point, since it will be more novel than the somewhat threadbare case of seeing the non-existing sun, and furthermore in their eyes more damaging to the cause of realism. One discovers in the psychological laboratory a kind of lapse of attention during which sensory stimulations are prevented from reaching the sensorium, or from coming to consciousness; yet if the lapse is brief, say not over five-tenths of a second, sensory stimulations given during the lapse reach consciousness afterwards and are then perceived in the *reverse of their true time order*. This is, of course, hard on realism, although the same reversal happens to a bunch of delayed telegrams, letters, or express parcels.

3. *Errors in Secondary Qualities.* — The detachment of secondary qualities from physical objects has seemed so conspicuous to the makers of history, that these qualities are rather generally deemed to exist in minds and nowhere else, to be in very essence mental. On the other hand, there is a group of thinkers who assert that the secondary qualities are not in minds at all, neither ideas nor even sensations being endowed with these qualities. In this case either they are spoken of as if they were a part of the physical objects, or else no status or habitat whatsoever, so far

as I have been able to discover, is assigned to them. I take it that in urging the case of secondary qualities against realism, our opponent assumes the case (for him) contrary to fact, that the qualities are out there on the objects, and undertakes to argue to a *reductio ad absurdum.*

The larger part of illusory instances here in question needs but brief comment, for their case is still parallel to the cases already considered. As one passes down a dark street and past a lighted window, the darkness of the street seems more profound, although the night is really no darker: but just so a photographic plate carried past the light of the window is thenceforward less sensitive to the faint illumination of the darkness beyond, and this illumination is for it one of reduced intensity. But in such a simple fact of modified physical process no one sees raised at all the issue between reality and unreality, or between the material and the mental. The hill and wood that one looks out upon are practically invariable in their chemical properties, yet as the day progresses they are seen in a perpetual variety of light, shade, and hue: but their luminous properties, although invariable, are invariable functions of the incident illumination, functions whose particular values vary therewith; so that the light that is reflected is in reality ever changing. Since it is *reflected light* that is perceived in this case, and *not the invariable functions*, it would be a falsification of reality if the light were *not* seen in perpetual flux. The orthochromatic moving film will record this diurnal flux in an entirely parallel way. The change of 'appearance' as an object is carried from peripheral to foveal vision is only a case of one light differently affecting differently sensitized surfaces: and the 'brightness distribution' of the totally color-blind eye is photographed outright by exposing a tube filled with a solution of visual purple from the eyes of frogs, to the several wave-lengths of the spectrum.

A feeble tone sounds fainter when a stronger tone is sounded: so too it will yield less physical sound when occurring simultaneously with other sounds (owing to partial interferences). The intense stillness after explosions has its counterpart in the 'fatigue'

of physical mechanisms. In binaural diplacusis one given pitch is heard by the two ears as two different pitches (generally less than one third of a scale-interval apart): but so will one tone set up overtones of different pitches in as many resonant bodies; as one may note by listening to several telephone transmitters which are connected with one receiver. It may be alleged that auditory 'beats' falsify the perception of physical sounds, but 'beats' take place in every damped membrane, and are in human audition nothing but the true perception of what is going on in the tympanum of the middle ear. Likewise, in some measure, at least, auditory 'attention waves' are the true record in consciousness of interrupted function of the tympanum, owing to rhythmical changes in the latter's tension, which prevent it from vibrating responsively to some pitches. (Similarly visual attention waves are in part at least due to like rhythmical changes in the shape of the lens.)

The phenomena of dizziness and other peculiar affections in our sense of orientation have found a singularly satisfactory explanation in the Mach-Breuer theory, wholly in terms of the inertia and elasticity of bodies. And a model has been constructed which manifests in the real world many of the very same false responses to changes of orientation that the human being perceives by virtue of the labyrinth of his two ears. An almost identical organ has been found in plants. One can only regret, in this connection, that none of our sense-organs contain gyroscopes, for then there would be material startling enough to prove to the satisfaction of some a dozen anti-realisms.

The case of all the other senses is exactly parallel, and I will mention only the sadly overworked instance of the bowl of water which feels hot to one hand and cold to the other, adding merely that if our learned opponents who find this experiment so significant will heat one thermometer and put a second for a time on ice, the first will record as objectively as one pleases that the bowl is really cold, while at the same time the second thermometer will record that the bowl is really hot. In connection with

all of the phenomena so far cited, the admirable papers of Professor Alexander and Mr. Nunn, already referred to, will be found most illuminating.[1]

But I have not yet mentioned hallucinatory secondary phenomena, cases in which a color or sound comes in all distinctness to consciousness, while nevertheless no such color or clue to it is out there in the physical world. In a way positive, negative, and complementary after-images seem to belong here; and yet they are really cases like the foregoing. A positive after-image has of course a thousand parallels in the physical world, and indeed it depends certainly on the nervous 'after-discharge,' which has been well made out by physiology. The image is therefore a true perception of a real process, which in its turn constitutes a part of the real properties of a real thing (as shall be more amply brought out later). Likewise a negative after-image is paralleled by the photographic 'negative.' The complementary after-image seems indeed a purely subjective hallucination. The yellow candle-flame is not blue as it looks in the after-image. Vision after santonin poisoning shows objects, again, suffused with an illusory or hallucinatory yellow cast. This latter case is nearly paralleled by fluorescent bodies which increase the wave-length of all light that comes to them. It is not probable that santonin vision depends on fluorescence (although the visual purple of the retina happens to be a fluorescent substance), but it would be explained in physical terms, and given a real status like that of our other instances, by any physiological process which should have the effect of a yellow light-screen interposed between the object and the sensorium. Although the means for this have not been discovered, it too clearly rests on a subtraction from consciousness (as it were a selective eye-lid) to be of interest in the present connection

The complementary after-image still looks more like a subjective creation. Now it will be recalled that Helmholtz plotted a

[1] Cf., regarding these and similar cases, Dewey, *J. of Phil., Psychol., etc.*, 1911, **8**, 393–397.

curve showing the wave-lengths of the complementary color-pairs,[1] and I have learned from Professor G. W. Pierce that when the capacity of the receiving mast of a wireless telegraph system is tuned to a given length of Hertzian wave, it is *ipso facto* tuned to a second wave-length as well; and for each new tuning it becomes sensitive to a similar *pair* of waves: that, further, the curve of these wave-pairs shows precisely such a function as the plot of the complementary color-pairs. The complementary or antagonistic colors are comparable, then, not to the octaves in audition (as some serious but abortive speculations have tried to show), but to the complementary pairs of Hertzian waves. Now it is not known how the cones of the retina pick up light-waves and send them on as nervous impulses, but it is improbable that they do this by virtue of any photo-chemical substance (as is the case with the rods), for in spite of repeated investigation of the cones no such substance has been found. (The question of 'visual substance,' as raised by Helmholtz and Hering, is not necessarily involved here.) But it is most probable for a variety of reasons which have been advanced by Meisling,[2] that the cones resonate to waves of light, as in Helmholtz's theory of audition the radial fibers and organs of Corti are believed to resonate to sound. Now light-waves and Hertzian waves are closely related physically, so that if the view of Meisling is correct, — and it is not only the most reasonable view so far offered, but it is itself well supported by facts, — the complementary colors of vision are nothing but a true presentation in consciousness of the fact of complementary attunement of light-resonators. This is not an assured fact, but it is a view possessing too high a degree of probability to leave any interest attaching to the case of complementary colors as a special difficulty in the path of realism.

The case of pure hallucination involving no peripheral stimu-

[1] Helmholtz, H. von, Handbuch der Physiologischen Optik, Hamburg, 2te Auflage, 1896, 317.

[2] Meisling, A. A., Ueber die chemisch-physikalischen Grundlagen des Sehens. *Zsch. f. Sinnesphysiol.*, 1907, **42**, 229–249.

lation whatsoever, the case, that is, of centrally induced sensations and images, or, as Johannes Müller called them, "fantastical visual phenomena," is more unmistakably to our purpose. And I confess that this is the first of the arguments allotted to me in which I can see enough plausibility to enable me to meet the adversary with either amiability or patience. I heartily grant the propriety of our opponent's question, How can realism pretend to assert the reality of the color, sound, and perhaps tactile or olfactory sensations which are vividly present in the dreams of a person sleeping, it may be, in a box no bigger than his coffin? The case has still two aspects: first, how can these purely hallucinatory secondary qualities have, even in themselves alone, any sort of being other than a subjective and mental being? Second, the argument already twice referred to, how can they pretend to *assert themselves to be*, or how can *the realist* pretend to *assert them to be* the real object?

The former difficulty first. It must have occurred even to the idealist, in a ruminative moment, what a singular thing that cleavage in our universe, the sharp division between primary and secondary qualities that is ordinarily attributed to Locke, after all is. Whether one views our 'universe' as a material system, a scheme of relations, a subjective realm, an 'Absolute' system, or whatsoever, one is ever confronted by the strange apartness of the secondary from the primary qualities, a cleft that is bridged only by the bare one-to-one correlation of some of the colors, sounds, and so forth with certain vibratory wave magnitudes found in the primary system. Since this is a bare one-to-one relation, not even for instance admitted to be a true causal relation, the case presents even to the thought of our own day as clean and gratuitous a 'preëstablished harmony' as was ever dreamt of by Leibnitz. This cleavage and the mystery of error constitute, I take it, the chief empirical motives (as opposed, say, to temperamental motives) which have led thinking men into some form of subjectivism. Since, however, subjectivism by no means clears up this inscrutable correlation, it remains to

me personally a mystery that, so far as I know, no explanation has been attempted of this harmonious accident — so uniform and inveterate. But is this fixed correlation a fixed accident? This is a question which must be answered on solely empirical grounds, if our adversary grants that term to have any meaning, and without regard to realistic or anti-realistic prepossessions.

For the empirical psychologist the unique and isolated position of secondary qualities is enunciated in Johannes Müller's doctrine of the specific energy of nerves, for which Müller himself gave various formulations, one of which is substantially the theory generally believed to-day. The germ of the doctrine descends to us from Locke through Hume to Kant, for it was Kant's epistemology that Müller, by his theory, aimed to exhibit in concrete operation. (He hoped thus to confirm Kantian metaphysic, and although the work turned out, unconsciously to Müller, a caricature, we still note among idealists a real affection for the 'Sonderstellung der sekundären Qualitäten.') Nevertheless, explicitly Müller proceeded empirically, and based his theory on two groups of phenomena; the 'fantastical visual phenomena,' or in general the central excitation of mental processes; and the fact that some nerves when stimulated by some other than their normal stimulus still respond by yielding the same sensation as when exposed to their normal or 'adequate' stimulus. Thus, it was believed that a surgical severing of the optic nerve produced a confusedly brilliant burst of light and color sensations. Clearly the world outside the body contained only primary qualities and, more pertinently, vibration-rates, while the secondary qualities were certainly found only in the nervous system and undoubtedly (but this was pure assumption in the supposed Kantian interest) only in the mind. And it was a specific energy of nerve fiber 'or' brain center (the latter being the modern view), that, although having nothing about it that resembled a secondary quality, had the power of arousing the secondary qualities in the mind. Thus the specific energies were the physiological counterpart of a Kantian category.

But obviously the specific energy of the optic nerve must differ from that of the acoustic nerve in order to account for the different effects of the two on the mind. Müller spoke somewhat roughly of specific energies, qualitatively[1] differing, for each of the several senses. The assumption was later made by Helmholtz, and not without reason, of a specifically different energy not merely for the modes of light, sound, heat, and so forth, but for many of the qualitative differences within these modes as well. Thus we have the sundering of primary and secondary qualities with the harmonious accident of their correlation, restated in the terms of mind and body or rather of mind and the cortical cells of the cerebrum, with nothing done to explain the steady correlational accident. (And as for the Kantians, it is hard to see how they can feel grateful to Johannes Müller for exhibiting so definitely the slender cortical threads by which the mind is held in touch with a contrastingly *non-mental* world, even though the latter was devoid of secondary qualities.)

The point about this theory which interests us now is that nerve physiology has not been able to discover any trace of specific nerve-energies.[2] All nervous impulses seem to be of quite the same 'qualitative' order, differing only in intensity: sensory impulses are even not different from motor impulses. Yet the question remains, — How can the mind (to continue Müller's conception of the case) be affected to different modes of sensation by nervous impulses which are all qualitatively alike? And it is a question not merely of understanding the cases of centrally induced hallucinations and of normal sensations caused by abnormal, 'inadequate,' stimulation, but a question of still broader import, — How can any physical stimuli whatsoever, whether normal

[1] Müller uses the term here with no reference to 'secondary qualities,' but merely as one might loosely speak of a 'qualitative chemical process.'

[2] The unsuccessful attempts in this direction, notably by Hering, have chiefly been actuated by the theoretical needs of sense-psychology. Cf. Boruttau, H., Alte und neue Vorstellungen über das Wesen der Nervenleitung. *Zsch. f. allg. Physiol.* (*Verworn's*), 1902, 1, Referatenabteilung, 1 (especially 10–11). Hering, E., Zur Theorie der Nerventhätigkeit, Leipzig, 1899 (especially 8, 10).

or abnormal, produce different qualitative sensations when the differences between the stimuli, the differences of wave-length or vibration-rate, are merged and lost on their way to the brain in nervous impulses which appear to be all alike.

The readiest answer should seem to be that the differences required are not differences in impulse but in nerve-fibril: each nerve fibril different from every other might, whenever excited, give the cue to the mind for one specific secondary quality. But no such differences between nerve fibrils have ever been discovered; any more than between nerve impulses.[1] Might then the differences be in the cortical cells at which the fibrils terminate? This has been somewhat investigated and a very slight difference in the chemical composition of different *lobes* of the brain found. Even this has not been confirmed, and I believe that no investigator has ever claimed to find chemical, histological, or other differentiations between homologous cells of one lobe; as our assumption requires. (Differences between the cells of different cortical layers will not serve our purposes, since these differences between layers extend practically unmodified over the whole cortex.) Professors Sherrington[2] and McDougall[3] have shown that not the cell-bodies but the synapses *between* neurones are in other respects (such as duration and fatigue phenomena) significant for consciousness; but here again no differences between synapses even remotely approximating what we require have been adduced. The only course remaining is that taken by Professor Münsterberg in his 'action theory,'[4] where the correlation between neural impulse and secondary quality in the mind is conceived as a bare

[1] This distinction is at best a somewhat academic one, since it is hardly conceivable that any significant differences in nerve-fibrils should not bring in their train phenomena that would become manifest in the experimental study of the nerve-impulse.

[2] Sherrington, C. S., The Integrative Action of the Nervous System. New York, 1906, 14 ff. Cf., however, earlier writers such as Goldscheider, A., Die Bedeutung der Reize im Lichte der Neuronlehre. Leipzig, 1898, I.

[3] McDougall, W., Physiological Psychology, London, 1905, 30–33.

[4] Münsterberg, H., Grundzüge der Psychologie, Leipzig, 1900, I, 15.

one-to-one correlation, no other differentiation in the nervous substratum being suggested than one of spatial position. And this view again brings us back to the unexplained preëstablished harmony; and to the mind of a realist, at least, nature abhors a preestablished harmony. But another and strictly empirical reason makes impossible the assumption which we have just considered. In the words of the late Professor Nagel,[1] "Unquestionably an hypothesis which should permit us to ascribe to individual nerve-fibers a single qualitatively determined and unvarying mode of excitation (*Erregungsart*, and the context shows that he is referring not to the form of stimulation, but to the nature of the sensational response) would be by far more satisfactory, and would stand in closer accord with other investigations. The special investigations in sense physiology, however, are not at present favorable to such an assumption." The evidence is as follows. Müller left his theory in a crude form, inasmuch as he thought of a 'specific energy' for each 'sense' — sight, hearing, and so forth; but each 'sense' gives us several qualities (as four for taste, at least several thousand for hearing, and an indefinitely large number each for sight and smell); and every argument that speaks for specific energy at all for the several sensory modes, speaks just as imperatively for a separate energy for each quality within the mode. This undoubtedly influenced Helmholtz, in his theory of audition, to assign to each fibril of (the cochlear branch of) the eighth nerve, the work of transmitting a separate auditory sensation of pitch. The fact that these fibrils are connected serially with the graded series of organs of Corti made the

[1] Nagel, W. A., Die Lehre von den spezifischen Sinnesenergien. Handbuch der Physiologie des Menschen, Braunschweig, 1904, **3**, 15. Professor Nagel was not optimistic, indeed, about several of the reputed facts on which Müller based his theory. "So far as I know we have still no proof that mechanical or electrical stimulations of the optic nerve-trunk produce sensations of light" (7). And again, "The most clean-cut (*eleganteste*) and in fact the only really clear confirmation of Müller's law (regarding the results in sensation of 'inadequate' stimulation of nerve-fibers) is the already mentioned experiment on the chorda tympani of the exposed middle ear; mechanical, chemical, and electrical stimulation of the central end of the severed nerve does produce a sensation of taste" (8).

theory very plausible. Helmholtz was similarly influenced (although the evidence is here less obvious) in his assumption of three fundamental qualities of vision. Now the extension of the theory of specific energies to the sensory qualities, as required if the theory is to explain the facts which it undertakes to explain, has been thoroughly unsuccessful, and has been put by recent investigations quite out of question.[1]

In the first place the theory never has, in spite of several efforts, been extended with any degree of completeness to the qualities. The greatest success was attained in Helmholtz's theory of audition. This theory conceives the series of pitches as the qualitative auditory series (of which the justice has been disputed), shows the different pitches to be carried to the brain by different nerve-fibrils: and in spite of some doubts on the score of difference- and summation-tones was on the whole a credible theory. The theory still meets with several difficulties, nevertheless, a rather serious one being the difficulty of conceiving how the radial fibers with their almost microscopic dimensions can 'resonate' to so great a range of pitches as are included in the audible range of hearing, and specially how such resonance is possible between the little fibers and the lower audible wave-lengths which are little short of sixty-four feet. Furthermore these radial fibres are transversely bound together, so that any true resonance must be made more difficult, and a specific resonance of individual fibers to respective individual tones seems quite out of question. Were this not the case, it is estimated that the radial fibers would be numerous enough to correspond to the number of distinct audible pitches *if* this latter is taken as the same as the number of successive pitch *differences* discriminable in an ascending or descending continuous series of tones. In fact, however, the series of pitch sensations is continuous, and so includes infinitely more pitches than are brought out in the step-wise series yielded

[1] Nagel, W. A., *op. cit.*, 14. Professor Nagel's entire essay is of interest in this connection. The history of Müller's theory is ably treated by Weinmann, R., Die Lehre von den spezifischen Energien, Hamburg, 1895.

by the discrimination experiment. Helmholtz himself admitted, if I recall aright, that many intermediate pitches must be accounted for by the simultaneous activity of adjacent organs of Corti excited severally in differing degrees of intensity. This rather stretches a point in order to prop up the general theory of a nerve-fibril to a sensory quality: and yet one is tempted to let it pass, owing to the close resemblance between near-lying pitches.

But in vision the case is less favorable. The color series is also a continuous one, and since on the red-green zone of the normal retina (a very considerable area) every hue can be perceived at every point, it was from the outset out of question to look for, or to assume, a cable of nerve-fibrils going to every point and large enough to provide a separate fibril for each of the discriminable color differences, to say nothing of the actually continuous series of such differences. So here Helmholtz stretched still further (and very far) the point which just now we let pass. He assumed, in effect, three fibrils going to what is practically each point of the red-green zone, and assumed one of the three colors red, green, and blue to be aroused in the mind by activity of one or other of the three fibrils. Intermediate colors, as in the dubious point conceded in the case of audition, were aroused in the mind by the simultaneous excitation in different relative amounts of two or even three of the fibrils. Thus yellow, in which few persons recognize any resemblance to either red or green, must nevertheless be understood as the mental result of simultaneous and equal excitations of red and green fibrils: and white, which resembles no color, as the mental result of equal excitations of red, green, and blue fibrils together. Now here surely the matter has been stretched too far, for if yellow and white are not sufficiently distinct qualities to have special fibrils assigned them, then the theory of a nerve-fibril to a sensory quality has simply failed. The case is furthermore worse than in audition, for the mind must be inexplicably aroused to perceive different qualities on the excitation of different fibrils, and intermediate qualities according to relative and exactly discriminated quantities of excitation;

and now, per contra, it must be aroused to apprehend the *same* quality on the excitation of several thousand different red, or green, or blue fibrils. When the point is stretched so far, the principle of a nerve-fibril to a quality is squeezed to vanishing; it is lost.

Moreover, continuous qualitative series quite bridge in many cases the gaps which the older psychology rather jauntily assumed to exist between the 'five senses.' There are innumerable sensations which are aroused by the simultaneous excitation of taste and smell fibrils; indeed, all but four of the so-called tastes are due to the coöperation of olfactory excitations, and yet it is notorious that none but the trained, and few of these, can mentally resolve these sensations into taste plus smell. For nearly every one they are as unanalyzable as is white unanalyzable into red, green, and blue. Again the variety of tastes is greatly increased by the (mentally) unsuspected assistance of the touch sense. The senses of touch, pain, warmth, and cold (known to have separate end-organs) are inextricably co-involved in the production of a vast variety of 'dermal' sensations; while, according to Professor von Frey, the sensation of heat is due to the simultaneous action of organs which if excited severally would yield sensations of warmth and *cold*. The number of instances could be increased to any length, but I will further mention but one sensation which I may call the still, small voice of psychology: the sensation which has *no namable* quality. It is familiar, I think, to every trained introspector, and certainly to every observant one; one seeks in vain to assign it to any of the familiar senses, and it is distinctly not visceral or otherwise of a proprio-ceptive order. Thus I have several times been as assured as the nature of the case allowed, that the stimulation which yielded the experience was either visual or auditory, and still I was quite unable to recognize the result in consciousness as either a color or a sound; yet the sensation was moderately intense and it held its own well under the process of introspection. By way of introspective description I can only say that its quality suggests

something primal and unelaborated. I mention this at some length because it will interest us later: and also because it is so little suggestive of a rough and ready scheme of specific energies.

And thus it is that the theory of specific energies of nerve, twist and refine it as one will, encounters so many difficulties and ends up with such a bland profession of ignorance, that one must go back, and indeed for economy of thought much prefers to go back, to the original facts, perplexing as they are. The considerations which I shall now adduce seem to me to plunge the merciful bodkin into the Müllerian theory and also to throw a flood of light on the seemingly baffling facts.

If nerve physiologists have been unable, for the support of Müller's theory, to discover anything like a qualitative difference among nervous impulses, nor yet suitable chemical or histological differences among cortical cells and synapses, certain recent discoveries have shown something about the nervous impulse which both does away with old conceptions and introduces rather extraordinary new ones. That something is, that the nervous impulse, and particularly the sensory nervous impulse, presents periodic fluctuations of a frequency vastly higher than was hitherto suspected. In the words of Professor Sherrington,[1] "The number of separable excitatory states (impulses) engendered in a nerve-trunk by serially repeated stimuli corresponds closely with the stimuli in number and rhythm. Whether the stimuli follow each other once per second or five hundred times per second, the nervous responses follow the rhythm of stimulation. Using contraction of skeletal muscle as index of the response the correspondence at rhythms above thirty per second becomes difficult to trace, because the mechanical effects tend at rates beyond that to fuse indistinguishably. The electrical responses of the muscle can with ease be observed isolatedly up to faster rates: their rhythm is found to agree with that of stimulation: thus at eighty per second their responses are eighty per second. If the muscle note be accepted as an indication of the response of the muscle, its pitch

[1] *Op. cit.*, 42–43.

follows *pari passu* the rate of stimulation of the nerve through a still greater range." "The refractory period in nerve-trunk conduction seems to last not longer than 1σ." The last sentence is equivalent to the statement that the periodicity of the nerve impulse can go as high as one thousand per second; and it leaves the question whether the frequency does not go higher, unprejudiced, for further investigation. Almost all of the recent work on axis-cylinder conduction, muscle-tone, tetanus, 'Treppe,' and refractory phase gives indication of a similar oscillation of the nervous impulse at rates quite unsuspected by physiologists of an earlier day.[1] Thus, for instance, Professor Piper finds that in *voluntary* contraction (under virtually normal conditions, then) the flexor muscle of the lower arm receives fifty nervous impulses per second.[2] The reason why this discovery has been reserved until so recent a date is of the simplest, and is the one hinted at by Dr. Sherrington in the passage just quoted: the mechanical inertia of the recording instruments hitherto used in studying the nervous impulse has been such as to 'fuse indistinguishably' anything but slow fluctuations of the nerve-current intensity. But the mass and variety of evidence already on hand, together with its unquestioned authority, make it certain that as the use of finer electrical recording instruments progresses (particularly the oscillograph, which is a relatively new instrument in physiological laboratories), we shall become acquainted with a large field of phenomena relating to high frequencies of the nervous impulse.

Now, as has so often happened, evidence of the same fundamental fact has been simultaneously accumulating from another source, that of specifically sense physiology or psychology. In 1907 Lord Rayleigh[3] published a paper in which he showed conclusively

[1] I confess to being so far baffled in my search for the earliest experiments in this line. It would be interesting to be able to assign the historical priority in what is after all a profound modification of the earlier conception of the "nervous wave" of, say, a second's duration or over. Cf. Hering, E., *op. cit.*, 29.

[2] Piper, H., Arch. f. d. ges. Physiol. (Pflueger's), 1907, 119, 301; also *ibid.*, 1909, 129, 180.

[3] Rayleigh, *Phil. Mag.*, 1907, Sixth Series, **13**, 214.

that sounds of lower pitch than 128 d.v. per second, at least, (and perhaps of pitch as high as 512 d.v.) could not be localized by means of differences between their heard intensities; but that they could be and were localized on the basis of their relative phases as they entered the two ears. Lord Rayleigh adds, "It seems no longer possible to hold that the vibratory character of sound terminates at the outer ends of the nerves along which the communication with the brain is established. On the contrary, the processes in the nerve must themselves be vibratory, not of course in the gross mechanical sense, but with preservation of the period and retaining the characteristic of phase — a view advocated by Rutherford, in opposition to Helmholtz, as long ago as 1886" (*loc. cit.*, pp. 224–225). Now earlier, but unfortunately either not published or not adequately emphasized and therefore unnoticed, work had already been done which proved the importance of phase-differences in the localization of sound, by Sylvanus Thompson,[1] Professor L. T. More,[2] and Mr. M. Greenwood;[3] and the fact has received further confirmation from subsequent experiments of Lord Rayleigh,[4] Professors Myers and Wilson,[5] Mr. Bowlker,[6] and Professor More.[7] The last named author finds that phase-differences are effective up to pitches in the vicinity of 1024 d.v. (*loc. cit.*, p. 314). Professors Myers and Wilson have tried to subsume the new facts under the old intensity-ratio theory, by alleging that phase is operative only as it is correlated with intensity, but their explanation is too patently a case of ingenuity expended to save a preconception. If the nerve-impulse were known not to show phases of the periods here involved, one would perhaps let the explanation in terms of

[1] Referred to, but place of publication not given, by Mr. Greenwood. (Professor Silvanus P. Thompson intended?)

[2] More, L. T., *Phil. Mag.*, 1907, Sixth Series, **13**, 452.

[3] Greenwood, M., Physiology of the Special Senses, London, 1910, 83.

[4] Rayleigh, *Phil. Mag.*, 1907, Sixth Series, **13**, 316; and 1907, S. S., **14**, 596.

[5] Myers, C. S., and Wilson, H. A., *Brit. J. of Psychol.*, 1908, **2**, 363.

[6] Bowlker, T. J., *Phil. Mag.*, 1908, Sixth Series, **15**, 318.

[7] More, L. T., *ibid.*, 1909, S. S. **18**, 308.

the intensity-ratio theory stand, however improbable. Since, however, the very periodicities which are prerequisite have been independently proved to exist, the view of Lord Rayleigh and Professor More is altogether the natural one. Professor More pertinently says (*loc. cit.*, p. 319), "The only objection to the idea that the ear is capable of detecting the phase of a sound or at least the difference in the phase of two sounds, is that it is difficult to reconcile with our theories of audition."

But the experiment showing that phase-differences govern the localization of the lower pitches is one in which no 'hypothesis' and indeed very little deduction has entered, whereas the Helmholtz theory of audition (to which Professor More must mainly if not exclusively have referred) involves a grave hypothesis, in the much-disputed resonance assumption, and was furthermore framed not a little in the interests of Müller's 'specific energies,'[1] — a theory which we have already seen to be valueless. I say that it is the Helmholtz theory to which Professor More must have referred, because of the three other prominent theories, Ewald's in no sense depends on the Müllerian tradition, and Rutherford's and Meyer's are irreconcilable with that tradition. And the new facts regarding auditory phase are *not* difficult to reconcile with these theories. Indeed, Dr. Rutherford's theory consists in little else than an interesting, and to my mind valid, protest against specific energies, and in favor of the view that sensory qualities are conveyed to the sensorium by vibratory nerve-impulses whose rates are closely related to those of the impinging physical stimuli. The considerations adduced by either Dr. Rutherford or Professor Ewald are hardly complete enough to be called a 'theory' of audition; those of Professor Max Meyer better deserve the title. This investigator has offered a theory which takes into account and plausibly explains all the important peculiarities of audition (specially some of those which Helmholtz found most difficult), *except* the phenomenon of pitch ('quality'), which generally is the first point that a psychological theory

[1] Cf. Ebbinghaus, H., Grundzüge der Psychologie, Leipzig, 1905, 335.

undertakes to explain. I cannot discover that Professor Meyer has once made explicit mention of pitch, or how he understands it to be transmitted to the brain. And yet his theory is positive on this point; what it requires is to suppose that pitch is transmitted not by specifically different nerve-fibrils (as in the Müller-Helmholtz conception), but by nerve-impulses, along any or all fibrils, which consist of periodic vibrations identical in rate with the vibrations of the outer sound stimulus. I have never understood what I must call Professor Meyer's mysterious reticence on this point; unless, indeed, one may suppose that, unaware of the arguments in his favor adduced by Dr. Rutherford and many other physiologists, he has hesitated to give explicit prominence to a feature of his theory which so widely departs from the Müllerian tradition. Indeed, the views of Meyer and Rutherford are not rival, but complementary and entirely harmonious theories. Together they form a compact, complete, and very promising theory of audition; which, for that matter, would seem in no wise to jar with the fragmentary and somewhat whimsical speculations of Professor Ewald, although I can assign no immense value to these latter. In short, I have no hesitation in affirming that what we may call the Rutherford-Meyer theory is an adequate theory of audition, and that in view of recent discoveries in nerve physiology, it has the distinct advantage over the theory of Helmholtz. I could substantiate this conclusion in much greater detail, but in our present connection I have wished only to show that all considerations require us to abandon 'specific energies,' [1] that the facts of nerve physiology point unmistakably to the view that the quality of sensations is transmitted to the brain by vibratory nerve-impulses, that certain facts of sense psychology prove this in the field of audition, and further that here the vibration-rate corresponds to that of the

[1] It is interesting that in 1899 Hering in his defense (*loc. cit.*, 8) of "qualitative specific energies," cites even Helmholtz as an opponent of them. In other words, Helmholtz believed that the specific energies were to be interpreted in some quantitative fashion, possibly in terms of nervous vibrations (*ibid.*, 29).

outer sound stimulus, and lastly that this is *not* "difficult to reconcile with our theories of audition."

How may such a view, now, fare in the field of vision? — the only other sense which has been at all exhaustively investigated. The reply is that it fares very well. In a paper already referred to Mr. Meisling has presented very urgently the following considerations regarding color (cone) vision. Heat, light, and Hertzian waves belong to the same physical order, all being electro-magnetic vibrations and differing in the one essential of wave-length or rate. These waves can and do affect substances photo-chemically, as they have hitherto been conceived to affect the rods and cones of the retina; that is, by means of so-called visual substances. But there must be a photo-chemical substance to be affected. In the case of the rods such a substance is found in the visual purple, and the conscious result is white or gray sensation. In the cones no photo-chemical substance has been demonstrated, although the purple of the rods was discovered relatively early (by Boll in 1876), and three or more visual substances have eagerly been looked for in the cones. Now the 'visual substances' were always *purely* hypothetical in our *color* theories, and were conceived merely by analogy with the pigmented cells of rudimentary vertebrate eyes and with the visual purples of the rods in vertebrates. This analogy was not unreasonable, but it is unreasonable to cling to it when almost a half century of investigation has failed to bear it out, by demonstrating not even one of the supposedly requisite photo-chemical substances. Now the cones need not be conceived of as actinometers; they may be thermometers (bolometers), or resonators. They are probably not thermometers, since then they would be more sensitive to red than to yellow light, and still more to the slower heat waves than to red. But the cones may very well be resonators. If they are, the fact would account for their remarkable unfatiguability, a point which Hering emphasized in his arguments against Helmholtz, and to provide for which (in part) Hering conceived his antagonistic ana- and katabolic visual processes: a conception

which was applied by Hering to the temperature sense, and which was overturned by the discovery of separate warmth and cold spots. Now Meisling adduces facts concerning the structure of the cones, their several types, the structure of the several layers of the retina, the contraction of cones under light stimulation, and concerning the rest-currents and action-currents of the retina, showing how these facts well agree with the view that the cones are electromagnetic resonators.

Perhaps the most interesting confirmation of this view lies in the complementary attunement of those instruments which receive Hertzian waves;[1] a point which I have already touched on. This would account inevitably for the complementariness of colors, and in this regard both of the present theories of color are unsatisfactory. Helmholtz's 'errors of judgment' are in many phenomena of antagonism altogether far-fetched: and Hering's kata- and anabolic processes are unconfirmed hypotheses; they meet special difficulties in regard to the white-black series, and they contravene sound physiological analogy. For, as has been pointed out before, it is as unprecedented that an *ana*-bolic process should directly yield sensation, as that it should directly cause muscular contraction.

It is admitted on all sides that neither the Helmholtz nor the Hering theory of vision had ever the authority of Helmholtz's theory of audition, and that neither is to-day an acceptable theory. It is generally believed that each contains errors so radical that it would take elimination as well as supplementation to transform it into a definitive theory. Such a transformation, of *either* theory, Meisling offers when he suggests in place of 'visual-substances' three or more differently attuned types of retinal resonators. And, as we have seen, the same suggestion contains the foundation for an explanation for the so-far unexplained antagonism of colors. Whatever the result may be for color the-

[1] Pierce, G. W., Experiments on Resonance in Wireless Telegraph Circuits. Parts II, III, V., *Physical Rev.*, 1905, **20**, 220; **21**, 367; 1907, **24**, 152. Also Theory of Coupled Circuits. *Proc. Amer. Acad. of Arts and Sci.*, 1911, **46**, 293.

ory in general, our present point is that we have cogent arguments for believing that the visual impulse traveling along the optic nerve is, as in the case of audition,[1] a vibratory impulse whose period corresponds with the vibration rate of the impinging stimulus. And the opposing view of photo-chemical substances with 'qualitative specific energies' has no direct evidence to support it and a considerable body of evidence to refute it. Mr. Meisling's position, I believe, is conservative, and more secure than any other.

When we come to the other senses much less can be said on either side of our question. I cannot discover that anything pertinent, and I might almost say anything at all, is known of the actual physiology of the remaining organs of sense. Certainly all details of the processes of stimulation here are veiled in mystery. These other senses are generally thought to be either mechanical or chemical as to their immediate stimulation. Rod-vision remains a chemical sense of which no further details are known concerning the nervous impulse that the bleaching of the visual purple initiates. Yet the minute hairs on the olfactory and gustatory cells have given rise to some speculation as to whether the ultimate stimulus here might not be mechanical after all. The temperature organs may well be resonators to heat waves, but that is pure hypothesis. The pain, touch, and joint senses are almost certainly mechanical in their mode of stimulation, but that statement has no special significance for one who is trying to understand the physiological processes involved in their stimulation. The fact that mechanical stimulation of the chorda tympani, a gustatory nerve which passes through the middle ear, produces a sensation of taste, remains the one undisputed case in the series that was adduced by Müller. It does not

[1] Lest the reader think me perverse in arguing against resonance in audition and for it in vision, I must remind him that I am arguing not in the interests of theoretical grace or symmetry, but solely on the basis of evidence. Audition might very well depend on resonance and still the nervous impulse might be vibratory, while still the Müller-Helmholtz hypothesis of a nerve-fibril for each auditory pitch might be untrue.

prove the existence of a qualitative specific energy, but it may squint that way, and must be borne in mind in a dispassionate survey of the whole situation.[1] We are woefully ignorant of all these matters, and in science imagination is no counter-irritant for ignorance. The Müllerian theory of specific energies receives no support from the total ignorance prevailing in this field, while it is refuted by much that we do know about vision and audition. If conjectures are to be made as to the nervous impulse in the mechanical and chemical senses, the safest way will be to draw some analogy with what we do know about the light and sound senses. I personally believe that gratuitous conjectures (as opposed to grounded deductions) are mischievous, and I have no interest in them, whether they are pro- or anti-Müllerian. There is a general consideration, however, which may properly be mentioned here. The specific energies, whether in nerve-fiber, brain-cell, or synapse, are conceived of as differing qualitatively from one another. Now science has so frequently found that examination of what appear to be qualitative differences shows them to be really quantitative differences, that it has come to be a maxim of science that there *are* no '*qualitative*' differences. This, I think, oversteps the mark: there *are* qualitative differences, obviously, but these are usually *analyzable* into quantitative differences; precisely as every starch *is* a starch, but can be *analyzed* into one of a series of quantitatively related carbohydrates. The maxim should then be, simply, that quality is not an ultimate category of natural science,[2] and this maxim is universally acknowledged save by a small group of persons of a certain, possibly

[1] I could mention several explanations which have been offered for this phenomenon, which expressly avoid the assumption of a specific energy, and which are consonant with a vibratory theory of the nerve-impulse. I do not mention them because the facts still seem too meager to point clearly to any explanation whatsoever, either Müller's or another's.

[2] I am speaking here of the more concrete empirical sciences, and do not by this wish to prejudice the question as to whether philosophically 'quality' is or is not an ultimate category. The maxim referred to is the equivalent of — "Look with suspicion on all apparently qualitative differences."

rather vague, type of mind, such as, for instance, the neo-vitalists. Now it follows from this that the specific energies can hardly hope (or desire) to retain their peculiar, strictly 'qualitative' status, and I should like to ask the believers in specific energies if they can think of any other quantitative interpretation for these qualitative differences, than one which I have been arguing for. If I have spoken against specific energies *in toto*, it was solely because most of the followers of Müller cling tenaciously to their unanalyzable 'qualities' and account them the palladium of their sect. It is significant indeed that Helmholtz, who did more than any one else to substantiate Müller's theory by physiological evidence, held that the energies differed only in quantitative ways.[1] And it is only fair to add that in Müller's own writings the word 'quality' is used only in a casual fashion, as if it slipped in while his attention was focussed on other matters. I do not think that Müller anywhere proposes to exclude the resolution of these 'qualitative' into quantitative differences. And it is a matter of indifference whether the arguments which I have presented shall be said to oppose or to interpret and extend the *original* theory of specific energies. The real purpose of this all too tedious digression into physiology, is to show that there is excellent and abundant evidence of minute periodic fluctuations in the nerve-impulse, and of a close correspondence, in the cases of audition and color-vision, between these fluctuations and the vibration rates of the impinging physical stimuli.

We have next to examine the secondary qualities from the so-called subjective or introspective point of view: and here we shall presently see the bearing of the foregoing discursus on the realistic issue.

Our urbane adversary adduces secondary qualities, and perhaps even deigns to mention his favorite red, yellow, or blue, quite as if these matters contained no intricacies worthy of his closer attention, and none that could throw any light on his own pro-

[1] I have to give this on the authority of Hering, as I do not readily find the statement in Helmholtz's writings.

found views as to their 'subjective' nature. Indeed our adversaries, particularly of the present generation, are so emancipated from allegiance to anything that can be called empirical, look to it so little for guidance, and argue on grounds so *a priori*, that they can only expect some day or other to be punished for indolence and frivolity. The blessed Absolute will certainly strike out at them with a burst of novelties: for the Absolute is a powder-magazine as well as a precious pot of slumbering ineffables. Now the secondary qualities present interrelations both fixed and intelligible, so that those persons who seriously study them begin to see that they form a system like the systems discovered in mathematics, and this fact alone, as some one has said, already sets them off from the purely 'subjective,' individual, and incalculable. Unquestionably the most comprehensive single treatise on these interrelations is the remarkable work of Dr. Brentano, "Untersuchungen zur Sinnespsychologie." [1] He dwells primarily on the relation of similarity between the qualities. Thus in the spectral series of colors, every hue has a position intrinsic to itself by virtue of its similarity to the adjacent hues: a particular orange has no place in the series except just between a certain yellowish red on the one side and a certain reddish yellow on the other. To assign it any other position would be like trying to assign to the number 3 a position in the number series between 528 and 529. (I know that some subjectivists declare with their usual license that this can be done, but before they stake great hopes on doing it I urge that they actually try and then report to us from time to time on progress made. One *can* place orange *in space* among the reddish purples, but it hits back at one because the spatial order has been made discrepant with the 'intrinsic,' logical color order.) And the case is the same with grays, with auditory pitches and timbers, with warmth and cold sensations, to some extent (which increases with careful study) with tastes and odors: the same thing is true of all intensities in whatever field of sensation.

Now why, asks Brentano, is this relation of similarity so rigid

[1] Leipzig, 1907.

and inexorable? The reply has often been that the question admits of no answer, that namely this qualitative similarity is an ultimate, unanalyzable category; the very answer that for centuries was made regarding the similarities between plant and animal species and between chemical substances. God made them so; *voilà tout.* The modern answer is identical save that, agreeably to the whim of the day, God is left out. But Dr. Brentano is something of an empiricist, and knows the empirical grounds for the maxim that quality is not an ultimate category of science. He looks then, but only looks and does not *a priori* argue, for some quantitative resolution of these qualitative relations of similarity. And he finds them in profusion. It happens that ever since the day when Helmholtz made a group of tuning-forks pronounce the vowels, and he and Stumpf showed that musical chords can be analyzed, not merely physically but as purely 'subjective' phenomena, it has been generally conceded in psychology that a quality may seem as unitary as possible, and that it may nevertheless *be*, still merely as a conscious phenomenon, complex. It is admitted in short, though sometimes grudgingly, that even consciousness requires careful study, like any other phenomenon, and that a seemingly simple quality may only need practised scrutiny to be resolved into separate elements. The merest novice may have an inkling of this if he will strike the prongs of a fork from the dinner table, press his finger very lightly thereon, and ask himself carefully whether he feels a simple quality of roughness or a microtactile succession of impacts. In fact, the analysis of conscious qualities is precisely like the analysis of chemicals; if careful study yields an analysis, the phenomenon was not simple; if components are not isolated, the phenomenon may be simple, or it may yet be analyzed by further study.

This principle is now endorsed by the most conservative authorities, for the entire range of musical chords, timbers, and every other variety of auditory quality, except pitches, and including (with a few dissenting opinions) noises. The principle is not so

universally admitted in the field of color, and here Brentano commences his investigation — "Concerning Phenomenal Green." Is green a simple quality with 'similarities' to yellow and blue, or is the green composed of two elements, yellow and blue? Introspective reports differ, and the question arises whether this is because the judgments are based merely on associations (as in some careless investigations in æsthetics) and are subject to various 'illusions of judgment,' or whether the divergence arises because the individuals reporting have varying degrees of skill at introspective analysis, as in the case of the analysis of a chord by musical and unmusical individuals. For Brentano the latter is the case here, and in my opinion he thoroughly substantiates his opinion [1] with a wealth of fact and a scrupulous precision of treatment, which leave nothing to be desired. The concensus of opinion among painters, who are here the trained musicians, is that green is composite, and phenomenally *is* yellow and blue. This is not owing to the fact that they often make their greens by mixing yellow and blue pigments, for on the one hand they very often make green by mixing yellow and black; and on the other hand, while they as often make yellow by mixing orange and green pigments, they never see in the phenomenon yellow — orange and green. They make 'fine gray' (S. 153) too by mixing red and green, and another gray by mixing yellow and blue, yet they never see in the resulting gray these pairs of colors. Brentano's argument touches every conceivable aspect of the case, and I must here refer the skeptical reader to the original work.

Green is, in short, an interesting, because disputed, case like others which are more generally admitted. More persons admit that they see orange *as* red and yellow, that purple *is* red and blue, that greenish blue *is* green (or yellow) and blue, than admit that green is a composite quality. There is, on the other hand, a striking unanimity of opinion among the practiced as well as the unpracticed, that white resembles no color, that gray resembles nothing

[1] *Op. cit.*, 5–49, 129–158. It may be remarked, by the way, that Dr. Brentano seems to be quite untainted by realistic heresies (cf. 1).

except white and black, and that red, and yellow, and blue are phenomenally simple.[1] Thus the rudiments of a mathematical system among the colors begin to emerge, as once analytical chemistry emerged, by virtue of unanimity among the penetrating and expert, and in spite of some dissent from those less experienced.[2] Brentano brings out many other analyses of color qualities into their simpler components: but of these I will mention but one. Is it true, he asks, that red and green are as antagonistic as Hering, for instance, declares them to be when he says that they can never be perceived together at one place? And if so why is it that olive-green seems to so many persons to contain a red component? Brentano says much more about it, but I will leave the question here to the reader's introspection; admitting for myself that I have always seen red in olive-green and have never dared to say so.

In the field of audition Professor Brentano takes up an analysis by Professor Mach [3] of the pitch series, into merely two qualities — 'Dumpf' and 'Hell'; such that the various pitches consist solely of these two qualities combined in varying proportions. Brentano does not fully agree with this, but agrees so far as to admit the qualities, dull and bright, and that the lower and higher pitch ranges are always tonally unsaturated by reason of an admixture with one of these qualities, precisely as dark and light colors are always unsaturated by reason of admixture with black or white respectively.[4] There follows an incisive and careful account of the matter, based on introspective judgments, which is not wholly out of joint with the valuable contributions of Stumpf in this same

[1] Cf. H. Ebbinghaus on the 'turning-points' of the color quadrilateral (Grundzüge der Psychologie. Leipzig, 1905, 197–198), also Titchener, E. B., A Textbook of Psychology. New York, 1909, Part I, 60.

[2] An interesting paper on the mathematics of this system is K. Zindler's Ueber räumliche Abbildungen des Continuums der Farbenempfindungen und seine mathematische Behandlung. *Zsch. f. Psychol. u. Physiol. d. Sinnesorgane*, 1899, 20, 225–293.

[3] Mach, E., Die Analyse der Empfindungen, 2te Auflage, Jena, 1900; Kapitel "Die Tonempfindungen," 169–205.

[4] Brentano, *op. cit.*, 99–125.

field. On these and many other purely introspective empirical analyses of the qualities Brentano bases his principle of 'compound qualities' (multiple Qualität),[1] the principle, namely, that the qualities presented in consciousness are generally not simple, not even 'phenomenally' simple, but are composed of two or more qualities which careful introspection enables us to apprehend as integral parts of the presented quality. This principle is by no means new, being merely an extension to the entire field of conscious qualities of the principle of analysis already brought to approval and acceptance through their work on musical chords and timbers, by Helmholtz and Stumpf. And I think that an unbiased survey of the facts adduced by Brentano must convince any one of the correctness of this extension of qualitative analysis which is offered in the principle of compound qualities.

Now in recent years the traditional distinction between the 'different senses,' *i.e.* the modes, has been generally breaking down. It is at best based on nothing but the gross anatomy of sense-organs, and has just about that weight of authority which we concede to the popular 'five senses of man.' Apart from the facts that the 'sense of touch' is supplied with at the very least four different sets of nerves and sense-organs, and the tongue with at least three types of sense-organ and three distinct cranial nerves, we have innumerable conscious units, phenomenally considered, which at first sight seem as simple as colors or musical chords, but for which we know that the physiological apparatus of production involves a variety of different senses.[2] The most familiar case of this is the so-called 'taste' sensations, of which all but four (sweet, salt, bitter, and sour) involve the coöperation of an indefinite number of olfactory fibrils, besides, very often, that of touch, warmth, cold, and pain fibers as well. Thus a taste which until analyzed seems as simple as the color yellow is yielded by no less than three of the 'five senses' working in coöperation; or, in the modern terminology, by the action of the taste, smell,

[1] Brentano, *op. cit.*, 159–161.

[2] This fact is brought out well by Nagel in the essay previously referred to.

tactile, and perhaps the warmth, cold, and pain 'modes' all together. Almost every familiar touch sensation (smoothness, wetness, *et cetera*) is recognized as being similarly compounded of two or more dermal modes. And the number of such seemingly simple, yet physiologically complicated, sensations is beyond reckoning; and were it to come to such conscious entities as "the feeling of triangularity," which several psychologists have asserted to be simple, the variety exceeds all bounds. In short the modal boundaries, perfunctorily taught in many elementary textbooks, has no meaning at all for a psychology which has outgrown its swaddling clothes (cf. Nagel, *op. cit.*). Here too Brentano comes in with fresh arguments, and notably in the matter of intensity. Now intensity is admittedly a feature of all sensations and perceptions, and in so far binds together the different modes. Yet only rather recently has it been shown [1] that the intensities of two different qualities even within a mode can be accurately compared and a judgment pronounced of more and less. Professor von Kries now says that this is undoubtedly possible for colors however distinct in quality. Dr. Brentano goes further, showing that in such cases as of a very faint odor compared with a loud noise, it is possible to judge that the latter is more intense than the former. How far practiced introspection may enable us to go toward the refinement of such judgments, nobody as yet may know. There are also other communities between the different modes: "A sound that approaches a noise in character we . . . pronounce a less saturated tone sensation than another which is less like a noise. In the field of taste, indeed, Aristotle correctly remarks that sweet is related to bitter as is a brighter to a darker color. And similarly several persons whom I have asked have definitely pronounced the cool sensation of a breeze blowing on the hand as brighter than the feeling of a warm breath. A sensation of coolness compared with that of sweetness or with the odor of a lily, is as un-

[1] Cf. von Kries, J., Nagel's Handbuch der Physiologie des Menschen, Braunschweig, 1904, 3, 256–257.

saturated as white compared with a color in the narrower sense, or as a hiss or other noise compared with a vibrant tone.[1]" By such examples this author shows not only that the infinity of qualities within the mode consists, phenomenally, of combinations of elementary qualities, but also that the modes themselves merge into one another and present, in part at least, common elements such as intensity, saturation, brightness, and so forth. Lastly I will mention Professor Brentano's thesis that no quality which has intrinsically a position between two other qualities can be simple. It must rather be a compound of the qualities between which it so obviously lies. For in what, otherwise, should the two similarities, this necessary betweenness, consist? Here he takes, as unequivocally as possible, the accepted position of science, that qualitative 'similarity' is never an ultimate category.

However one may agree or disagree here with some of the particular cases, enough is proved, and I think very amply proved, to show that nearly if not quite all of the so-called secondary qualities are, taken merely as phenomena, complex; that careful introspection enables us to analyze out many, more elementary qualities; and that, furthermore, we cannot as yet see the limits to the possibilities of such analytical procedure. Such a psychological 'atomism,' for this is what the whole matter points to, has been shown by other writers to be the course which the facts are clearly leading psychology into. Professor Münsterberg is one who has urged this.[2] "Are these sensations," he writes, "the ultimate elements of our consciousness, or is that which we call a blue or a hot sensation, a sweet taste, a tone C, a muscle sensation or a pain sensation itself a complex affair which consists of more elementary parts: in short, have we in the mind ultimate elements which are simpler than the sensations? It is the inquiry for a radical psychological atomism." (pp. 4–5). "The psychological fact which stands immediately in the foreground of such considerations is the fact of the similarity of the

[1] Brentano, *op. cit.*, 80.

[2] Münsterberg, H., Psychological Atomism. *Psychol. Rev.*, 1900, 7, 1–17.

sensations. . . . Similarity from the point of view of description is community of parts: . . . The logical conclusion by analogy is that two sensations also are similar to each other only when they contain various component parts of which some are common to both. These parts are of course not sensations but inexperienceable factors like the atoms, and as we do not know a sensation which is not in some way similar to some other one, we can say that no known sensation is an ultimate element" (p. 11). Thus for Professor Münsterberg the ultimate elements will necessarily be 'absolutely dissimilar' from one another, since so long as any similarity subsisted, it would indicate the presence of some yet similar common ingredient. The same should indeed seem to follow from Professor Brentano's principle that no quality is simple which (by similarity) lies between two others. Both writers agree that all the traditional modal "demarcation lines which existed for the sensations have now disappeared. . . . The similarity between smell and taste, or between touch and muscle sensation, and so on, appears then not different from the similarity of two tones" (p. 13). Professor Münsterberg adds that only the ultimate elements, "the psychic-atoms can rightly be correlated with the physiological units" (p. 16), meaning to suggest, clearly, something like cortical cells or synapses.

This is a very promising program, but one point needs further examination. We seem to come out with a set of 'utterly dissimilar' psychic elements, and we seem to have no clue as to how many of these we are likely to find; it will apparently not be less than the number of cortical elements. This must be, of course, as it empirically is found to be; and yet an analysis with so stated a limit is so different from all other scientific analyses, that one is prompted to look through the argument once again. Besides, scientific analysis arrives at similars and not at differents. Will it pay us to undertake the analysis at all if at the end the number of irreducible elements is to be not less, and perhaps far more, than the number of brain-cells or synapses? Will that be a kind of science to which the human mind shall advisedly address

itself? We have already seen that introspective analysis is precisely comparable to chemical analysis, and Professor Münsterberg's program promises as its goal very much that thing which chemistry had attained when it had reduced all substances to some seventy not further reducible types of atom. But we now see that this was not to be the goal of chemistry; the periodic law, largely, dissolved these 'atoms.' A further comparison with chemistry shows the miscalculation in this psychological program. And this lies in the neglect of an important aspect of analysis.

If it is true that a quality which lies between two others must have a common ingredient with them, it does not necessarily follow that for the original three qualities the total number of ingredients is now four (one common and three proprial). Such cases occur, but they are utterly atypical. Typically the three qualities are at first found to consist of two ingredients only, combined in different numerical proportions; and finally of only one substantial ingredient, such as one kind of atom, variously organized, such as three sizes of molecule. And science has the best empirical evidence for accounting no analysis complete until it has reduced *all qualitative differences* to different arrangements of elements which are all alike in quality. (And 'quality' here is presently seen no longer to have a meaning.) In physics and chemistry these arrangements are confessedly numerical values organized in time and space. Now it is here, probably, that Professor Münsterberg finds the rub, for he denies (for reasons of a somewhat metaphysical character) that psychic atoms exist in time and space, or can be organized therein. It should seem to be for this reason that he sets so singular a goal to psychological analysis. Now we can for the moment grant him the timeless aspatiality of psychic atoms, since a merely numerical, or, as I should perfer to say, logical principle of organization is quite enough for our purpose; — of which the number system itself is an instance. This principle alone will give, from one type of element, all the variety which we require, as any one shall see who will trouble to enumerate all the positive whole numbers, to say nothing of the

negative, fractional, irrational, and 'unreal' numbers. There seem, then, to be no reasons of a general nature why we should not hope to reduce by analysis all of the conscious qualities to different forms of organization of one sort of element. So much for theory; how are the concrete facts?

They are most patently that psychic entities in general (and not merely elements) are organized into higher units precisely in time and space. The 'Gestaltqualitäten' are precisely such higher units: any rapidly phrased sequence of a few tones yields a form-quality which psychologists have repeatedly declared to be a new, unique, independent, and unanalyzable quality; and yet it is a thing of which the structure remains conspicuous. New and unique it may be, but it is neither independent nor unanalyzable; indeed, the conscious analysis cannot be inhibited except by the most purblind votary of preconceptions. Certainly there is novelty about a new form of organization; water is, indeed, more than oxygen and hydrogen, it is these with organization added. And this is precisely what the analyst says, — water is hydrogen and oxygen *and* organization. So with the form-qualities. Their number, too, is without end in all the fields of sensation where succession can be perceived, and I make bold to affirm that none can deny that here the psychic components are organized in time (just like 'ether' vibrations) except after an *a priori* metaphysical preamble which is deliberately calculated to obscure the salient empirical fact.

Now we have form-qualities in space as well as in time. The late Professor James has dwelt on the integral aspect of such 'feelings' as that of triangularity, rotundity, squareness, and one quite grants this as one grants the integral aspect of water. Indeed I should add millions more, for I discover a similar integral aspect to the comic and the tragic, to the picturesque, the blithe, the wholesome, the inquisitorial, and the horrific. (While the unanalyzed aspects of the canonic-pretentious, the idiotic-fallacious, the obscurantic, and the conscious-deceptive are units to keep well in mind so that one may recognize and name them when one

meets them — whether in one's self or in another.) These all, however, have their disintegral aspects as well; they are clearly complexes organized temporally, spatially, or logically, or in more than one of these ways at once. The beauty, however, of the purely temporal or spatial form-qualities is that they reveal more clearly than any instance ever shown in chemistry, that the peculiar flavor of the whole does not devour and supersede the distinctness of the parts, or that the relatedness of the parts is not repugnant to the unity of the whole. If one finds it at all within one's powers to believe that the water which one drinks *is* oxygen and hydrogen spatially combined, how much more should one see that the Graal Motiv *is* a temporal succession of tones, and that the triangle *is* perceptions of line and angle spatially ordered: for the water does appear to supersede its gaseous components, whereas in the form-qualities the synthesis and analysis are to be observed simultaneous and amicable. Once more I affirm that one cannot deny the spatiality of the organization of the conscious elements of a triangle, except one close one's empirical eye-lids in sleep.

But these cases seem remote from the secondary qualities, our theme. I mention them merely because their temporal and spatial organization is so indubitable. Yet from these form-qualities we can pass directly down to the qualities where the formal element almost or quite defies introspection, and we shall find examples at every step. A paradigm than which nothing clearer can be desired is a series of light touch stimuli given at an ever increasing rate. The single tap is called a conscious (secondary) quality. A pair in slow succession is already a form-quality, with all the vaunted charms of novelty, uniqueness, and what not; yet I will not believe that even amid such delights any one can for an instant find there anything more than two taps plus temporal organization (I grant that this last consists of more than mere twoness). A pair given in more rapid succession is another form-quality, 'entirely different' from the first, as we may read in many of the textbooks. It is not entirely different, but it is different, and by just as much as the difference of temporal or-

ganization has altered it. Here too the unity of the whole does not infringe on the distinctness of the parts. As the taps are given in faster and faster succession, however, there comes a time when encroachment sets in (at somewhere around 3 taps per sec). The integral aspect is approaching that to which we give the name roughness (but is not yet roughness), and the attention is drawn ever and anon from this to the other aspect, which now consists in an attempt to count the taps and to articulate the number with the tongue. The two aspects have begun to behave precisely like the two aspects of water — *either* H_2O *or* water. The incompatibility of the two aspects depends, however, on no feature of the new form-quality, but on a definitely physiological defect of the time-sense which has begun to be flustered and calls in the tongue to its aid and so spasmodically wins to itself the balance of attention. This is precisely comparable to those time-errors mentioned in an earlier part of this paper. Even here favorable moments arise when the integral and disintegral aspects are apprehended together and as not antagonistic. As now the rate of tapping increases the unified aspect approaches the (form-) quality of roughness, and more and more tends to usurp the attention; while the succession-of-parts aspect becomes vaguer. Articulation is outstripped, then the count is lost, then a sympathetic, voluntary, inner rhythm (of the vocal cords?) which replaced lingual articulation falters and fails, leaving a bare and non-participating awareness of succession. This last persists up to very much higher rates, dying down only at about 600 taps per second. Meanwhile the roughness has become a distinct quality in its own right, so that some psychologists describe it as subsisting with, but 'utterly independent' of, the awareness of succession. They are the same who find water utterly independent or hydrogen and oxygen; while the truth is merely that with the increasing rate of the taps comes increasing (logical and temporal) complexity of relations, to meet which the attention (with its time-sense and other auxiliary implements), no longer able to survey the whole intricacy, covers such parts as it best

can. Again (to resort to my all but evaporated simile) this is like the many properties of water, all of which are deducible from, and logically bound up in, the properties of oxygen and hydrogen and their form of combination; yet so intricate is the whole manifold, that the scientist thinks himself fortunate if in a lifetime he can make a survey of even the vapor-pressure properties of oxygen or the rôle played by water in dropsy of the mammalian heart. This is what there is, and all that there is, in the current semi-mystical rubbish about the incorruptibility of wholes into their parts. A whole is different from and independent of its parts for precisely those persons who find the word 'independent' so censurable when uttered by the realist.

Thus in the experience of tactual roughness the properties of the ordered whole gradually supersede in attention the properties of the parts ordered, not because the whole, as the rate of tapping increases, is coming to be anything other than the ordered sum of its parts, but because the quicker succession soon eludes the sense of time, and so leaves other features of the succession (which moreover is itself now a more complicated thing, per time unit if not also otherwise) to occupy the attention. This is merely to say, what we have found all along, that the faculty of attentive introspection (and notably in so far as this relies on the time-sense) has its distinct limitations. Stated with less concreteness but with more logical precision, the case is this. Even a slow succession of taps (and even were each of these logically simple like a geometrical point) is already a logical system of no mean complexity; as one sees from the number of derivatives discovered by differential calculus where a rate of succession is involved. It has therefore distinct parts which I have in deference to a bad tradition called 'aspects.' Now the case of the rather slow tapping shows us that the series *is* at one and the same time both a division of time and a quality, roughness; by which I *do not* mean that the quality is anything over and above, or added to the pure succession of taps. It is some intrinsic feature of that succession, logically bound up in it. The quality part may be

related to the time-division part as the mere arithmetical number of railroad ties to the mile is to the spatial distance between the ties: these two values are simple functions of each other, of course, and yet mathematically not identical. Indeed, the actual experience of the taps strongly suggests that the quality *is* the number of taps per unit of time (*i.e.* their *density*) as distinguished from the (perceived) time interstices between them; for as this time-perception wanes, the (to be sure uncounted, which is a still different matter) number-quality, if I may so call it, waxes. To show that this is by no means whimsical hair-splitting, I may remind the reader that in railroad construction one speaks of a cheap or expensive road-bed, quite as if these were 'qualities' of the bed. Now this quality of expense is held to vary directly with the number of ties to the mile (for one of the factors); while the very different quality of safety of traffic is held to vary directly (for one factor) with the *nearness* of the ties to one another. And even to a layman it would seem less direct to state the safety of traffic in terms of the number of ties to the mile, or the expense of construction in terms of the spatial vacancies between the ties, although either could be done and by some accountants doubtless is. Similar niceties abound in the computation of traffic-density, train-load, and so forth.[1]

Again a rate of motion is a rate of motion, yet it has, not by way of additions but by way of inclusion and inalienably, first, second and n derivatives of space with regard to time: these are parts of it just as number of taps per time unit and the divided time intervals are parts of the tap-sequence. Yet as intimately as the rate of motion and its first derivative are related, so that to loose thinking "one is merely a different aspect of the other," the rate of motion may be very great while the first derivative is zero;

[1] Again, to borrow a simile from Professor Royce, how unrelated is the shiftless or penurious habit of shaving every other day, to the pious practice of shaving immaculately every Sabbath: surely as different as the quality of tactual roughness is from the quality of tactual slowness. Yet the oft-demonstrated incompatibility of shiftlessness and piety rests on the mere numerical triviality that 3 times 2 is an even number, while 7 times 1 is odd. The parallel is imperfect.

the body is moving rapidly, but accelerating not at all. And when this little mathematical scheme of relations is found to prevail in concrete affairs it often determines extreme qualitative contrasts. A man may be very rich (a form-quality surely) and happy (another and very different form-quality), yet the being-rich depends on his rate of income while the being-happy or unhappy depends on the first derivative of the rate of income — the rate of accumulation; for however rich a man is he sees and feels his fortunes bright if his rate of income is increasing (*i.e.* if the first derivative is positive); but he sees them dwindling and feels that ruin is only a matter of time if the first derivative of his rate of income is negative.

I hold it then to be no academic act of logic-chopping if I say that the experience of the tactual rhythm shows that time-division and number ('*Anzahl*') of taps per time-unit are distinct though inseparable parts of this sequence, and that this *latter* feature *is* just the quality of roughness. At some rates the attention may be given to both features simultaneously or to either at will; at other rates the powers of attention (introspection) prove inadequate and only the quality can be apprehended. This reveals a limitation of the power of introspection, and more specifically of the time-sense, but not any cleavage between the inseparable features of time-division and tap-frequency.

Now as the rate of tapping becomes still faster the quality of roughness changes continuously toward the quality of smoothness (just as in the spectrum red changes to yellow), until eventually it has run its gamut and becomes the steady quality of continuous touch; which under other complications is a component of the form-quality solidity. The precisely parallel experience is to be had in the field of audition where a slow sequence of faint thuds or hisses passes over into a musical pitch. Here too there is a rate (best gotten with a siren of governable speed) at which the sound sequence and pitch are experienced together, as distinct but inseparable. Here too careful scrutiny shows that the marked-off time-intervals are time perceptions, while the repeated

hisses *are* the quality of pitch: the two are just as distinct but just as inseparable parts of the given succession as are the first and second derivatives of a rate of motion. In perception they *are* separable (as in mathematics distinguishable) just as in perception the form is separable from the size of a concrete object: — so specific is the action of the nervous system in selecting what features of a complex shall enter consciousness. The same experience is had again when the beats between two tones (nearly alike, but steadily departing from each other in pitch) gradually pass over (with a disagreeable transitional stage of dissonant roughness) into a third pitch, the difference-tone. Anent which we have some amusing speculations, called introspections, by persons whose logic has vitiated their introspection. These persons say that because the beats *and* the difference-tone can at a certain rate be apprehended simultaneously, the two "must be utterly independent" entities — a point which we have already dealt with. The parallel experience can be had in vision where an intermittent color stimulus is seen with increasing rate of flicker. At first it is succession without the flicker quality, then succession and a form-quality of flicker, then less obvious succession and more distinct (form-) quality, then the quality of (rough) flicker, then the quality of smooth flicker, then the end. This series is run through rapidly, since flicker entirely disappears at 60 to 70 alternations per second. The plain lesson of all these cases is that what we call secondary qualities are in truth form-qualities, simple psychic entities in temporal organization (rate of sequence) and we are tempted to view them as qualities instead of form-qualities because for all but the most absurdly slow rates of succession the time-sense is inadequate to its task. The successive 'aspect' is unperceived while the multitude 'aspect' (it might be by mere summation) gains on the attention. The time-sense throws over its duty so preposterously early that it is no wonder that for the upper range of pitches and for all the colors (which we know are 'correlated with,' and which I am aiming to show are identical with, extraordinarily rapid successions) every

trace whatsoever of a form-quality should elude the introspection.

We are now in a position to sum up what I fear will have been a tedious and apparently aimless array of evidence. The prevalent form of the specific energy theory, or the view that the secondary qualities present ultimate unresolvable 'qualitative differences' (like the immutable species deposited by the hand of God in the Garden of Eden), has utterly broken down. It is actually the view that the qualities are independent, unanalyzable, psychic *substances*, and there is no good evidence that Johannes Müller ever intended his theory to take this shape. These qualities, considered merely as phenomena, reveal to introspection compound structure (musical chords, timbres, colors like blue-green, orange, violet, sensations such as roughness), 'similarities' (odors), and other affinities and repugnancies which prove that these qualities are not so independent as was supposed, but are at least related as different species are related in a genus. Further, the field of consciousness presents innumerable instances of psychic components organized into higher unities by means of spatial or temporal relations (form-qualities). Indeed, the entire field of consciousness presents *nothing but* such complex entities in which the principle of organization is either spatial, temporal, or logical, *and* a class reputed to stand quite apart, of entities alleged to be simple and independent — the 'secondary qualities.' These complex entities have indeed a unified 'aspect,' on which alone some writers are prone to dwell, and otherwise they were not units at all; but they each and every one, as I have tried to bring out, reveal unmistakably the unity of the whole undispelled by the relatedness of the parts, and the ordering of the parts constitutive of the unity of the whole, as even no example of chemistry or physics so reveals. To any but the most purblind gaze they utterly scatter and quench the neo-Hegelian imbecilities about 'vital,' 'organic,' unanalyzable, and altogether ineffable 'wholes.' Alone the secondary qualities maintain their hereditary Sonderstellung. But we have found a breach in their wall and now know

how defenseless is their position behind it. Any form-quality of which the principle of organization is *time* is, like any other content, dependent on the mechanism of perception for its entry into consciousness. And when time is the formal principle, this form, if perceived at all, must be perceived by aid of the time sense (of which the physiological mechanism is so far not in the least understood); and this time-sense is utterly inadequate to perceive the form-qualities when the time divisions therein involved are very small.

One hears that the time-sense is most acute: and the most favorable case that can be cited is that of bare succession. A single pair of auditory stimuli can be perceived as two, even when they succeed each other by two thousandths of a second. But this is not in truth a time-perception; it is one of mere 'twoness,' *i.e.* bare numerical as opposed to a truly temporal discrimination. And if the stimuli continue at anything like this rate of succession, the conscious result becomes at once a mere burred sensation akin to the quality of roughness. The time interval involved is not apprehended (as time). Tactual roughness can still be apprehended when the stimuli are as frequent as 600 per second, and this, again, is cited as a feat of the time-sense. But such it is not. There is no more consciousness of time involved in the quality of roughness than in that of smoothness or in the quality red, as the most casual introspection proves. What is interesting about roughness is that its quality varies so immediately with the number of stimuli given in a time-unit that it shows conclusively that the nerve is able to carry an impulse of this same frequency number, and that the roughness quality *is* precisely this frequency magnitude and with the time element specifically omitted from consciousness. Just this, now, is what I contend is the case with all of the secondary qualities: they are all *form*-qualities in which the temporal subdivisions are so small that the *time*-sense cannot discriminate them, whereas the frequency magnitude or the *density* still remains perceivable: and density is different from time, since we have it in spatial and even in mathematical manifolds.

Now if the secondary qualities are all such densities, it must be

that, however inadequate the time-sense, the nerve-fibril is at least able to carry these densities or frequency magnitudes to the brain (even those of the highest frequencies, which are the violet end of the spectrum). And this is precisely what physiology is now showing to be the case. Rayleigh and More have proved that the auditory nerve carries sound-frequencies, up to 512, if not 1024, per second. And Meisling has adduced facts and arguments of great weight to show that the visual cones are electromagnetic resonators, and that the optic nerve must carry impulses of a frequency proportioned to that of waves of light. Everywhere, moreover, physiology, as distinct from sense physiology, is finding in the phenomena of 'Treppe,' refractory phase, *et cætera*, that the nerve current shows oscillations which can be measured only in a few thousandths of a second. If physiology has been late in discovering this, it is because such frequencies, to say nothing of higher ones, could by no possibility have been discovered prior to certain very recent improvements of instrumental technique, and specially the introduction of the oscillograph or string-galvanometer. I hold it, then, to be a view which is amply supported by facts, that the secondary qualities, instead of being unanalyzable psychological elements are all form-qualities of which the time-sense is inadequate to perceiving the form, while the density is perceived for very high frequencies by a process which is perhaps related to physiological summation. It is to be noted that the secondary qualities seem to engage the attention roughly in proportion to their density, as from our present view we should be led to expect. Tactual roughness is readily driven from attention (inhibited) by a sound of moderate pitch, this by a higher pitch, and so on up. But a color of anything like the same intensity, when presented, makes it difficult to attend to a sound.[1]

[1] Of course all this is true only when the comparisons are carefully made. Attention factors such as 'Bewusstseinslage,' difference of intensity between the compared qualities, fatigue, and many other factors will obscure the point. I am speaking, too, of cases where the time element is not present, and excluding, therefore, such temporal form-qualities as *rough* flicker *et cætera*. Where the temporal organization begins to be perceived, it often strikingly commands the attention.

Our argument comes out to a psychological atomism which is substantially like that proposed by Spencer.[1] "Although the individual sensations and emotions, real or ideal, of which consciousness is built up, appear to be severally simple, homogeneous, unanalyzable, or of inscrutable natures, yet they are not so. There is at least one kind of feeling [musical sound] which, as ordinarily experienced, seems elementary, that is demonstrably not elementary. And after resolving it into its proximate components, we can scarcely help suspecting that other apparently-elementary feelings are also compound, and may have proximate components like those which we can in this one instance identify" (pp. 148–149). There follows an account of the beats going over into a difference-tone, and so forth. Now "if the different sensations known as sounds are built out of a common unit, is it not to be rationally inferred that so likewise are the different sensations known as tastes, and the different sensations known as odors, and the different sensations known as colors? Nay, shall we not regard it as probable that there is a unit common to all these strongly-contrasted classes of sensations? If the unlikenesses among the sensations of each class may be due to unlikenesses among the modes of aggregation of a unit of consciousness common to them all; so, too, may the much greater unlikenesses between the sensations of each class and those of other classes. There may be a single primordial element of consciousness, and the countless kinds of consciousness may be produced by the compounding of this element with itself and the recompounding of its compounds with one another in higher and higher degrees: so producing increased multiplicity, variety, and complexity" (p. 150).

"Have we any clue to this primordial element? I think we have. That simple mental impression which proves to be the unit of composition of the sensation of musical tone, is allied to certain other simple mental impressions differently originated.

[1] Spencer, H., The Principles of Psychology. Third Edition, I, Part II, Chap. I, (New York, 1892, I, 145–162).

The subjective effect produced by a crack or noise that has no appreciable duration, is little else than a nervous shock" (p. 150). Quite so, and I think that the experience which I before called the still small voice of psychology, somewhat approximates this primitive nervous shock. Spencer gives many further illustrations. "The fact that sudden brief disturbances thus set up by different stimuli through different sets of nerves, cause feelings scarcely distinguishable in quality," he continues, "will not appear strange when we recollect that distinguishableness of feeling implies appreciable duration; and that when the duration is greatly abridged, nothing more is known than that some mental change has occurred and ceased. . . . It is possible, then — may we not even say probable — that something of the same order as that which we call a nervous shock is the ultimate unit of consciousness; and that all the unlikenesses among our feelings result from unlike modes of integration of this ultimate unit" (p. 151).

In view of the time at which this was written (about 1855), the speculation seems astonishingly bold. Even more so, to me, seem certain remarks (pp. 152–153) on the oscillatory nature of the nervous impulse, and I should much like to know what physiological investigations were then available, which justified the belief in nervous frequencies at anything like the rate of sound or light. Nevertheless subsequent investigations have remarkably confirmed Spencer's view (I had almost said, intuition), and it seems to me that to-day this atomistic theory of consciousness, hardly modified from the form which Spencer gave it, must be looked on as a very shortly to be demonstrated fact. Most substantially supported by empirical investigations it already is. For myself I quite adhere to this view, while dissenting from Spencer's further remarks as to the nature of the primordial conscious unit, and from other features of his philosophy of mind. In weighing this theory one should never forget the phenomenon of roughness, which (whatsoever the sense-organ that originates it) *is* to introspection a quality, and *is* at the same time nothing else

than the density of a succession of conscious shocks, which seem individually to be of quite infral-modal primitiveness.

This completes our argument. And now I can reply to the anti-realist's questions: How can realism pretend to assert the reality of the color, sound, and so forth which are vividly present in the dreams of a person sleeping, it may be, in a box no bigger than his coffin? Realism, I say, can assert this because the nervous system, even when unstimulated from without, is able to generate within itself nerve-currents of those frequencies whose density factor is the same as in ordinary peripheral stimulation. I have not said, be it noted, that the density factor of the nervous impulse is the secondary quality: it is the density of the series of some relatively primitive sensation which *is* the secondary quality; and nerve impulses may also have such a density, as also may Hertzian waves and many other things. The case, then, of sensory hallucinations, whether due to the 'inadequate' stimulation of nerves or to so-called central excitation, is entirely comparable to the cases of illusion which we considered in the earliest sections of this paper.[1] In this connection I should not quite say with Professor Alexander [2] that, "The illusory character of the appearance is the defect of our quality. With an organ adapted to see red we can see only red, no matter how the organ is set a-working." The hallucinatory quality needs to be explained more specifically, and this, I think, we have done. We could, of course, be more specific yet and suggest that such sensory resonators as the retinal cones would resonate in their own period to the electricity released by any of the various metabolic processes going on in their vicinity (as a brass resonator will sound its own tone in response to any tap): we could suggest that the cortical synapses have much to do with the periodicity of

[1] If some un-serious objector wishes to know, then, whether these qualities may on occasion be surprised by an outsider as they flit through some patient's skull, I will say that it is here precisely as with the same nerve-oscillations when they are normally instituted. One studies their densities by such means as one finds available; and these are commonly not the unaided eye or ear.

[2] Alexander, S., *Proc. of the Aristotelian Soc.*, 1910, N. S., **10**, 10.

nerve-impulses: or that nerve-impulses of various periods coming together in the central nervous system must often produce an impulse of a new and perhaps higher frequency. But speculation on the minuter details ought to wait on investigation. Certain it is that the nervous impulse at large is oscillatory; and that the oscillations do sometimes (without external aid) become very rapid, is no ground for astonishment.

I must here forestall an erroneous inference that will almost certainly be made from the foregoing paragraph: this is, that hallucinatory and other consciousness is in the skull. Quite on the contrary, consciousness, whenever localized at all (as it by no means always is) in space, is *not* in the skull, but is 'out there' precisely wherever it appears to be. This is, for me at least, one of the cardinal principles of realism, and a realist would say with Berkeley that "the rose is really red" and so forth, just as it appears to be.[1] The idea that consciousness is within the skull, current as it is, has arisen from the obvious connection between modifications of the nervous system and changes in consciousness. But this connection can be in other ways than that of a spatial inclusion of consciousness by the nervous system. Suppose, for instance, that the latter is like a search-light which, by playing over a landscape and illuminating now this object and now that, thus defines a new collection of objects all of which are integral parts of the landscape (and remain so), although they have now gained membership in another manifold — the class of all objects on which the illumination falls. Here, too, there would be a direct connection between the members of the illuminated class and the movements of the light: as there is between the contents of consciousness and changes of the nervous system. Any class that is formed from the members of a given manifold by some selective principle which is independent[2] of the principles which have organized the

[1] I cannot here treat such a point with the thoroughness that it deserves. I have, however, discussed it at length in a volume, "The Concept of Consciousness," which was completed some time since and which will appear, I hope, very shortly.

[2] See Perry's essay in this volume, The Importance of the Notion of Independence.

manifold may be called a *cross-section.* And such a thing is consciousness or mind, — a cross-section of the universe, selected by the nervous system. The elements or parts of the universe selected, and thus included in the class mind, are all elements or parts to which the nervous system makes a *specific response.* It responds thus specifically to a spatial object if it brings the body to touch that object, to point toward it, to copy it, and so forth. It responds to a secondary quality which is 'on' a particular object by, firstly, a similar (and physiologically very complicated) response to this special color and no other. This last is effected, the facts seem to show, by the nerves being capable of carrying a nervous impulse of the same frequency as the vibrations which are sent through the intervening space by that color. If the nervous system can pick these up and transmit them, it can specifically respond to them: otherwise not. This puts the colors or qualities into the nervous system neither less nor more than the fact of ether or air vibrations of the same period or density existing all through the intervening space puts these qualities into that intervening space. We are little tempted to believe that the color of a flower fills all the space between the flower and the eye: and neither less nor more does it fill, or enter into, the peripheral nerves and skull. The entity responded to is the color out there, two factors which involve two factors of response; but *that color out there* is the thing in consciousness selected for such inclusion by the nervous system's specific response. Consciousness is, then, out there wherever the things specifically responded to are. Now in cases of hallucination, indeed, the colors, shapes, and positions responded to are not in 'real space,' as we are accustomed to say; but they are in a space which is in all respects comparable to mirror space, and which is just as objective. Of their *reality* I shall say more in connection with thinghood and contradiction.

But one more point here. In calling the primitive entity whose density constitutes a secondary quality a 'sensation,' I meant in no wise a thing within the skull, nor a thing at all mental or

subjective in substance.[1] To introspection itself this simple entity is as objective as anything else; it is simpler, truly, than a concrete object like a shell or fossil, and so may seem more abstract. But it has all of the objectivity of other abstractions such as points and numbers (which are as little subjective as the starry heavens). I have discussed at length in another place [2] the ultimate substance of mental and physical elements, and endeavored to show that no difference of substance exists between the two groups. Professor Stout has well called the qualities "secondary attributes of matter." [3] Mind and matter consist of the same stuff,[4] and the little entity that in aggregates of various densities constitutes the secondary qualities is not far removed from the little atom that constitutes physical bodies, and in point of *substance* there is no distinction at all. So, it seems to me, we get an intelligible picture of how the secondary qualities are as objective as the primary. Their being included or not being included in the class of things which we name a consciousness, depends for both alike, on their being specifically responded to by a nervous system. But consciousness is in no sense at all *within* the nervous system.[5]

4. *Illusions of Thought.* — In the matter of errors of thought —

[1] I take it that this is in opposition to Mr. Nunn's "realist doctrine which takes as ultimate data a psychic monad." *Proc. of the Aristotelian Soc.*, 1908, N. S., **8**, 149.

[2] The Concept of Consciousness — chapters on the Substance of Mind, and the Substance of Matter.

[3] Stout, G. F., *Proc. of the Aristotelian Soc.*, 1904, N. S., **4**, 146.

[4] Cf. Alexander, S., *ibidem*, 1910, N. S., **10**, 16.

[5] I hold this view of the secondary qualities as densities, solely because of its empirical (and not its realistic) value; but I offer it *here* on account of its interesting and favorable bearing on realism. For realism it is not essential that the nervous impulse should reproduce and transmit to the brain any specific character or property of the stimulus. And indeed, while my own views are as stated above, I can conceive that realism should successfully dispense with my notion of 'specific response.' This too is not a theoretical construction in the interests of realism, but my reading of the empirical facts. Were it merely the former thing, I should feel bound to define more sharply 'specific response,' which is now the best name I have so far found for an empirical relation that on further study I hope to be able to describe in much greater detail.

contradicted opinions, fallacies exposed, disappointed expectations, and outstanding perplexities — we meet again a difficulty which can honestly be urged against realism, one where the anti-realist challenges and still more inspires the thoughtfulness and zeal of the realist. Such contradictions subsist, it is quite true, and if realism took on itself to explain them away realism would, in my opinion, be no better than several other obliteration-philosophics which I could name. The task for realism or for any philosophy is not to show that evil is only quintessential good, the imperfect-perfect, and so on, but to acknowledge the empirical subsistence of errors and contradictions and to show the significance and place of these things in the tissue of the universe. And precisely here I believe realism achieves one of its most signal triumphs.

We have already found, and left still outstanding, a charge against realism which is now just a case in point. Not the illusory or hallucinatory image as such, it was rightly said by our opponent, but such an image when *it asserts itself to be* or when *the realist asserts it to be* a real object, is the crux for realism. And the sting of this situation would of course be that such a thought would soon find itself contradicted. The illusion that proclaimed itself real would soon encounter a higher authority to show up conclusively its unreality. Or the realist who declared these unrealities to be real could soon be confronted with the contradictory empirical evidence that they are unreal. And he certainly could be. The difficulty in either case is clearly one of contradictory assertions or opinions — errors of thought — and so we can discuss these issues together, and in doing so we shall have left from our previous arguments no other objections outstanding. The issue includes all illusions of thought, but is more comprehensive still, and therefore it logically introduces a new section.

II

ERROR

1. *Images Assert Nothing.* — Our first case shall be the above-mentioned 'crux.' Now it is not true that an image or other content 'asserts itself' to be real, although I am aware that several neo-realists and other persons who may be said to evince some leanings toward realism, have declared this.[1] I cannot see with what right a person asserts that a "truth which the sensation 'reveals' is its own extra-mental existence." This is certainly revealed, but not by the sensation content itself. Nor can I conceive that any content asserts, for or about itself, truth, reality, objectivity, or anything else; such content simply is, and anything asserted for or about it is another content and one of a *propositional* nature: this is a thought or opinion and it may or may not be a true one. The former content simply is, and is in itself neither true nor false. As Professor Dewey has said,[2] "Truth and falsity [and I should add reality and unreality] are not properties of any experience or thing, in and of itself or in its first intention": that is, in its capacity as a bare subsistent. The fallacy in this notion of the self-qualification of mental contents lies in a failure to discriminate the bare content as it subsists, from (propositional) assertions about it which may coexist with it in the mind, either explicitly or subconsciously. The first content is what logic knows as a term, the second is one or more propositions. To confuse the two is absurd. But the same confusion is present wherever we find it said that a sensation or idea is 'aware of,' 'refers to,' 'points at,' or 'means' its object. The content does not refer to its object in any way; it is a part of the object. Any such assertion about objectivity or about reality is another (and propositional) content; it is also

[1] *E.g.* Stout, G. F., *Proc. of the Aristotelian Soc.*, 1904, N. S., **4**, 159. Nunn, T. P., *ibidem*, 1910, N. S., **10**, 201.

[2] Dewey, J., Mind, 1906, N. S., **15**, 305.

supplied by experience, and it may itself be further qualified as to truth and reality by another propositional content. It is important to discriminate in every case between what has been called the content and intent, or more accurately between terms in the mind and propositions in the mind; and after that, in the words of Professor Alexander,[1] "the intent is for description another and special part of the content." I do not admit, then, that the image, whether it is true or illusory, asserts anything about itself. Such an image may, however, exist in the mind together with mutually contradictory propositions about it; — another case of errors of thought, which we are to examine.

2. *What the Realist Asserts.*[2] — The realist does also not assert that an unreal thing (image or whatsoever) is a real thing. And here the realist insists on the conscientious observance of a distinction which logic and mathematics have long since known and scrupulously observed, which even some idealists have perhaps heard of, but which not one anti-realist nor yet all realists seem even remotely to appreciate. This is the distinction between reality and being or subsistence. Here is a typical case of 'reality' confused with being. Professor MacKenzie writes,[3] "and so the new realist seems to be in truth one who is persuaded that things are just as he apprehends them. The idealist, on the other hand, maintains that what is directly perceived is never in itself real." Thus when the realist says that as things are perceived *so they are*, the idealist stupidly misunderstands him to say "as things are perceived *so they are really*," *i.e.* all perceived things are real things. But while all perceived things are things, *not* all perceived things are *real* things.[4] Stupid as such a confusion is, it will be found to have been made at some point in every anti-realist argument. This abuse involves two of Perry's fallacies,[5] pseudo-simplicity

[1] Alexander, S., *Proc. of the Aristotelian Soc.*, 1910, N. S., 10, 2.

[2] I have treated all of the ensuing topics more fully in my Concept of Consciousness.

[3] Mackenzie, J. S., Mind, 1906, N. S., 15, 318.

[4] This is why on a previous page I said that "as they really are" is not a realist's phrase.

[5] Perry, R. B., *J. of Phil., Psychol., etc.*, 1910, 7, 341, 350.

and verbal suggestion: 'reality' is taken to be a simple qualification connoting no more than being (as if there were no *un*reality to be accounted for, as there *is no* non-being); and, again, the fulsome delights experienced by most minds on mention of the 'real' (especially when exasperated by idealistic futilities and untruths), make it a welcome epithet which can be slipped in unprotested anywhere. Small wonder that idealistic arguments which provide so little of the article should make the most of a pleasant verbal suggestion: for however troubled the sea of debate, the comfortable word 'real' gives one a sense of being at home.

Now for realism by no means everything is real; and I grant that the name realism tends to confuse persons who have not followed the history of the term. For the gist of realism is not to insist that everything is real, far from it, but to insist that everything that is, is and is as it is. Not a dangerous heresy, this, it should seem; but it just happens that every form of idealism has maintained the contrary, has maintained, to use a term of Professor Dickinson Miller's, some kind of 'false-bottom' theory of the universe. Idealism has either said that since some things are demonstrably erroneous they are not as, on the same authority, they are (*i.e.* erroneous) — and this is the German way; or it has said that everything is erroneous, nothing is as, on the very same authority, it is — the way of Mr. Bradley and his school. The approaches to idealism are extraordinarily diverse, or at least are so represented by their expounders; but these latter are in fact primarily engaged with the problem of error, and either they profess to discover that it is not, and so find themselves rather busied with an uneasy conscience; or else they are obsessed with error everywhere, and consequently fold their hands in despair. For if I dare profess at all to grasp these anthropological mysteries, the differentia of idealistic philosophers is their common assignment of first importance to the problem of knowledge, and this problem has been, from the earliest Greek times to our own, primarily the problem of error. Realism neither succumbs to this problem with the *non-possumus* of the modern

English school, nor tries to explain error away with the solemn circumstance of the German schools. It meets, if I may venture at all to speak for it,[1] the problem of error by borrowing from logic and mathematics the well-authenticated distinction between reality and being. The universe is not all real; but the universe all is. Two more distinctions, and we proceed: being is to be distinguished not merely from being real, but from being true, and from being perceived or thought. Realism has a just and proper place for the functions of perception and thought, but the subjectivist's contention that "being means always in some sense or other [*sic*] being perceived or thought," rests solely, as Perry has demonstrated,[2] on the fallacy of the ego-centric predicament.

3. *Contradiction and Being.* — The earliest (and very ancient) 'solution' of the problem of error seems to have been that errors are all matters of opinion, are merely subjective, found only in consciousness: but that the objective world is error-free, so that no one need worry lest the universe totter and collapse. This remains to-day the comfortable popular view of the matter. Nor can I see that the triumphal progress of idealism has brought enlightenment. Rather has idealism thrown us back on the original difficulty by asserting that everything is subjective, from which the conclusion must be that error is again ubiquitous. Yet many idealists, and especially the leather-patch school of Professor Karl Pearson and his associates, profess not to draw this conclusion, since they continue to dispose comfortably of error on the ground of its 'subjectivity.' It is true that Hegel undertook to treat error much more responsibly, but his solution seems to have evolved a checkmate of thought and intellection *überhaupt*, so that his followers have no course left to them save to sing the cradle-song of the Absolute, and, so lulled, to surmount error by oblivion. Yet error remains a problem for persons who have kept awake, and one observes that the hated name of realism

[1] But of course I offer this, as well as any other lines of argument, as merely my personal interpretation and defense of realism.

[2] Perry, R. B., *op. cit.*, 5–14.

suffices to arouse even the Hegelians to a disturbed consciousness: "If you won't repose ineffably [1] in the Absolute, what are you going to do with error?"

Now it may be admitted that 'errors' are all of knowledge, or are in experience; but the important point is another: that all errors are cases of contradiction or contrariety. One has met error who has experienced that A is B and that the same A is not B. But the experiencing is not the significant fact, and that all errors are of knowledge is true merely by definition, since contrariety or contradiction is called 'error' only when it occurs in some person's field of consciousness.[2] The actual problem is the contradiction or contrariety itself: what is the significance of a universe that holds such things? And here, once more, the only solution which appeals in practice to any one is the ancient one: that only one of two incompatible propositions *is* in the universe, the other is 'only subjective.' It is for this reason that every one of the recent writers against realism centers his attack about the problem of error or contradiction. I shall base my remarks on their own assumption that there can be no contradiction in an objective (or 'real') universe.

This last proposition is always expressed, or tacitly implied, with an assurance which shows that these gentlemen assign to it axiomatic validity; and if they were to be asked how they know so interesting a fact about the universe, they would infallibly reply that it is self-evident. On which I should remark that so far from being self-evident, it is categorically untrue. "Are you," say they, "crazy enough to think that you have ever seen an existing object move both up and down at the same moment? Have you ever met the round-square, or the A that was at the same time not-A?" and I reply, "No; are you so crazy as to be able to *think* these objects?"

An answer to this is, that while it may not be easy to visualize

[1] *Vide* Sheffer, H. M., Ineffable Philosophies. *J. of Phil., Psychol., etc.*, 1909, 6, 123–129.

[2] The reader must here avoid the fallacy of the ego-centric predicament, already referred to.

or image an A-not-A, yet that one can easily think of an A that should be, or might be, also not-A. This is a mere defect of imagery, just as it is an accident of *vita brevis* that one cannot enumerate an infinite series although one thinks it readily enough. Now this is the core of the matter. It is *not* a "defect of imagery" which prevents us from visualizing the round-square or the A-not-A as readily as we visualize a hippogriff, the whale discussing Jonah, or even a Cook at the north pole. The thought of the round-square is a *propositional* content *about* a strictly *unthinkable* IT: — that it is to be square, and it is to be round, and so forth. Further than this even thought cannot go: even the inner eye cannot grasp the square which is also round. One can think *of* a point which *should* move up and move down at the same moment, but when one images the point, it moves either up or down, or the two successively. Now this "defect of imagination" is not a psychological matter at all, but rests on a fundamental distinction which symbolic logic and mathematics have more or less recently made out, between *propositions* or postulates on the one hand and *terms* in relation on the other. It is found here that propositions may subsist together in a set although they are mutually contradictory, but that such contradictory propositions can never generate, or be realized in, a system of terms in relation. Indeed, so harmless, oftentimes, are the contradictions between propositions that the only certain test that propositions *are not* contradictory is the discovery of a system of terms in relation of which the propositions all hold true, or in which they are exemplified. Thus if one undertook to define a figure such that it should be the portion of a plane surface included between three straight lines; that it should possess four (internal) angles; that the sum of these should equal 180 degrees; and that the sum of its external angles should equal ten times 180 degrees; — one would have no means of discovering whether a contradiction [1] had been

[1] I take no pains here to differentiate between contradiction and contrariety, because both contain a common and more fundamental element of *negation*, for which we so far have no good name, but which is one of the secrets of this difference between sets of propositions and systems of terms.

posited except by appealing to the corresponding system of terms (plane, lines, *et cæt.*) which such a set of postulates *undertakes* to define. This is of course an appeal neither to physical existents, nor to the faculty of imagination: nor are propositions more 'subjective' than terms. This distinction between sets of propositions and systems of terms is of the most profound importance; it sheds light, for instance, on analysis and synthesis, the meaning of verification, concreteness, empiricism, and on the triviality of the 'geometrical method,' or any other, when the propositional seqence of the argument swings free from the patient exhibition of terms in their relations. Now this fact that propositions oppose one another freely while such opposition or contradiction is never exemplified in a system of terms in relation, does not, I admit gladly, tell us all that we wish to know about contradiction and negation. On the contrary, it merely opens up a field of study most stimulating to the appetite, and one which at the present juncture I conceive to be the most promising of any, for both logic and philosophy. But the considerations just adduced are important in two respects; they do not purport to explain 'error' (contradiction) *away;* and they do show that the problem of contradiction (error) has nothing whatsoever to do with the problem of knowledge or epistemology.

The dichotomy proposition-term, fundamental as it may be, coincides in no wise with the dichotomy mind-matter, subject-object, nor yet with unreal-real. Conscious images, like physical objects, are terms in relation, and as the round square or A-not-A is not found among physical systems of terms, so it is (and for precisely the same reason) not found among mental systems of terms. What is in the one case called physically impossible ('unreal') is in the other case found to be mentally impossible, *i.e.* unthinkable. On the other hand, the mind can and does entertain the most contradictory propositions *about* terms, precisely as physical laws, which have obviously the nature of propositions, are *habitually* in a state of contradiction.

I say 'habitually,' although I know how shocking a heresy it is to speak of contradiction in any connection with the physical

world. This does not contain, it is true, A's that are not-A's. Neither does the mental world contain them; and the expression A-not-A, or round-square, has no meaning at all save as symbol for a little pair of contradicting propositions. But having discovered this valuable fact, apparently, at some pains, natural science conceived such an animus against the name 'contradiction' that it devised means for disguising the true cases of (propositional) contradiction among natural laws; of which every case of collision, interference, acceleration and retardation, growth and decay, equilibrium, *et cætera, et cætera,* is an instance. This is as follows. A law of motion states always that a physical particle (or series of them) moves (or shall move) thus and so. If now two wave-motions are progressing along the same straight line and toward each other, there will be a moment when a certain particle will be 'acted on' by both motions at once. The law of one motion will state that the particle moves up (or shall move up), while that of the other motion states that it moves down (or shall move down) at the same moment. Each law opposes the other, and although the relation is called one of contrariety, this contrariety is in fact *more* than contradiction; for if one law says *up,* the other not only says *not-up,* but further specifies *down* Logic cannot show a negation more thorough. And while the impossible-unthinkable does not happen, the result which is characteristic of all contradictions ensues, namely, zero motion; or in the cases of different amounts of energy one motion is reduced toward zero by as much as the opposing motion has energy to contradict it. To say that because no energy has been 'lost' there has been no contradiction is nothing whatsoever to the point. Two laws ot motion have met in contradiction, and this is precisely the appointed signal for energy of one sort to be transformed into energy of another. Because a third law can be framed (in terms of transformation, strain, or elasticity) to describe what shall continue to happen *when* a contradiction arises, should not blind us to the fact that it is not until the first two laws do meet in contradiction that the third law goes into operation. The case is paralleled in

the game of chess, where the laws governing the moves of the several men often come in contradiction with the rule that no two men shall simultaneously occupy one square. To meet this case a *further* law declares that the second comer shall 'take' or annihilate the earlier occupant; and the whole game hinges on such contradictions. To imagine that in this way contradiction has been forestalled, is to do like the fatuous master who commands: "Stand up, but if you won't stand up, lie down; my orders shall be obeyed." Not even from the point of view of a static logic is contradiction in this way avoided; and modern logic is not static.[1] Contradiction is after all a tame and harmless thing, although a very interesting one. The pretensions of many natural scientists that they find no contradictions is uncommonly absurd, because in fact they find little else. That is, all natural motions are the result of so many partially contradictory laws operating together that it requires a fabulously clever technique to produce a motion which is simple or uncontradicted enough to allow any one of the component laws (or constant functions) to be determined. The natural scientist may conceive this as he likes, but if our idealist opponents object to the above considerations I will beg them to take down the gospel acccording to Kant and read what the latter-day Immanuel had to say in his "Essay toward the Introduction of the Concept of Negative Quantities into Natural Science", it is one, but only one, of the authorities for what I have ventured to present above.

The gist of the whole matter is, that the impossible-unthinkable never happens anywhere, but that every variety of contradiction, contrariety, repugnance, opposition, and negation which logic itself recognizes is quite as plentifully manifested in the objective physical world as it is in the subjective sphere of mind. A thought, then, which negates another thought is neither more nor less significant than a physical law which negates another

[1] Modern logic might well devise a system of purely logical 'strains' and 'stresses,' not in order to conceal the fact of contradiction, but in order to study certain as yet little understood properties of sets of mutually incompatible postulates.

law. The problem of error, as that of 'reality,' is in no way involved in the problem of knowledge.

Now the image in consciousness does not assert anything about itself, nor does the realist, as it seems to me, assert of it that it is necessarily real; still less would he assert that all the propositional contents of consciousness are real. But what I suppose that realism insists on is that every content, whether term or proposition, real or unreal, subsists of its own right in the all-inclusive universe of being; it has being as any mathematical or physical term or proposition has being; and that this being is not "subjective in its nature" (a phrase indeed to which in this connection I can attach no meaning). I believe, further, that no content is 'constituted' by a metaphysical knower or ego, for I believe that no knower, or ego, such as metaphysics means, exists. I believe also that no conscious content is 'constituted' even by the knowing process, in the sense commonly attached by metaphysics to the word 'constitute.' If the knowing process ever constitutes its content, it is, I believe, only as a ripple of water in assuming successive forms may be said to constitute these forms (if that appears either significant or interesting to any one, as it does not to me). But particularly meaningless is the assertion of idealism that a mental content is 'subjective' in its substance or nature, or is constituted by a metaphysical knower or ego.

As to what reality is, I take no great interest; nor do most other persons, for if they had done so, they would have taken more pains to define it sharply as against the equally and perhaps even more prevalent unreality. But if challenged, I should hazard the guess that perhaps reality is some very comprehensive system of terms in relation. For by reality we seem to mean the thing most remote from contradiction, and this is with certainty found only in systems of terms. This would make reality closely related to what logic knows as 'existence.' If this is correct, probably all of the terms found in the physical world, also some and possibly all of the terms found in minds, are real. But all this, so far as

I know, has been far too little studied. Certain it is that unreality is no more subjective than reality; for a thing may be objective and yet unreal, as is commonly asserted of certain numbers and of some systems of geometry.

4. *Contradiction and Realism.* — Let us now return to some arguments of our opponents. In a somewhat over-ingenious paper [1] Professor Lovejoy brings up at length the case of hallucination. "While it lasts, the hallucination is for the victim of it as good 'content' as any other of his perceptions." But "it was not at the time an object perceived by others. . . . In fact, it turns out that the other percipients at that time perceived as vacant, or as otherwise occupied, the very space which the hallucinatory object ostensibly occupied . . . and since the testimony of many witnesses and of the general uniformities of experience is against *his* object, the victim of the hallucination, when he recovers, proceeds to call his object somehow 'unreal,' and to declare that the 'content' that was truly in the space in question was that beheld by the other percipients. . . . Be it observed that the corrective judgment, through the making of which the conception of consciousness is generated, predicates 'unreality'— now interpreted as 'existence merely for consciousness' — of the object of the hallucination *at the moment when that object was present*" (p. 595). Professor Lovejoy grants it as possible that the "new realism . . . does not maintain that the same portion of real space can be at once both empty and filled," but he does not see "what account a new realist can consistently give of the status of the hallucinatory object *at that time*, or of the difference between it and the coexisting 'real' objects" (p. 596). Now I should not call the hallucinatory object necessarily 'unreal,' still less an existent "merely for consciousness," nor need anybody hasten to the conclusion that the other object is 'real' since collective hallucinations are also possible. It is to be noted that a "corrective judgment" (*i.e.* a proposition) in opposition to one or more previous

[1] Lovejoy, A. O., Reflections of a Temporalist on the New Realism. *J. of Phil., Psychol., etc.*, 1911, 8, 589–599.

judgments is that which carries the difficulty, and I look on a conflict of judgments precisely as on any other propositional conflict.

If now it is asked how one surveying the whole situation (as if this were possible without implicitly or subconsciously making many judgments [1]) can interpret it in the spirit of realism, the answer is simple. One interprets it precisely as Professor Lovejoy probably interprets mirrored space in connection with the space behind the mirror. The case is parallel to our own in all respects germane to our argument; and I have yet to hear that mirrored space gives rise to grave difficulties about reality or about "existence merely for consciousness." It does, however, show *in exactly the same degree* to which hallucinations show that "the same portion of real space can be at once both empty and filled." Lest the opponent have no ready interpretation of such a mystery, I will offer one.

Mirror-space is a cross-section of ordinary space and of the bodies therein; it has all the pure-space properties of the other save for a geometrically definable mode of reversal, and it includes the surfaces and shapes of the mirrored objects (reversed) with their colors. But it does not include the ponderability and many other physical properties of these objects. As in the case of all cross-sections (of which one case is consciousness), a new manifold is formed, consisting of certain parts, and integral parts, of objects; and here, as usually, such partition and analysis of the objects reveals that they are made up of elements which are not in the popular sense 'physical,' but rather conceptual or mathematical, or, as I prefer to say, neutral — because neither physical nor mental. These mirrored parts remain objects, but they lack many properties, such as ponderability, *et cætera*, which pertain only to the original entire object in its natural state of organization. All this is precisely what natural science has discovered from its own analysis of the same objects; — matter analyzes out completely into mathematical entities, and leaves no residue by way of little

[1] Cf. the fourth chapter of Schopenhauer's Fourfold Root of the Principle of Sufficient Reason.

material brickbats. A block of wood is ponderable, *et cætera*, but the shape, volume, physical masses, and electrical charges of which it is composed are not ponderable; ponderability being a property of, and deducible from, just these things in their organized completeness. This circumstance gives rise to what Professor Lovejoy and others have remarked as the "wide denotation which the realist gives to the term object," a denotation which physical science itself imposes. It is true that in the case of mirrored space reproduction is involved, but it is a reproduction of identicals without change of their 'nature'; and while it presents, indeed, interesting problems concerning particulars and universals, it affords no footing for speculations as to a subjective realm of representations. And no more do the cases in which consciousness involves reproduction (as it sometimes but by no means always does); they are invariably entirely comparable to physical reproductions. Yet they have given rise to no end of silly talk, which, when applied to the equally eligible case of the mirror, reads as follows: "You say that the mirror does not alter its objects. Where then does it get its reproduction of them? Must it not make them? But if it makes them, they must derive their nature from the mirror itself, and be intrinsically subjective mirror-stuff. The mirrored reality cannot be other than of the nature of the mirroring spirit." [1] Or if there are two actively imaging mirrors we read: "Data which are qualitatively different cannot be numerically identical; and no 'this' in the one mirror can ever be exactly the same, qualitatively, as any 'this' in the other mirror at the same moment, could not be unless the two mirrors were exactly alike and occupied the same place in space, *i.e.* in idealistic terms, unless *every* element pictured in the two mirrors were identical; in which case they would be one and the same mirror." [2] Thus it is proved to the satisfaction of idealists that two mirrors cannot image the same object. I say, then, that the case of hallucinations, as cited by Professor Lovejoy, is paral-

[1] Cf. Carr, H. W., *Proc. of the Aristotelian Soc.*, 1908, **8**, 128.

[2] Cf. Drake, D., *J. of Phil., Psychol.*, etc., 1911, **8**, 369.

leled by such cases as that of mirrored space, wherein sundry mirrored objects occupy the same spatial positions as are occupied by other 'real' objects situated behind the mirror. It is admitted that such physical cases give rise to no difficulties about 'unreality' or a separate subjective status. In some cases of hallucination and illusion the error consists solely in the entertainment in the mind of mutually contradictory propositions; and while one of these may be for some reason preferred or assigned a superior value, neither is more subjective than the other; nor are both subjective, because, as we have seen, the entire universe is brimming full of just such mutually contradictory propositions. In other cases of hallucination and illusion (as with the two eyes asquint) a certain actual interpenetration of terms in relation is experienced, which is precisely paralleled by the interpenetration of mirrored objects with the objects behind the mirror. This is not a case of the impossible-unthinkable realized, but it is merely a case which shows that the neutral cross-sections of objects possess properties of interpenetrability and so forth which differ from the properties of the entire objects. So, too, fire burns, while the idea of fire does not, just as it still burns although the magnetic properties of flame do not. Thus, whatever practical terminology may be found most convenient for the case of hallucinations, these afford no grounds for an argument toward subjectivism. The realistic account of them is clear, simple, and straightforward, even if it is admitted that *re*production is involved. In many if not most cases of consciousness reproduction is not involved, and the realistic account is still simpler.

A word may here be in place on the realist's "wide denotation of the word object or thing." A common anti-realistic argument is that since fire burns and the idea of fire does not, since an object has no perspective foreshortening, while the visual image of it has, an object has definite position in space, and the memory image of it has not, and position in time, while the idea comes always subsequently; — that for these reasons realism makes itself absurd in asserting that the idea *is* 'qualitatively' and in

many cases 'numerically' the object. I think that it was probably this argument mainly which led Mr. G. E. Moore[1] to the view that consciousness and its objects are distinct existents, that even color qualities are never content of sensations, and then on to a belief in a fundamental unresolvable relation of awareness; from all of which I should emphatically dissent. Now to the argument above stated it might be replied that fire burns but the shape of the flame does not, that an object is not foreshortened but that its geometrical projections are, that the object has position in space but that, say, the *n*th derivative of its physical motion has not, and that while the object has position in time the value of its physical mass is timeless. Thus the argument rests entirely on a singularly crude brickbat notion of physical object. This is that the object is a sort of indivisible brickbat, of which any and every property of the object can under any and all circumstances be predicated; or that if the brickbat has parts, all of its properties can be predicated of each of its parts. The absurdity of this is patent, and yet one can see how far such an error may go from the astonishing words of Dr. Drake,[2] who after remarking the many aspects presented to different spectators by a tree, continues, "If we believe, then, that each of these 'thises' that we have in experience is a permanent existence [he should say a subsisting entity], we have a marvelously multiplied world. A thousand, a million different 'thises' permanently exist as 'this tree!' Disparate as they are, they cannot be squeezed down into one simple object [indivisible brickbat], and we have a world reduplicated *ad infinitum*. . . . We ['critical realists'] give him [the 'natural man'] a simple, homogenous external world; 'natural' realism does not." I should hope not! And I can conceive no better advertisement for what Dr. Drake calls 'natural' realism. But what, meanwhile, can he possibly be thinking of the infinity of actual geometrical projections of his tree, to say nothing of its innumerable other actual relations? Can these

[1] Moore, G. E., The Refutation of Idealism. *Mind*, 1903, N. S., **12**, 433–453.

[2] *Op. cit.*, p. 370.

all be "squeezed down into one simple object"? Surely the tree is, with its relations, all of these things: and even more. For, as Professor Alexander says,[1] of a straight stick which looks bent when a part of it is under water, "There is illusion only if we deny that the bent and the straight appearance in the two different sets of conditions belong to the same stick." Certainly they belong to it, and so does every other of its projective properties (and these are not merely spatial, but temporal and logical as well). For it must not be forgotten that while the object itself, if a physical thing, is far from simple, we are always perceiving it in a complicated setting of (spatial, temporal, and logical) relations, which is a still more complicated thing. But the conscious cross-section is always a group of the integral (neutral) components of the object and of its innumerable relations. And since, firstly, it is seldom possible to say just where the object itself terminates and its relations to other entities commences (Is, for instance, the first derivative of motion a part of the moving object or one of the object's relations?), and since, secondly, any discriminable entity may be 'object' of consciousness (*i.e.* a member of the class of entities to which the nervous system specifically responds), realism has good grounds for extending the denotation of object or thing.

This completes my argument, and more than fills the space allotted to me in this volume. The picture which I wish to leave is of a general universe of being in which all things physical, mental, and logical, propositions and terms, existent and non-existent, false and true, good and evil, real and unreal *subsist*. The entities of this universe have no substance, but if the spirit is weak to understand this, then let the flesh, for a season, here predicate a neutral substance. These entities are related by external relations, and man has as yet no just ground for doubting that the analytic method of empirical science can proceed without limit in its investigation of this universe. The dimensions of this universe are more than the three dimensions of space and the one of time: how

[1] Alexander, S., *Proc. of the Aristotelian Soc.*, 1910, N. S., 10, 11.

many more is not known. The line that separates the existent and the non-existent, or the false and the true, or good and evil, or the real from the unreal, seldom coincides, and *never significantly* coincides with the line that distinguishes mental and non-mental, subject and object, knower and known. A mind or consciousness is a class or group of entities within the subsisting universe, as a physical object is another class or group. One entity or complex of entities can belong to two or more classes or groups at the same time, as one point can be at the intersection of two or more lines: so that an entity can be an integral part of a physical object, of a mathematical manifold, the field of reality, and one or any number of consciousnesses, at the same time. As the class of physical objects is defined within the subsistent universe by principles known to science, so the class of consciousnesses is defined within this universe by principles which are partly known, and which are coming to be more fully known, by empirical psychology. A consciousness is the group of (neutral) entities to which a nervous system, both at one moment and in the course of its life history, responds with a specific response.

SOME REALISTIC IMPLICATIONS OF BIOLOGY

SOME REALISTIC IMPLICATIONS OF BIOLOGY

BY WALTER B. PITKIN

THE following investigation falls into two parts. The first part is a formal analysis of several fundamental types of organic action. Here, certain facts appear which decisively refute several biological, psychological, and metaphysical theories. The second part, which begins with Section IV, will offer an incomplete formal analysis of the cognitive situation and a hypothesis of consciousness.

The five chief points herein to be urged are: (1) That theories about life and mind have generally been based upon erroneous, more or less naïve opinions about the nature of things and relations. (2) That anti-realistic hypotheses in biology or derived from biology owe their strength either to (*a*) the erroneous opinions mentioned above or (*b*) a false emphasis upon the facts of introspective psychology. (3) That the ordinary methods of analysis and research pursued by natural scientists are rapidly yielding a coherent, adequate account of life and mind, without invoking either intuition or transcendent entities. (4) That a formal analysis of the organic situation discloses three basic factors (each complex) related as are the three factors in projective geometry. (5) That an interpretation of the cognitive function in terms of these three factors largely reconciles at least four modern theories of consciousness and also makes clear how errors, illusions, and hallucinations are not made by consciousness nor are peculiar to it, but are necessary features of a projected physical system.

This last topic is introduced, less to convince the reader than to offer a definite, positive theory which may be criticized. Realistic studies have, by necessity, been overwhelmingly polemical; but they should not continue so. Reconstruction must begin; and a theory of life and mind must be worked out which dispenses with the old, discredited categories of idealistic psychology, such as

'mental states,' 'subject-object polarity,' 'creative synthesis,' and the like. Now it is evident that the first attempts to slough off these notions will be not only difficult, but full of strange writhings. They will be no less violent than an endeavor to exchange the parts of speech in one's native tongue and to use nouns for adverbs, or adverbs for prepositions. For the older manner of thinking is woven into our unconscious 'universes of discourse.' Because of this, any genuinely realistic hypothesis of consciousness to-day must be obscure; and it is almost certain to contain difficulties which the author himself cannot clearly sense. It must, therefore, be submitted in fear and trembling.

I

THE BIOLOGICAL ATTACK ON REALISM

THE strongest influences against realism to-day emanate from the biological sciences. Only a few years ago, it was physics and mathematics which made the natural world-view seem untenable; and before them it was logic and psychology. The objections which these sciences have brought have been cleared away in the previous essays of this volume; the inaccurate descriptions and defective logic underlying those objections must now be moderately clear. But, from a new quarter, there arises a host of adversaries, declaring that the unanswerable disproof of realism is found in the simple life-processes.

At least three lines of research lead up to this assertion. The first lies wholly within the biological sciences; it has been followed by men whose intimate knowledge of life-processes commands respect. Hans Driesch is the modern leader of this movement. His Gifford lectures on 'The Science and Philosophy of the Organism'[1] are a remarkably thorough, systematic attempt to establish idealistic vitalism on biological evidences.

The second line of research proceeds from psychology to biology. The immediate data of consciousness, when properly described,

[1] 2 vols., London, 1908.

afford a new basis for interpreting life processes; and the latter, when reinterpreted, reveal a cosmos not composed of distinct characters, a flux wherein everything interpenetrates everything else. All distinctions are products of a 'vital force' and serve only for organic controls. To this hypothesis comes Henri Bergson, in his now famous trilogy.[1] The third line of research yields a formal analysis of the fundamental biological situation. It is not a theory about life-processes. It is rather a simple description of (*a*) the situation in which conduct arises, and (*b*) the direction and character of conduct. It bears the same relation to the biological explanation of conduct that the equation and the graph of a given trajectory bear to an explanation of the chemical constitution of the nitroglycerine that hurls the projectile. The leader of this movement is Dewey, whose book on 'The Study of Ethics' [2] was the first formal analysis [3] of conduct ever attempted.

These three lines of research terminate in as many anti-realistic hypotheses. Driesch concludes that the entire 'content' of experience is created by the Ego, in the same manner as Kant held. Bergson believes that there is an objective flux which constitutes the environment of the 'vital force,' and also that in primitive perception some of its characters are immediately presented; but he insists that all discreteness is produced by the 'vital force,' and hence that not only the differences between individual percepts, but also all concepts, are 'static,' 'condensations,' 'convenient abstractions.' Dewey is by all odds the most realistic. He accepts as an ultimate the biological situation (*i.e.* an environment and an 'agent,' the former acting upon the latter, and the latter reacting upon the former); moreover, he regards perception as a 'natural event' on a par with a thunderstorm, in that its characters are not created by the percipient. He draws the realistic line, though, at cases of knowledge, which, he says, are wholly

[1] Essai sur les Données Immédiates de la Conscience, Paris, 1888, Matière et Mémoire, 1908, and L'Évolution Créatrice, Paris, 1909.

[2] Ann Arbor, 1897.

[3] For a fuller description of formal analysis, cf. Spaulding, 156. The meaning of 'formal' in this connection must be carefully guarded.

different from perception. Theories and their constituent ideas are genuine constructions of the thinker. They have no existence apart from him, any more than a mowing machine has. The stuff out of which the machine is fashioned is indubitably physical, but the arrangement and all its efficiencies are a result of thinking; it would therefore be absurd to allege that somehow in the stuff the mowing machine is contained (implied, potentially present). Now, what iron and hickory are to the machine, percepts are to knowledge.

The realist cannot count his case won until he has disproved the anti-realistic inferences of these three investigators. He must therefore scrutinize just enough of their deductions to show the complete independence of all things thought of.[1] Now, to discuss the relation of agent to environment, we must agree on a description of the situation under debate. This description should enable us to effect a division of the question, if the latter proves complex. If the environment is a hazy entity, it must be cleared up; if it is a complex, its simple constituents must be discerned and their relations to one another indicated. Likewise with the agent: whether we are to mean by that term the whole organism, or a part of it, or something 'behind' the organism, or something else must be settled before another step can be profitably taken. All this, of course, is no explanation of any biological happening. It is only a clear visioning of what happens. It is not complete insight, but only *accurate description of as much as is described at all.* To give this is our first task.

II

FORMAL ANALYSIS OF THE BIOLOGICAL SITUATION

NATURALLY inspecting animals and their circumstances of life, we find: —

1: that they exist in a world larger than themselves.

2: that this world sets for them certain difficulties.

[1] For the sense in which 'independence' is here used, cf. Perry's essay.

3: that some individuals overcome these difficulties.

4: that those which signally overcome the difficulties differ, in some observable respects, from those which do not.

5: that the two phases of an organism, namely its structure and its functions, are very closely correlated, and perhaps absolutely. (Structure is the arrangement and character of the parts or elements of the organism; function is the natural operation of these under the circumstances of existence.)

6: that both structure and function are, in all save the very lowest organisms, differentiated. There are, in a given animal, many structures, and each does something peculiar. Each such structure is called an organ.

7: that what a given organ does depends upon at least three factors: (*a*) its own total character (especially its acquired character); (*b*) its relation to other organs (*i.e.* its connections with them and their own total character at the given moment; and (*c*) those influences from the environment which affect the organ, at the moment.

8: that both the structure and the function of an organ vary, in a more or less measurable way, with some variations in the external stimulus.

All these are simply observed features of the situation; they are not an explanation of anything, nor does our acceptance of them depend upon any particular theory of life processes. On the contrary, all theories about the latter are only attempts to explain these peculiarities in their many concrete forms. A hypothesis which asserted or implied the non-existence of any one of these would not be dealing with the biological situation at all. This becomes more obvious, as soon as we force a special interpretation. Suppose, for instance, that a biologist were asked to explain how an elephant comes to grow a trunk. If the learned man assured you that there wasn't any elephant, or that what you called its trunk was only a product of your own mind, you might be interested and perhaps enlightened; but you would not be enlightened

on the subject of your inquiry. His assertion would be irrelevant Were it true, it would not dispense with your question; for you would still wish to know how in a world of illusion an illusory elephant comes to have an illusory trunk. The creature surely does grow a trunk, no less regularly than before; and the trunk has certain definite, constant peculiarities. You ask for an explanation of this particular situation. It is unprofitable, then, to be told that the *terms* of this dynamic relation have a different status from that which you may have assigned to them; for you have asked, not about the status of the terms, but about the origins of the *relation* between them.

Let us first consider the reciprocal influences of the organism and the environment. In what manner does the one alter the other? Precisely what is changed, in a given situation? We must describe specific reactions and their stimuli, and find out whether they reciprocally transform each other; and, if so, what the general nature of the transformation is: and, secondly, we must ask whether the transformations we may find are sufficiently profound to warrant the inference that any (or certain) entities which men perceive or establish by thinking are strictly constituted by the act of perceiving or thinking.

1. *Simple description of some stimuli and the reactions they induce.*—

A. What is the descriptive distinction between stimulus and reaction?

In distinguishing stimulus from reaction, we have no right to smuggle in any characteristic which is only inferred. This rule of formal analysis compels us to admit that the precise limit of a stimulus action cannot be pointed out; nor can the origin of the reaction. We are not even free to say that all processes within the organism are reaction processes, in the strict sense. Many may be merely conduction processes, serving only to carry a stimulus to some further sensitive region, at which the reaction is set up. A number of organic events seem to be this type. For in-

stance, some experiments indicate that the nucleus of the single cell is the sensitive part from which all reflexes originate. If this is true, then the other regions of the cell serve as mechanisms for bringing in to the nucleus certain influences from without, or else for effecting the adjustment which the nucleus initiates. But, as Pfeffer and Delage have pointed out, this is only a hypothesis; and it has some serious difficulties. We cannot admit it here, then.

Nevertheless we can describe stimulus and reaction accurately enough to distinguish them without equivocation. The stimulus includes whatever acts upon the reagent so that the latter acts with reference to the former. That is, not every influence acting upon the organism is a stimulus. Thus, the pull of the moon upon a man's heart and the action of terrestrial magnetism on his neural currents would not be stimuli. For neither sets up any reaction, nor does the organism behave in any specific manner toward either. But the action of gravitation on the semicircular canals is a stimulus, and so too in geotropic plants. For here there is a reaction to differences in gravitational pulls.

Another point to notice is that stimuli are not exclusively extra-organic, nor are they nothing but stimuli. The poisons generated during fatigue are, with reference to the moments succeeding their generation, true stimuli. So far as we are now concerned, they do not differ generically from bacterial toxins. There may be instances of a given influence being, at the same instant, both a stimulus and the *product* of a reaction. In such a situation there is no mystery or contradiction; for the influence is not both stimulus and reaction product *in the same sense.* It is the stimulus of one reaction and the product of another, the two reactions going on simultaneously.

The reaction is whatever alters some part, element, or action of the organism in relation to the stimulus. It is not to be identified with every effect of an extra-organic influence upon the body. Many a bodily motion and change is not a reaction, although its cause is an incoming force. For instance: a man falls to the ground under the shock of a violent blow in the face; his motion

is no reaction, for it is a mere effect, not that peculiar kind which refers back to its cause somehow. Were he to struggle to keep his footing, though, he would in that measure be reacting.

There is nothing to hinder a given reaction from being, at one and the same time, an adjustment to a stimulus and also a stimulus to other reagents in the same organism. For instance, reactions of the salivary glands at the sight of food certainly have for their stimulus the visual reaction; and, in turn, they become the stimulus of various gastric glands. This does not indicate that stimulus and reaction are 'purely relative' terms, in the sense that the distinction between them is not genuine, and that a stimulus is not 'really' a stimulus, but now one thing and now another, according to the way one happens to look at it. Like every other real entity, stimulus and reaction stand individually in innumerable relations at every instant, without any loss of their distinctness. So they appear, and so must they be described.

About the reaction, we may say more. Its peculiar character appears best in *its outcome for the organism;* and this outcome is often conspicuous and may be described in terms of the stimulus. Thus, the lungs select oxygen and pass it on to the blood; the heart drives on the blood; the eye regulates certain motor reflexes; and so on. The special task, in each case, is most sharply distinguished, *not by the details of the reaction process but by its final relation to the stimulus which has set up the reaction.*

In looking to this final relation between reaction and stimulus, we are not implying that this relation has been 'aimed at.' The final relation is not necessarily a finalistic one. All that we assume is the rather obvious fact that *the character of any process cannot be clearly read off until the whole process is before us.* Were we describing a dynamite explosion, we should have to look to the final phase of it, in order to know what had happened, and what a dynamite explosion is. Were we to halt in our description at the very instant when the unstable molecules of the stuff were disintegrated, we should not be describing the explosion. Everything deriving *peculiarly* from that disintegration must be inspected and specified;

e.g. the kind, volume, temperature, pressure, incandescence, etc., of the gases generated.

B. Some Types of Reaction. — This final relation can, in many cases, be very precisely indicated, although the means of attaining it are absolutely unknown. It has many distinct types, seven of which are the following:

(*a*) Adjustment; (*i*) partial and (*ii*) total.

(*b*) Selection

(*c*) Conduction

(*d*) Transformation; *i.* Non-Constitutive *ii.* Constitutive
α. Selective
β. Additive

(*e*) Resistance

(*f*) Reception

(*g*) Retention

These last two will not be discussed at present; they involve psychological issues, all of which are to be avoided until the problem of consciousness is broached, in the closing section of this essay. The other five types of reaction may be briefly described as follows:

(*a*) The outcome of some reactions is to put (*i*) one *part* of the organism into a new relation with some part of the stimulus; and of others to put (*ii*) the organism, as a *whole*, into a new relation with some part of the stimulus.

(*i*) The lens of the eye reacts so as to throw a sharp image of the stimulus upon the retina. Within this act the organism as a whole does not alter its relation to the environment. And only one feature of the stimulus is reacted to. The color, intensity, and specific character are inefficient with respect to the ciliary reflex.

(*ii*) The leg muscles react so as to bring the entire animal toward or away from (*i*) the origin of the stimulus or (*ii*) the immediate influence of the stimulus.

(*b*) The lungs select oxygen from the inhaled air and reject various other gases. The ear picks out air vibrations and is indifferent to ether vibrations.

(*c*) The afferent nerves carry certain characters of peripheral

conditions to the central nervous system. Whether these peripheral conditions are identical with characters of the stimuli will be later discussed.

(*d*) The stomach adds solvents to the material taken in, and the material is thereby altered no less qualitatively than hydrogen is altered when it is combined with oxygen. The alteration is not 'absolute,' for the constituents of the new mixture can all be separated and identified. It does, however, involve genuine new qualities.

This fact raises at once a question of terminology. Shall we designate as transformative every reaction which develops a quality (character) which was not present and efficient *in the same sense* in the complex stimulus? A question of terminology, indeed! But, like many others, one on which many vital distinctions of philosophy and science turn. It is largely the unclarity of words here that has brought about differences of opinion about the relation we are studying.

Now, for present purposes, it is enough to demarcate three conceivable types of relation between stimulus and reaction: —

Species A: Non-constitutive.

Type 1; The reaction simply *releases* one part or element or phase of the stimulus.

Type 2; The reaction *adds* some part or element or phase of something else to the stimulus.

Species B: Constitutive.

Reaction and stimulus are simply two phases of one unitary process, as the two poles of a magnet are. Just as the positive pole does not take something from nor add something to the negative pole, so the reaction does not consist in selecting something from the stimulus or adding something to it. Each gets its character from its relation to the other.

These three types represent distinctions which have been drawn. So long as they are going to be employed by anybody, their differences should be recognized and appropriately named.

Now, it strikes me that Type A1 should not be called a qualita-

tive transformation. To label it thus is to blur over several highly important differences. There is no denying that when an element is released from a complex, both the element and the remaining complex behave as they did not behave before. There is a change from behavior of one character, if you will, to behavior of another character; but this is not at all identical with a qualitative change of the behaving entity. The change of behavior may be one and the same with a change of the entity's *position in a complex.*

For instance, a dog is frequently docile when at large and vicious only when tethered. Would anybody say, though, that in turning the dog loose, *we* change his quality? Hardly: for the releasing, *as such,* does not constitute the difference in the animal's quality of action. The animal changes its conduct, under different circumstances; but the act of changing the circumstances is not identical with the dog's changing its behavior. Neither is the animal's doing different things under different circumstances a sign of a change of nature. To act now thus and now so under identical conditions, though, would indicate such a change. The new circumstances (*after* the untethering) bring the dog into new relations; and it is in response to these latter that it now behaves differently. The distinction is fine, to be sure, but none the less genuine. It appears more clearly in biological cases.

If a reaction selects a part of a stimulus complex, this means simply that it picks the part out, just as one might take the dog out of the barn. But, having so removed it from its setting, it has perforce let it into some other settings. The lungs not only pick out oxygen, but, having done so, turn it loose in the blood. And now the oxygen, released from previous restraints, as it were, does things which it previously could not do. But did the selective reaction endow it with these newly developed efficiencies? Not at all, and we can prove empirically that it did not, simply by separating the oxygen in the laboratory and discovering all those very qualities. It is, therefore, the positional relation of the part to various complexes that determines the results, quite independently of the way in which that positional relation has been brought

about. Of a truly selective reaction, then, we must say that it does not bestow qualities upon entities (stimuli) or take them away.

Type A2 may reasonably be called a 'qualitative transformation' in one restricted and somewhat questionable sense. The dog which is savage when tied is not changed qualitatively by the mere act of being released, but only by the new situation into which it enters when free. If, however, the dog is overfed, while tethered, it may grow less ugly. Now, that which is added changes the quality of the dog's conduct, quite independently of any change in the dog's relation to the barn or the tether or the persons barked at. The important point to note here is that the addition is made, not to the total complex (dog-on-rope-in-barn), but to the canine part of it alone; and, secondly, that adding does more than bring the part (dog) into a new relation with other parts of that or other complexes; it involves an internal change of the particular part involved. The position of the dog, *as a whole*, to its rope, the barn, and the passers-by is not at all changed by overfeeding; hence *so long as we regard the dog simply as a part of such a complex*, it is a logical simple in that particular complex; and the change wrought is therefore qualitative *with respect to that particular complex*. The change does not consist in a change of its positional or other relations to the complex. So, too, the stomach genuinely qualifies the food it receives, inasmuch as it lends it chemicals and efficiencies which were not there previously, either in any element as such or in the complex as such, *in any sense*.

Obviously, though, such a transformation is 'qualitative' only because we treat as a simple a factor which we have not analyzed. In the complex, dog-on-rope-in-barn, the dog is an element. Now an element is not identical with a simple, in the sense in which we speak of the dog here as an element. But, for many purposes, we do not need to analyze the dog, in so far as we are dealing merely with this particular complex. When this is the case, we reckon the dog as simple, *within the limits of our inquiry*, and hence we must say that every change in the animal is a change in a simple, and hence an 'internal,' 'qualitative' change. So long as we un-

derstand clearly the restricted universe of discourse within which this proposition holds, there is no harm in asserting it.

Type B is indisputably a qualitative transformation, and more. The reaction and the stimulus are not only modified; they are in some degree constituted by it. Their nature is just this being a pole of a polar complex. Thus it is radically unlike the suppressed qualities of A1 or the added qualities and the pseudo-simple changes of A2.

I shall hereafter speak of transformations as of Type A1, A2, and B. Type A1 is identical with the simple selective reaction, listed as No. 2 in the enumeration of certain fundamental reaction types. For the sake of a historical understanding of so-called 'transformations,' I shall tolerate this cross-division.

(*e*) The last type of reaction here to be described is resistance. The organism, affected by some injurious stimulus, internal or external, does not avoid it, as in ordinary adjustment; it builds up structures which intervene between the stimulus and the organic parts which the stimulus injures. Frequently this process appears to be incidental to the regeneration process of an injured structure. (In this manner Ehrlich explains antitoxins.) In other cases this is not evident; as in the fox's growing of thicker fur in winter, in the pigmentation of skin under extremely bright sunlight, etc. And it is quite obscure in the case of attention to cognized entities, where some kind of resistance is offered to all other elements tending toward the cognitive field.

Let us now consider each of these five reaction types in more detail.

a. Simple Adjustment. — Stahl has demonstrated [1] that the direction of incident light determines the position of the first cell wall in the developing spore of *Equisetum*. And Pfeffer's experiments show that the same factor, direction of light, is what fixes the plane of symmetry in the growth of *Marchantia*.[2] The roots of plants

[1] *Berichte d. Bot. Ges.*, 1885, 334.

[2] Sachs's Arbeiten, 1. 92.

regularly turn in the direction of the gravitational pull, and the stems away from it. Some species are so sensitive that a very slight change of position sets up a reaction which readjusts the growths to their previous directions. Driesch's experiments with *Sertularia* also show this very prettily.

Now, let us try to explain absolutely nothing, but only describe what has happened. We note the following three points:

(*i*) It is *not* the color, nor the intensity, nor the duration of the stimulus which causes the adjustment of organic parts into definite positions. It is only the direction of the stimulus. If, then, we are to speak of the color or the intensity of light as a cause of other types of reactions, *we must now speak of direction as being no less a true cause in the present case.* It is, in short, not a metaphysical hypothesis to say that direction is a cause; it is pure formal analysis. Direction is the necessary antecedent concomitant variant. Descriptively, it is an efficiency, no less than the mass or the electric charge is.

This fact is not altered by the other alleged fact, that, in adjustments to the direction of gravity, this effect is brought about by the sinking of the heavier cells within the organism and the rising of the lighter kinds, which latter are central in the roots and peripheral in the stems.[1] Suppose this does occur; is it not the very same happening which we have just been describing, in another manner? It is the direction of the gravity pull which causes the direction of the motion of the cells. And the proof is as before: vary the direction of the stimulus, and you vary correspondingly the directions of the moving cells.

The implication of this reaches far beyond biology. It touches physics and mechanics. Here, too, the efficiency of a force cannot

[1] I cite this hypothesis only because it presents the strongest case against the view above set forth. But it is strong only in form; to-day it cannot cover the facts of geotropism. Pfeffer and Czapek have proved that only those cells within 1 mm. of the tip of a root are sensitive to geotropic influences. The position of this tip determines that of the whole root, and its removal suspends the geotropism until its regeneration is completed. In the light of this fact, we cannot admit that the mere pressure of cell against cell accomplishes the reaction.

be limited to the pure quantity of energy involved; for, if it were, then no regular relation would appear between the direction of a resultant force and the directions of its components. Vector analysis, however, reveals a simple and inflexible relation there. It is the direction, and not the velocity, mass, acceleration, or retardation exclusively which determines the path of a body acted upon by two or more forces in a pure mechanical system; and, in a physical system, this same direction value causes the transformation of kinetic into potential. That is, 'energy is consumed' in changing the direction of a body; or, otherwise stated, a force in one direction is efficiently equal to (reduces to) a smaller force after re-direction. And here, even as in the case of the developing spores, concomitant variation proves that it is the direction which is at least partly the cause of this. And by 'cause' we mean precisely this sort of necessary prior concomitant of a given event.

(*ii*) The reaction is generically like the stimulus. That is, the latter is a direction (or, more accurately, a force whose directive character is the determining one in the particular instance), and so too is the former. This is a most important feature of the situation, for it sets a very narrow limit to our interpretation of the relation between stimulus and reaction, in this case. We can say only that the specific stimulus causes a re-direction of motions in the reagent; it does not give rise to any new qualities, in the proper sense of the term 'quality.' There is a genuine change, of course, but it is from one direction to another; not from one quality to another.

We are now ready to state at least one restriction which must be put upon all three varieties of biological anti-realism. They cannot maintain that *every* reaction involves a qualitative transformation of its stimulus, unless they define 'quality' so as to make it absolutely everything that makes any kind of a difference. Such a definition reduces 'quality' and 'difference' to almost interchangeable terms. It does violence to good usage and offers no new philosophical convenience, by way of recompense. How its

champions defend it is hard to see. But if they do employ it, they must still admit that the reaction does not necessarily involve a *generic* change of quality, but only a change from one individual quality to another of the same genus.

(*iii*) The differences of reaction are related to one another in the same way as are the differences of stimulus. For instance, if a specimen of *Sertularia* be tipped ten degrees eastward from perpendicular, the difference between gravitational stimulus A (the one before the tipping) and stimulus B (the new one) is just that ten-degree angle. And this same angle constitutes the difference between the reaction to stimulus A and the reaction to stimulus B. Obvious as this is, its import has, so far as I know, never been sensed by those biological philosophers who are urging that the 'quality' of the reaction is other than that of the stimulus, or that the reaction qualitatively transforms the stimulus. There is not simply a one-to-one correspondence between stimuli and adjustment reactions (two qualitatively heterogeneous systems); there is also *a qualitative identity between the differences within each system.* The difference between stimulus A and stimulus B is not simply paralleled by a difference between reaction A and reaction B; but the former difference is identical with the latter, in kind and in measure. The implications of this fact appear, as soon as one seeks to interpret the two systems as heterogeneous, as we shall soon allow the anti-realist to do.[1]

Let us consider a case of adjustment in human life. One of the least obscure is the ciliary reflex. What happens here? The lens of the eye is thickened or flattened, so that an image with sharp outlines is thrown upon the retina. Now, however this adjustment is effected, it is determined, not by the color nor the brightness nor by the shape nor by the size nor by the mere grouping of elements in the visual field, but by the distance of the element attended to from the lens (or by some function of that distance). This is none the less true, even though the adjustment is accomplished by trial and error methods; *i.e.* by running rapidly through

[1] Cf., 428 ff.

the whole range of adjustments until that one is hit upon which gives a sharp retinal image. Suppose this is what happens. Then the adjustment is determined by the distance between the edges of overlapping images on the retina; and these distances, at each individual adjustment of the lens, are functions of the distance of the external object, as can be proved by simple experiments in optics. The extent of the ciliary contraction or expansion, therefore, is a function of a function of the object's distance; in other words, a second derivative. As in the previous cases, so here; distance is a genuine efficiency, and the reaction to it is generally like it, namely an adjustment *of* distances (as well as an adjustment *to* distances). And, finally, the differences between the stimuli are of the same kind as the differences between the reactions; both are distance-complexes.

b. Simple Selection. — This exhibits two phases: first, the disintegration of an objective complex (the stimulus), so that the element to be selected is released from the complex; and, secondly, the rejection of those other elements of the complex which are not chosen. The former activity sometimes involves the addition of something to the stimulant complex, as a means to the disintegration of the latter; and this addition may be, in one case, to the element that is to be selected, and, in another case, to the total complex. In all instances, however, the *outcome* is the same generically; one element is selected and the others discarded.

Simple selection is so familiar that a detailed description of cases would be needless. It will suffice to name a few striking instances. The eye selects light waves from the total medium acting upon it; the ear selects from that same medium only air waves. The lungs select oxygen, the digestive tract carbohydrates, and so on. Now this relation is accurately stated only by just this same term, 'selection.' The reaction *is* the picking out of a part of that which sets up the reaction. It would be foolish to ask whether the reaction *resembles* the stimulus here; the reaction is the process of selecting. And such a process no more resembles

that from which something is selected than the motions of a woman's arm in sorting strawberries resemble the fruit. What she picks out, though, not only resembles part of the mass she has been picking over; it actually is a part of that mass, transferred to a new situation and relieved of sundry undesirable elements, to wit, the stems and the soft spots.

No matter how closely one were to inspect the selecting process, then, one would never discover in it anything like that which it is selecting. But were one to look at the material with which the process operates, one would certainly discover, at every step in the operation, some element of it in some arrangement. These elements, however, might be so disposed that, at certain instants in the process, their identification would be impossible. This difficulty, though, is not even the flimsiest evidence against the real presence of the material in the process. The real test of its presence is indescribably simple; it is this: *if you can put it into the process and later take it out, you know it has been there, in one mode or another, during the process.*

In the grosser reactions this test is easily made. A man is put in a room and oxygen released; in due season his blood will be carrying more oxygen. The oxygen is taken away and his air supply cut off; soon the quantity of oxygen in his blood drops to the danger point. So too with the chemicals he selects from food; they reappear, after digestion, in the blood, and their entire progress may be accurately traced from the table to the living tissue. Can the same be proved in any of the finer, more elusive processes of the reacting organism? Does it occur, for example, in the sensing of colors, sounds, odors, etc.? Or are all these reactions of a wholly different order? This question will be faced later. Just now, I wish only to point out that there is a profound difference between selection and adjustment, a difference great enough to throw grave doubt upon any hypothesis which deals with reactions *in general. In adjustment, the reaction is most often generically one with the stimulus; in selection, it bears not the remotest resemblance to it.* In the picking up of oxygen, there is nothing

resembling oxygen; but in the ciliary reflex and like cases, the reaction consists in a complex of positions and directions, and so too does the stimulus. In adjustment, again, no element of the stimulant complex is identically taken up; and in selection, on the other hand, the operations are not the operations of oxygen, in whole or in part. In adjustment, there is no transforming of the stimulus, but only the taking of an attitude or posture toward it.

Plainly, adjustment of the sort we have been describing is not what biological philosophers refer to when they call life itself an adjustment to an environment. In their sense of the term, adjustment is exceedingly vague and embraces all manners of manipulations, changes, and remodeling of external entities. Is it not extremely probable that, through this loose usage, the notion has been strengthened that adjustments are intrinsically transformative processes?

It must be evident, by this time, that we have here to do, not only with two heterogeneous types of reaction, but also with two very different orders of stimuli. In selection, the stimulus is that which enters the organism; in adjustment, it is commonly an *order* outside of the organism which, in the ordinary sense of the verb, does not enter the organism at all, but merely acts characteristically upon it. This difference is not wiped out by the fact that often the organism selects stimuli for adjustment, selects from among its own various possible adjustments, and adjusts for a certain selection. Such compound processes do not rob their constituent phases of their proper characteristics, any more than water abolishes oxygen and hydrogen.

There is a further peculiarity of the relation between stimulus and reaction, in the case of adjustments. The adjusting reaction is not directed to that effect of the stimulus which enters the organism, but rather to the stimulus 'itself' (in common parlance, to the 'external object' or quality). Thus, although the ciliary reflex may be *regulated by* the distances between the edges of overlapping images on the retina, the direction and distance of the motions of the muscle fibers in the ciliary muscle regulate the

directions and distances of the *causes* of those overlapping images. Please catch this distinction. It is of tremendous importance, and is not theory, but simple description. These causes are, at the instant of adjustment, not yet a genuine stimulus; they *will be*, in the very next moment. And the lens is altered, so as to alter the causes of the images, viz. the as yet unsensed ether waves beyond the lens. The alteration aimed at does not take place outside of the organism; but *it does occur prior to the stimulation by that which is so altered.* That is, the light waves are changed in the lens, not directly on the retina where they later produce images. This operation is analagous to that of a stomach which might remodel food before the latter reached it, developing a special organ for this task. It may be, of course, that teeth and salivary glands are the results of such an adjustment; certainly their relation to the digestive process is much like that of the ciliary reflex to the visual process. But such speculation carries us beyond formal analysis. All that we can say, in pure description, is that adjustment reactions, unlike the purely selective, are directed *backward* from the immediate stimuli to the causes of these. Or, to state it in general form, *adjustment reactions* (and *a fortiori* the structural development of their mechanism) *deal with the cause-effect relation.*[1]

c. Conduction. — This relation between stimulus and reaction was doubtful until recently, and for the very good reason that it has not been directly observable, as adjustments and selections and transformations have been. With the improvement of recording instruments, though, it has rapidly been clearing up; and to-day, as Holt has pointed out,[2] we are in a position to assert that, in some cases at least, the reaction consists in the transmission

[1] To accept this description, we do not have to know what the cause-effect relation is. It is adequately marked off by the statement that *the effect is a function of any prior variable in a real system.* This does not limit causes and effects to purely mechanical relations. Any pair of characters, A, B, constitutes a cause-effect pair if A is at (in) t, and B is at (in) t', and $B=(f)A$.

[2] Holt, 321 ff.

of the periodicity of the stimulus. Lord Rayleigh's experiments, cited by Holt, prove that sounds of lower pitch than 128 d.v. a sec. — and possibly some of higher — cannot be localized by means of differences between their heard intensities, but can on the basis of their relative phases, as they enter the ears. This means, of course, that this difference of phase is sensed.[1] Sherrington has shown that nerve impulses follow the rhythm of stimulation, up to at least five hundred shocks per second; and there are good reasons for believing that, with better means of registering, this symmetry would be found to hold at higher rates.

I believe, however, that we need not wait on such technical improvements in order to describe the possibilities of conduction. In the adaptation of the flatfish to its background, we have the most striking of a host of instances which show directly the relation of approximate identity between the stimulus and the conductive reaction. The behavior of the flatfish is so remarkable that I shall describe it at length. As it beautifully illustrates selection and spatial transformation, I shall mar the logical order of my topics by here describing these other processes also, which are phases of one triplex reaction in this curious animal.

There has recently appeared a monograph on this subject[2] by Francis B. Sumner, of the United States Fisheries Laboratory at Woods Hole, Massachusetts. It interests me peculiarly because it confirms, by experimentation, my previously published hypothesis about the retinal image and the imitative reflex.[3] My own inferences were reached by an analysis of some obscure psychological

[1] Taken in isolation, this fact does not indicate homogeneous propagation of the stimulus, by any method of formal analysis; for the sensing of phase differences might, so far as the direct observation goes, occur in the peripheral organs. Rayleigh's statement is therefore an inference, not pure description. It is, however, a very sound inference. For there are numerous other experiments, especially with motor nerves, in which just such symmetrical conduction has been observed, and not inferred. I allude to these above and again refer the reader to Holt.

[2] The Adjustment of Flatfishes to Various Backgrounds, *Journal of Experimental Zoölogy*, 10, No. 4.

[3] *J. of Phil., Psychol., etc.*, 7, 92, 204. The second of these papers was read in part, before the American Philosophical Association, December, 1909.

events. In order to follow the analysis, the reader had to observe those events with severe accuracy; but this seems to have been not at all easy. In Sumner's data, though, no such difficulty arises.

The flatfish changes its hue to conform to the color of the backgrounds on which the creature happens to lie. For a time biologists supposed that this adaptation was effected by some direct photochemism upon the skin. But, a quarter century ago, Pouchet proved that it was brought about through the functioning of the eye. He found that blinded fish do not change their color adaptively. Interesting and significant as this discovery is, however, it does not tell us anything about the most astounding behavior of the flatfish, namely, its adaptation of its own geometrical skin-patterns to copy the geometrical pattern of the sea-bottom upon which it rests. By one of those freaks of circumstance which are only too common in all scientific fields, nobody paid serious attention to this phenomenon until Sumner approached it last year, first at the Naples aquarium and later at Woods Hole. "In observing a turbot," says Sumner, "I was impressed by the detailed resemblance which obtained between the markings of the skin and the appearance of the gravel on which the fish rested. . . . The query at once suggested itself: Is it a mere coincidence, or does the fish have the power of controlling the color *pattern* as well as the general color *tone* of the body?"

To answer this, Sumner prepared a number of backgrounds, some reproducing various types of natural sea-bottom (fine sand, coarse sand, fine gravel, coarse gravel, of various colors), and some being highly unnatural geometrical patterns (checkerboard, polka dot, stripes, screen, etc.). Placed in a tank having one of these patterns on its bottom, the flatfish began to copy the pattern *on its back*. ('Copying' does not imply 'consciousness' or 'effort,' so far as the mere use of the word here is concerned.) The time required to complete the imitation varied.

This time ranged from a few seconds to several days. A change involving the almost complete withdrawal from view of the skin pigments in a dark specimen probably required the longest period.

In general, . . . the maximum effect was commonly attained within one or two days at the most. The fact . . . that practice or habituation to these changes greatly reduces the time required was clearly shown. . . . Certain specimens, after several changes of background, were found to adapt themselves, in almost full measure, to one of these within a fraction of a minute.

Some of the adaptations were so perfect that the flatfish was all but indistinguishable from the background; and the spots on the skin became smaller when the diameter of spots on the background was reduced by less than a centimeter. Naturally, the imitation was by no means equally successful against all backgrounds. "Fixed morphological conditions" prevented the reproduction of perfect squares, triangles, circles, etc. It was, however, so exceedingly plastic and sensitive that "the notion that the fish is limited to a few stereotyped responses, representing the most familiar types of habitat, must be rejected at once."

The discoveries of greatest interest are two: *first, the imitation is accomplished through the flatfish's eyes; and, secondly, only a part of the fish's visual field is involved in the process — the creature does not imitate everything it sees.* The first discovery might have been made by pure analysis. For, were the eye not the instrument of imitation, then we should have to assume that the light reflected up from the background acted directly on the skin. Against this, however, there are two objections: first, the flatfish's belly, which directly receives the reflected light while the fish is swimming above the sea-bottom, is *not* sensitive — *only the back, turned away from the reflected light, takes on the patterns;* and, secondly, as Summer points out, "it is impossible to see how responses to a *pattern* could be brought about through any organs except the eyes, for these alone are provided with the lenses necessary for the production of images." The reader who suspects the analytical method, however, may ignore these proofs.[1] For Sumner has demon-

[1] The possibility that tactile stimuli may produce the effect cannot be absolutely eliminated by pure analysis. Sumner has put it out of court, though, by the simple experiment of putting fish on glass bottoms, the under side of which was painted with patterns. The imitative reaction was *exactly as quick and as sure as ever.*

strated the matter by cauterizing the flatfish's eyes with silver nitrate, blindfolding them, or blinding them completely. So treated, the animal ceased altogether to imitate the background pattern, and its hue reverted to an even, dark shade "representing more nearly the resting state of the chromatophores."

The second discovery grew out of a series of experiments in which the walls of the tank were variously colored and patterned.

> In the case of the *Rhomboidichthys*, . . . that part of the bottom immediately surrounding the fish appeared to be the one chiefly effective. . . . The influence of the vertical walls of the vessel commonly seemed to be a subordinate one, *even in cases where the fish was so large that it covered a considerable fraction of the bottom and was obliged to lie constantly with its eyes close to one side or another of the jar.* . . . What the fish saw directly overhead . . . seemed to exert a negligible influence upon the color pattern.

So much for the chief facts. Be it noted, first of all, that the imitative reaction is not always seen by the flatfish, and that Sumner has shown that the animal can adapt while its entire body (except for the eyes) is buried in sand or completely masked with a cloth or deeply stained. This renders it "highly improbable that any direct visual comparison on the part of the fish between its own body surface and the surrounding background is an essential factor in the production of these changes." In other words, *'consciousness' (in whatever sense the term be used) is not an instrument in making one space pattern match another.*

If it is not, how can one continue to hold the old psychological doctrine that the arrangement of space-elements (or non-spatial elements) into forms, patterns, or perspective orders is brought about in any degree by the cognitive process, or by the 'association of ideas'? As with the imitative reflex among human beings, so here. The process is set up by a physical stimulus, and its result either cannot or need not be perceived by the organism. *The correspondence, therefore, is not between the flatfish's percept A and the same flatfish's percept B;* it is between a stimulus (which may or may not be perceived, for aught we yet know) and a chemical pattern *which is the cause of a perception in an external observer.*

In other words, the flatfish is not imitating merely its own percept *A*, but is doing so in such a manner that *some other creature will perceive the flatfish's skin as having, not merely the characteristics of the fish's percept A, but as having the characteristics of the external cause of perceiving A.* To make this last point clear, consider the second phase of the total process; namely, the spatial transformation.

The flatfish's eyes are very close to the sea-bottom, sometimes only a centimeter or so above it — as when it buries its body. It is while in this position that the eyes sense the shape, size, color, and arrangement of the sand and pebbles. These objects are therefore cast upon the retina in an extremely oblique perspective. You may get the general effect by holding your eye close to your desk and glancing across the latter. The foreshortening will be at a maximum; a few items in the foreground will loom up, while the converging of the rest of the field will be rapid. But this is not the scene which the flatfish reproduces on its skin. It depicts, with its chromatophores, the color, shape, size, and pattern of the material on the sea-bottom *as this material would appear to an eye whose line of direct vision was perpendicular to the plane of the sea-bottom and a great enough distance from the sea-bottom so that the units of the pattern could be seen without any appreciable perspective distortion.* Roughly speaking, the skin pattern closely resembles that of the sea-bottom as the latter would appear to you if you were looking directly down at it, and six inches or more away from it.

However this queer deed is accomplished, it certainly *results* in a translation of one perspective into another perspective; and *this translation is precisely that which is deducible from Euclidean space.* The rate of reduction of relative sizes in the first perspective is a function (mathematical) of the distance between eye and plane; and this very same relation governs the chemisms in the chromatophores and also the rearranging of the latter.[1] Inasmuch

[1] Sumner has found that the plane in which a given surface lies with relation to the flatfish sometimes determines whether or not it shall be effective in calling forth a given change. It is not certain, he adds, that this influence is decided by "purely quantitative relations within the visual field." Should later experiments

as this translation is accomplished without the fish's seeing what it is doing to its own skin, we must at least conclude that somehow the perspective relations are so thoroughly 'in' the space which the fish sees around it that they can *cause* other perspective relations just as truly as one chemical relation causes another. And just as one chemical relation causes another, without the assistance of any psychical act, so too with perspective relations: they are not set up by the 'association of ideas,' nor by an '*a priori* synthesis.' They are physical, no less than weight is, and absolutely non-mental in the sense that they are not *constituted* by any psychical process. The full interpretation of this particular matter lies beyond formal analysis. But it is not improper to suggest that, if perspective is a mere physical relation in a lower animal's adjustment, it is probably the same in human perceptions. At all events, no mere introspective difficulties can now force us to assume that some mysterious psychical 'association of ideas' or 'local signs' manufacture, out of non-physical elements, the space relations which we see. Should this statement be taken in full earnest, the entire British and Kantian psychology, together with all modern disguised variations, would have to be discarded.

And now for the third phase of the process, namely selection. The flatfish adapts its skin pattern only to the sea-bottom, in normal life. The animal notices objects above the bottom and even directly overhead; it follows such with its eyes and moves toward or away from them. *But the very same pattern which sets up the pigment reactions when it is underneath the fish has absolutely no effect when above it.*

A plate of opaque white glass, of the same size as the bottom of the tank, was covered with small, irregular blotches of black paint. . . . . The three specimens used in this experiment had all been unmistakably influenced by this spotted plate when this was placed *beneath* them, assuming a much blotched appearance. Upon the removal of the plate from beneath them, they had re-

fully confirm the non-quantitative character of it, we should have to admit what I have above advanced, namely, that *directions* are precisely as objective and efficient as material things are.

turned to a nearly unspotted condition. The spotted plate . . . was next inserted above the fishes (under the surface of the water, of course). The plate . . . was brightly lighted by the mirror below. That the fishes could see this spotted surface cannot be doubted. Nevertheless, *not one of the specimens showed any appreciable influence, even after several days.* Return of the spotted plate to the bottom of the tank, beneath the fishes, resulted in each case in a resumption of the blotched condition within a few hours at most.[1]

Descriptively, then, the perceiving function is not constructive or transformative, but merely selective. Certain *important* elements in the environment are attended to, to the exclusion of others, when and only when it is a question of adapting the skin pattern. The other elements are seen, but they are ignored for this particular reaction. Unquestionably, the flatfish has a genuine 'field of attention' wholly distinct from the visual field. But the items entering into the field of attention are *not* transformed therewith; for they all pass over unchanged into the skin of the fish. I see no escape from the conclusion that at least one of the primary functions of psychic reactions is to select, reject, and direct certain environmental characters with reference to certain *other* functions (such as nutrition, protection, locomotion, etc.). It seems equally sure that selection and reaction to the selected character does not necessarily alter the latter. In other words, adaptation of agent to environment does not have to involve a qualitative change in more than one of the two *relata*. And, in the special case of selective attention, this operation does not modify the essential characters of the stimuli selected for response.[2]

[1] Italics mine.

[2] The remarkable facts Sumner has brought to light may not raise the difficulties which their discoverer fears. I do not find it difficult, as he does, " to conceive of a nervous mechanism competent to bring about such changes." Is it not quite probable that we have to do here with *an exceedingly simple*, rather than a mysteriously complex structure and function? Instead of being an elaborate photochemical process which begins in the retina and undergoes a large number of incomprehensible transformations on the tract to the pigment cells, may the patterning not be effected by the direct conduction of untransformed ether waves to the chromatophores? To-day this hypothesis is not so extravagant as it was before Sherrington and others demonstrated experimentally that the periodicity of nervous

We have still to consider a case of conduction which is even more illuminating than the untransformed conduction of stimuli through the flatfish. In the latter we found peripheral conditions flowing on through the organism; and we were justified in inferring that, whatever the sensory nervous system of the animal accomplished, it did not alter *all* of the stimulus characters. We were not assured, however, that the peripheral sense organs did not add some psychic quality to the received stimulus; and it remained at least conceivable that this additional tone qualified whatever may have appeared in the animal's consciousness and perhaps have been the necessary ingredient in the dynamic complex which later regulated the imitative adjustments. In other words, while the sensory nerves conduct some qualities, they may, so far as the case in question testifies, add to the latter some unique specificity; and this might be of the sort which anti-realistic thinkers would describe as 'physical' or 'mental' or 'non-physical.'

But there is another well-established fact which demonstrates that, even though sensory nerves (or structures) do add something to stimuli, that which is added is a character which can be propagated through *inorganic* spaces, precisely as light or electricity can be; and hence, that it is, in some sense, spatial or physical. I allude now to the experiments of Němec, proving that, in plants, stimuli that have been taken up by leaf and stem tips can pass through dead tissue and induce in the organism the same reaction as though the stimuli had been transmitted through living tissue.[1] The following summary of Němec's research is abridged from Macdougall's account of it.[2]

impulses corresponds to the periodicity of serially repeated stimuli, at least up to rates of 500 per second. If we suppose that this correspondence holds for *all* cases, even those of ether wave shocks, we then have a nerve impulse at the pigment cells which is, in pattern and in photo-chemical efficiency, identical with the stimulus pattern.

[1] Němec, B., Reizleitung und die Reizleitenden Strukturen bei den Pflanzen, Jena, 1901.

[2] Macdougall, D. T., Practical Text-Book of Plant Physiology, New York, 1901, 16, 17.

A specimen of *Mimosa* was employed. A section of its stem was killed by pouring boiling water on it for three periods of five minutes each. Harsh stimuli were then administered to leaves above the injured section. Some leaves were cut, and others were burned. The reactions were of the usual sort, in spite of the fact that the shock had to be transmitted through dead cells before the reactions could occur.

Now, one might say that the stimuli were conveyed through the dead section by the water in the tube-like cells which are supposed to conduct impulses consisting of hydrostatic disturbances of the fluid they contain. But this does not seem to be the case, inasmuch as the reaction of the injured *Mimosa* takes place also when the stem is dessicated. But suppose that, even in this latter instance, there is a microscopic amount of fluid present in the injured region, and that it is by means of this fluid that the reaction is regulated. Would this not still force us to infer that the specificity of the stimulus and of the reaction is not intracellular, but is somehow a property of the fluid; and a property, moreover, which can flow along through dead matter, just as an electric current can?

To be sure, the experiment does not prove that the specificity of the stimulus is not conveyed through dead tissue, say, by some unknown microörganisms in the fluid, and that these microorganisms infuse into the received stimulus some mysterious psychical, non-physical nature. I leave the reader free, however, to attach what importance he will to this conceivable state of affairs. For myself, it does not seem worth a moment's consideration, in the light of the other facts we know about afferent processes.

d. Transformation. — Type A1. This has just been described in the case of the flatfish.

Type A 2. — This reaction is the most difficult to describe, because it is either going on simultaneously with a selective process or else operates with a stimulus of which we know so little that we cannot

be sure that there is a genuine transformation. The former case we find in the digestive series; the latter case appears in the so-called 'lower senses,' touch, taste, and smell. Especially in the tactile sensation do we seem to have a qualitative change of the profoundest character. I mean, the stimulus is simple pressure, in the thoroughly physical sense of this term; but the specific *quale* resulting from that pressure cannot readily be thought of or perceptually analyzed into precisely what the physicist means by pressure. There would appear, therefore, to be here some inner change of the stimulus effected by the reaction to it. Pure description can carry me not an inch beyond this view. I know of no instances which give us evidence that pressure is homogeneously propagated through the nervous system, as light and air waves appear to be.[1] Indeed, I do not understand what that performance would be. So I shall say that, so far as description can now carry us, the stimuli of odor, taste, smell, and other 'lower' senses are transformed by the reactions to them. This does not mean, of course, that it is the sensing, as such, that changes them; it only means that, in con-

[1] Difficult as a matter of pure description, I mean. I have a hypothesis about this very difficulty, and the hypothesis involves an explanation of the striking differences between the tactile, olfactory, and gustatory characters and those of the 'higher senses.' Briefly, it assumes that the 'lower' sense operations are 'internal' to each stimulus unit, whereas those operations of the 'higher' senses are 'external' to their stimulus units. By 'internal,' I here mean that the 'raw' stimulus actually invades the sensing organ; by 'external,' I mean that it does not. When it does invade it, the *total* organ is taken up with its reacting to the single stimulus and so, sensing nothing else, does not sense the *difference* of the momentary stimulus from others. Lacking every such differentia, the stimulus is specific but not explicitly qualified. To speak the language of logic, the *quale* is a term stripped of all its relations. Hence our inability to classify and order the 'lower' *qualia;* hence their inability to compose themselves into forms analogous to a musical chord or a space-color pattern.

All this and its extensive presuppositions, however, are not formal analysis. I hint at them only to prevent a critic from supposing that, when I admit the failure of pure description to state the relation between stimulus and reaction in the 'lower' senses, I am confessing that a realistic view breaks down. This latter does not depend upon the universal possibility of formal analysis. To say that it did would be to presuppose that no genuine simples are given in experience, and also that every given complex must be equally clear as to its terms as it is in its relations.

nection with the sensory reaction, *some* process does. The process that does may bear the same general relation to the sensory process that the masticating of food bears to the digestive selection of food elements. Indeed, to lapse for an instant from pure description, there are many good reasons for supposing that it is just this relation which does obtain; and there are some grounds for conjecturing that most, if not all, cases of transformation precede selective processes and serve only to facilitate selection. Surely, all the clear instances of transformation, to which we shall now turn, are so to be described.

The two great, unambiguous types of transformation are respiration and digestion. Here the stimuli are actually seized upon and made over *in toto*. *In toto*, be it repeated, but not *in partibus*. That is, the received complex is, as a complex, increased by the addition of new elements (as saliva, bile, etc.) which alter the structure of the complex. The new complex is so formed that certain of its elements can now be withdrawn from it more readily; and they are so withdrawn. (Once more let me warn the reader that this language does not imply or presuppose finalistic processes.) After the elements have been withdrawn and appropriated by the organism, the remainder of the complex (including some original and some acquired constituents, in mixed measure) is cast out of the organism. The rejected part is cut off from stimulating and regulating the organism, in its *further* reactions to the selected part of the complex.

This general description is enough to make clear the broader character of the digestive and respiratory transformations. Were we conducting a biological canvass, we should now have to ask in which other operations the same type of transformation occurs. That is not our present duty; but I should like to point out one peculiar instance. In so far as pure description guides me, I find pleasure and pain to be precisely such additive transformations,

Formal analysis is only one of many methods of discerning reals. Formal analysis may be just as incompetent to deal with some problems as deduction is useless in one's endeavor to decide which of two paintings is the more beautiful.

serving to facilitate a later selection of some element. This description does not tell the whole truth about the situation, but, so far as it goes, it seems to fit.

I am directly aware of two circumstances in many algedonic reactions: first, that the 'external' stimulus is colored or suffused with the feeling tone, which is felt as not belonging to it in the same thorough manner in which its specific quality does; and, secondly, that, *in the succeeding reactions to this complex, the feeling tone is sloughed off and the organism operates solely with the 'external' character.* For instance, I hear a sound which is very pleasant; and the pleasantness of it 'makes' me attend to it exclusively. I select the sound from a large complex of auditory stimuli; but after I have selected it, I react to the objective character of it altogether (or, at least, predominantly). My motor adjustments are to *its* rhythms, not to the pleasure; my 'associations' (reveries) are about *its* specific character, *its* relation to other melodies, other places where I have heard melodies, its meaning, etc. In other words, the pleasure initially transforms the music; but *the consequence of its doing so is that it facilitates the selection of the music,* and after the selection the pleasure tone is not reacted to, but at most only accompanies or coexists with the selected music. So far as pure description can speak, then, the pleasure tone is, to the mental reactions, exactly what saliva is to the digestive reactions; a transformer by addition, serving to facilitate a later selection of *something else.*

Pleasure and pain, then, are intraorganic additives. Like saliva, they are not an original part of the incoming stimulus nor yet mere products of the assimilating process, but rather a preliminary aid to a selection and a later adjustment. They mingle with the received matter, and genuinely qualify it in such a manner that the organic reaction to the matter is heightened. Thus, they most remarkably resemble the opsonins of the blood, whose specific function it is to 'flavor' bacteria so that the leucocytes will absorb the latter. This resemblance, I admit, may be quite accidental and without much significance; but it is worth some in-

quiry, for it would be a discovery of no small moment, were we to find that blood reactions and algedonic reactions are generically related.

Type B. — I have not been able to put my finger upon a case of such transformation. Always the instances which at first seem to fulfill the conditions of this type prove, upon inspection, to be only complex and obscure instances of either Type A1 or A2.

e. Resistances. — These are structural or functional or both. For our purposes, they need not be so distinguished, though. It is here important only to indicate the type of relation between the stimulus and the resistance reaction. Now, there are at least two and almost certainly three or more radically different sub-types of this relation: (*i*) resistance by *destruction* of the stimulus (or an element of it); (*ii*) resistance by *interpolation* of insensitive material between reagent and stimulus; and (*iii*) resistance by *suspense of collateral functions.* Strict accuracy might lead one to add a fourth sub-type, namely resistance by simple rejection of the stimulus; as in the case of resisting attack by a wild beast. But, for obvious reasons, we need not concern ourselves here with this instance.

(*i*) *Resistance by Destruction of Stimulus.*—Specimens of this are very numerous. I mention only the blood resistances, because they bring out the important features of the type.

a. Antitoxins of the Blood. — The specific antitoxic reaction of the blood does not act upon the bacteria which have produced the toxin. It is simply a process of neutralizing the toxin. The diphtheria bacillus, the tetanus bacillus, and other varieties generate poisons injurious to the organism they inhabit. These poisons set up in the organism a counter-process whereby a chemical is generated which combines with the toxin so as to neutralize it. This antitoxin is absolutely harmless to the bacteria themselves, which thrive in it jauntily. It is evident, therefore, that the bacteria are not the stimuli of this antitoxic reaction. The latter is set up and directed toward one particular effect of the bacteria. In

short, the organism here reacts to only one feature of the 'total situation.'

β. Bacteriolysins and Bactericides. — These are two other varieties of organic chemicals generated by the organism infected. They possess the contrary power of the antitoxins. The latter neutralize the toxins produced by the bacteria, but do not injure the bacteria. The bacteriolysins and bactericides, on the other hand, do not neutralize the toxins at all, but they do kill and consume the bacteria. Here again, then, we have a reaction directed toward a particular feature of a 'total situation' and affecting only that feature.

Of such chemical reactions the number is legion; and not only is each one directed toward some element in a stimulating complex, but also it is efficient only with respect to that very element. The tetanus antitoxin neutralizes only the toxin of tetanus bacteria, not that of diphtheria or any other infection. The typhoid bacteriolysin avails naught against the malaria bacteria. And so on.

Another observation which will bear upon the philosophical issue we shall raise. At least five types of blood reactions are produced simultaneously in case of infection: the three above named and also agglutinators and opsonins. But, though produced as if by one reaction, they do not form an 'organic whole' in the Hegelian sense of this misleading phrase. That is, they are not of such a character that their nature is constituted by their interrelations. We have of this a perfect empirical proof, in the fact that they can be separated by the physiological chemist without losing their specific efficiencies. The antitoxic serum can be withdrawn from the blood of a horse, and, apart from the other chemicals of the blood, still neutralize its own proper toxin.

The question whether such resistance chemicals depend upon a natural reagent at all — that is, whether they are caused exclusively by an organic process — has not yet been conclusively answered. The trend of evidence, however, is strongly toward a negative answer. Organic secretions have nothing unique or mysterious in their make-up. They can doubtless be manufactured

in any laboratory, as soon as their chemistry is better understood. When the first one is so produced, biologists will see more clearly that the peculiar 'unity' of life is not to be looked for in organic chemistry, but rather in the dynamic relation between stimulus and the response to its specificity.

(*ii*) *Resistance by Interpolation.* — Here are to be included all operations like callousing, thickening of fur, pigmentation under sunlight, etc. Suppose my hands, now soft and thin-skinned, are put to handling rough boards. At first, the skin is scratched and worn through and blistered. But soon it thickens so much that repetitions of the previous stimulation no longer reach the sensory nerves and the subcutaneous tissues with the same violence. Now the immediate stimulus is a series of impacts, and these are halted. But this halting does not constitute the reaction of which we are speaking. The callousing is a wholly different operation. It succeeds the absorption of the immediate impact by a considerable period; and — what is infinitely more significant — *it is not directed to the stimulus which induced it* (*for that stimulus has long since passed*), *but is directed to the path of the stimulus, and so indirectly to future stimuli.* And the effect of the reaction is not to prevent its own initiating stimulus from doing damage to the organism, but to prevent later stimuli from so doing. I claim, therefore, that, as a matter of pure description, we ought not call the callousing a reaction *to* the stimulus initiating it, unless we peculiarly limit the meaning of the preposition 'to.' If 'to' indicates the direction of the reaction, the preposition is certainly out of place in the above context.

We may now state more precisely the manner in which the *relata* are and are not reciprocally altered in this type of reaction. The immediate stimulus is absorbed, not by the reaction, but by the organic stuff that intercepts it. The reaction grows out of this stuff, somehow, and operates, not so as to change the environment (*e.g.* the boards that are being handled, or the handling of them), but only so as to cut off the impacts from the sensitive organism. This does not change the impacts, in the sense that they

are any different, as objective, external events. A board, for instance, is equally rough before and after the callousing reaction has set up. It weighs just as much, whether the lumberman's palms are soft or hard. The inertia and momentum, as it slides off the lumber wagon, are not altered by the reaction.

How, then, has anything been accomplished by the reaction? The answer carries us back to the difficulty we alluded to at the beginning of this essay; namely, the demarcation of organism from environment. If we *define* the organism as that which initiates reactions to stimuli, then large tracts of the body are not organic, in this narrower sense. The callouses are not, for instance. They are products of a reaction, not the initiators. Should we employ that definition, we ought to describe them as elements inserted into the environment by the organism, as insulators. As objects, they bear the same relation to the biological 'situation' that the glass insulators of a telephone line bear to the telephoning. With respect to the latter process, the insulators are a true part of the environment; they are not a phase of the telephoning process, but only a means of preventing the earth from disturbing that process. They neither modify the elements in the telephonic series nor the earth, but rather forestall such modifications.

(*iii*) *Resistance by Suspense of Collateral Functions.* — This process appears in that all-important but little understood operation of mental attention, which Ebbinghaus aptly describes as 'eine rechte Verlegenheit der Psychologie.' If the reader will bear in mind that I am not here engaged in presenting a theory about attention, but am only describing what is open to formal analysis, he need not be offended by the remark that attention not only involves a certain facilitation whereby the observer smooths the way for stimuli of the chosen type, but it also involves cutting out all other stimuli — or at least offering them a heightened resistance.

As to the precise nature of this double performance, psychologists know little or nothing. They conjecture that the facilitation may be accomplished by a drainage of nervous energy into the appropriate sensory centers from the muscles which are accommo-

dated specifically to the stimuli that are to be attended to. But this strikes me as unilluminating; for the accommodation itself is certainly a part of the attending act, indeed may *be* the facilitation and not the cause of it. And, in any case, there is little or no physiological evidence of such a drainage, and there is even considerable doubt as to the existence of sensory centers, especially of the sort which are so highly differentiated that one receives only the pitch of tone and another only the *timbre*, one the form of a visible object and another the color. Because of such uncertainties, we must shun every exact theory about attention and content ourselves with pointing out certain respects in which its specific resistances — whatever they may be — contrast with the types above described.

Now, it is safe to say that the inhibited stimuli are not destroyed, as bacteria are by the bactericidal reaction. For we commonly become aware of events which we did not cognize while they were happening because we were engrossed with some other affairs. At the close of an exciting chapter in a novel, we suddenly sense for the first time that the clock struck midnight some minutes ago. Of course, this could not occur if the original stimulus had been annihilated somewhere along the afferent tract.

Again, there cannot be any interpolation of insensitive structure, as in callousing or protective pigmentation. Not only is all evidence of such a process lacking; the latter is inconceivable. No systems of screens can be imagined which would shut out or interfere strongly with all but *any* one kind of that incomputable multitude of stimuli which assail the sense organs continually. How, for example, could there be devised a material filter that would admit to the cortex only the meaning of words and not their printed form (a separation which is readily made, in attention) or conversely only the printed form and not their contextual significance?[1] To

[1] This phenomenon is less familiar and, so far as I know, has not been studied. It sometimes appears in highly expert proofreaders, who have trained themselves so well to note only typography that often they cannot state even vaguely the content of what they have just read.

put the question is to answer it. The filter would have to be of infinite complexity and instantaneous plasticity, to manage the swift shifts of attention in everyday life.

Now, if the stimulus is not destroyed, and if it is not excluded from the attention field by an interpolated structure, then there remains only one member of the biological triad to perform the trick; and that is the reagent itself. It must suspend certain *operations*. It must simply stop sensing certain data in certain contexts. How this is done, we do not know; nor need we, so long as we are merely analyzing observable events in terms of their observed differences. This much may be anticipated, however; the functions which are suspended are not mere spatio-temporal movements, for they do not effect the displacing of the inhibited stimuli in time or in space, but only their displacing from the cognitive field. Doubtless they involve spatio-temporal operations; but these do not constitute, of themselves, the specific resistance. If this statement is obscure, the reader may ignore it for the present.

III

RESULTS OF THIS FORMAL ANALYSIS

At least four highly significant facts have emerged from the above descriptions.

1. Reaction ('response') is not a single type, except in so far as every case of reaction involves the same types of complexes as its terms, namely, 'agent' and environment. With respect to the relations between these terms, there are many heterogeneous reactions which cannot be reduced to any one pattern.

2. The relations between the terms of the biological 'situation' are not 'internal,' in any observed case. Transformations which seem to produce new, unique qualities do so only in the sense that they establish new complexes which, with respect to their complexity alone, are novel. Primordial characters do not seem to be created by any organic change which we can observe.

3. Reactions are not to 'total situations,' but to phases or parts or elements of such. This narrowing of activity does not always entail a change in the environment nor the manufacture of synthetic products in the organism.

4. Geometrical, mathematical, and other relations are genuine stimuli, in the very same sense that material complexes are. Hence, for formal analysis, they are not products of the cognitive reaction, but the producers of it and many other kinds.

A few comments on each of these points.

1. This must be urged upon idealistic biologists and also upon some biological pragmatists. These investigators have tended to construe all reactions as fundamentally alike, not only in respect to the terms involved, but also in respect to the type of relation between these. This relation has been called a transformative one, and the adjective has not been severely analyzed.

The biological pragmatist, for instance, opposes radical realism on the ground that adaptation involves some transformation of the environmental character which stimulates the organism and to which the organism responds. He admits that there is an external and independent environment, and just so far he is one with the realist. But he denies that there is anything like correspondence between the environment as known and the environment as unknown. For, says he, knowing is a response to a situation; and wherever such processes occur, there is a modification of both the stimulus and the recipient organism. Therefore, the world, as known, is a peculiar system of 'contents,' which do not exist as qualities of the external order, but are nevertheless genuine functions of the two variables, stimulus and reaction processes. In this manner the biological pragmatist escapes epiphenomenalism and subjectivism, and he seems to have struck a happy compromise between the radical idealist and the radical realist. With the idealist, he maintains that there is some kind of synthesis involved in experience, and that this synthesis eventuates in a 'content' which is neither pure object nor

pure subject. With the realist, on the other hand, he believes that the object system (that is, what the biologist calls the environment) is in no sense constituted by its being known. So it comes that he finds himself unscathed by the realistic attacks upon the idealistic doctrine that *esse* = *percipi*. Also he is not put to it to clear up the difficulties in the theory of consciousness and the postulate of 'external relations,' as the realist is. All in all, then, his lot to-day seems a most happy one.

If, however, we inspect his hypothesis of stimulus and reaction, we find that he has placed several restrictions upon the facts which the descriptions we have been giving will not allow. This appears most clearly in Dewey's account of the matter. Dewey believes himself to be a realist with regard to percepts.[1] But he finds reason to maintain that the perceptive reaction is transformative and constitutive.

> The seen light is not in relation *to* an organism. We may speak, if we will or if we must, of the relation of vibrations of the ether to the eye-function; but we cannot speak, without making nonsense of the relation of the perceptual light to an eye, or an eye-activity. *For the joint efficiencies of the eye-activity and of the vibrations condition the seen light.*[2]

As I understand this passage, it means that the 'joint efficiencies' bring about either an A2 or a B type of transformation of the stimulus.[3] If the eye-activity simply picked out and conducted certain kinds of light to a center, and if also the seeing of the light consisted merely in the latter's being related to certain other physical entities (perhaps as elements are, in the cross section of some process), then there would be no nonsense in speaking of the relation of the perceived light to the eye, or to the eye-activity. The eye-activity would bear somewhat the same relation to the perceptual light which a camera bears to the light it has rearranged. This relation might be statable very precisely;

[1] Cf. especially his Brief Studies in Realism. *J. of Phil., Psychol., etc.*, 8, 393 ff.

[2] *Ibid.*, 396, note. Last italics mine.

[3] Cf. 386 above.

and, I shall venture to suggest later, that the general type of it is strikingly like a familiar geometrical relation.

To deny that such a relation obtains is justifiable only on the assumption that the eye and the ether in combination somehow *constitute* the seen light, after the manner of a Type B transformation. Were this the case, it would be futile to search for a relation between the relation of eye to ether and the eye. Such would be a Bradleyish procedure, precisely like that of hunting for the hidden relation between A and r, in the complex, ArB. Now, to condemn our describing the seen light as related to the organism is to presuppose that the seen light is not an entity in relation, but the relating of two entities. It is this view which Dewey explicitly holds, not on general metaphysical grounds, but for purely empirical reasons.

This, I believe, cannot be maintained against the evidence of biology. If there were no better facts to array, the imitative adaptation of the flatfish would prove conclusively that, at least in some cases, the eye activity does not condition the specific light-character of ether vibrations, but only the distribution and employment of these. To be sure, one might still say that the organism conditions the seen light; but exact description quickly reveals the danger in such a statement, for it is not the luminosity, as such, but some other peculiarities (especially the geometrical) which are conditioned.

The most effective facts to cite here, though, are those which we know directly and which have been long studied; namely, the facts of least perceptible differences. In these we have proof that the joint efficiencies of eye activity and ether vibrations do not condition the seen light. Unlike instances drawn from the behavior of lower animals, the psychological data to be considered forestalls one common and difficult retort of the internalist. "If," he often says, "you but knew A in all its inwardness, you would discover that every change in r involves a change in A (and B). A tree may seem to be unmodified by being perceived; but that is only because we know not all that is happening to it." However

forcible this may be when we are considering physical objects at large, it fails completely when we are debating about the *immediate* nature of the percept alleged to be conditioned by the organic and the physical terms of which it is a relation. For now we know in its entirety the subject of discussion; we are talking about the percept, *qua* percept.

I gaze at a pane of ground glass which is illuminated from behind. An experimenter slowly increases the number of standard candles which he allows to shine upon the glass from a certain distance. If the distance is great enough, he may light up twenty candles before I perceive an increased brightness upon the ground glass. In terms of relations and *relata*, what has happened? A stimulus has been modified twenty times, and each time a new manner (by another increment), but the percept has not changed at all. If, then, it be admitted that there is *any* relation whatsoever between the stimulus and the percept, it must be granted also that *the latter at least is not constituted by that relation.*

At first thought, one might be tempted to escape this conclusion by arguing that the changes in the stimulus have been 'absorbed' or 'overcome' somewhere along the physiological tract that is involved in the perceiving process. But this avails not at all, so long as one adheres consistently to the theory of internal relations. For let these physiological factors be *m*, *n*, *o*, *p*, *q*, *r*, . . . in the first instance, before the stimulus has been altered. Then, the complex S-*m*-*n*-*o*-*p*-*q*-*r*- . . . C constitutes C (the perceived brightness). That is, the relation of C to *r*, of *r* to *q*, of *q* to *p*, of *p* to *o*, etc. back to S makes C what C is. But if S changes its relation to *m* (as it must if S is increased by twenty candle power), then *m* is altered; for *m*, like all other entities, is modified intrinsically by its relations to other entities. And, if *m* is altered, then its relation to *n* is, and consequently *n* too is inwardly changed. And this alteration continues along the entire chain; hence, whatever the last member of the complex is prior to C, it must be different, hence its relation to C is; and hence C itself is. Resistance, absorption, adaptation cannot occur, inasmuch as they involve the *overcoming* of

changes and, at the same time, the keeping of some entity (character, function, etc.) unchanged, in the affected system.

It is not necessary to point out the series of transformations in the above-named series of relations, in order to prove that the internal theory of relations is false here. We shall score no less surely, by indicating what happens when the twenty added candles are extinguished one by one. After the nineteenth has been put out, the original stimulus no longer exists in any sense compatible with the hypothesis of internal relations. There was a light of n units power; there is one of $n-19$ units. Nineteen *relata* have dropped out of existence; each was related to the percept; hence the latter has lost nineteen relations. But not even nineteen losses alter it inwardly.[1]

From this there is no escape. It will do no good to suggest that maybe there are minute, unnoticed changes in the percept during the changing of the stimulus. Grant that there are; the difficulty for the internalist is not a shade less formidable. For a minute change in a phase or element of a complex inevitably modifies the complex, *as a whole*. But what is the percept as a whole, if not just that which we perceive, namely, a certain brightness? This whole, however, is not changed at all. And if we do not regard the percept, *qua* percept, as the whole, what in heaven's name do we mean by the *seen* light, the *heard* sound, the *felt* smoothness, and so on? In this particular debate, an appeal to 'subconscious' *qualia* would simply evade the issue.

In view of all this, I conclude that the discontinuous variation of percept values during continuous (or more nearly continuous) variations of stimulus proves empirically that the joint efficiencies of the eye activity and the physical matter do not condition the percept constitutively; that is, the seen light or the heard sound is not a new total complex of which stimulus and reaction are elements (Type A2 transformation), nor is it the dynamic relation between stimulus and reagant and so constituted by the terms in

[1] I treat each candle as a unit relatum, simply for convenience. It would be no less proper to speak of each ether wave as one.

the manner that the relation between positive and negative electric charges is constituted by these. (Alleged type B transformation.)

The difficulties which American biological pragmatists have found with the concept of transformation and constitutive processes can, I believe, be traced directly to the fact that, following Dewey's lead, they have attempted to apply formal analysis, first of all, to the ethical situation. Like Dewey, their first interest has been in human conduct; and, in describing its processes, they have rendered a noteworthy service to philosophy. But the subject matter offers peculiar obstacles. First of all, it is prodigiously complex; then, it is largely intangible; and, finally, it is thickly overlaid with traditions, prejudices, and suspected habits of speech and action. The inevitable result is that for a long time the analyst must deal only with broad complexes. He must handle many things as though they were one thing, and perhaps one thing as though it were many. He is in the predicament opposite to that of the mathematician, who quickly attains the simpler entities relation of his subject matter, but approaches with ever decreasing velocity the analysis of the highest real complexes.

In his early formal analysis of the moral situation,[1] Dewey employs the concept of 'transformation' in a manner which, however necessary at the time, was fraught with perils. It is worth criticizing here because it has undoubtedly influenced many pragmatists' interpretations of biological facts, even though they may have long since consciously modified it.

Take the passage in which Dewey analyzes the 'mediation of impulses.' This process he describes as the "back-reference of an experience to the impulse which induces it." And he maintains that "the expression of every impulse stimulates other experiences, and these react into the original impulse and modify it. This reaction . . . is the psychological basis of moral conduct." "Such mediations constitute the meaning of the impulse — they are its significance, its import." And, four pages further on: "We may

[1] The Study of Ethics. Ann Arbor, 1897, 14, etc.

recognize three degrees of completeness in this mediation. In the most complete reaction, the original or natural impulse is completely *transformed;* it no longer exists in its first condition. Our impulse to locomotion, for example, is entirely made over when the reaction of other experiences into it is completed — when we learn to walk. . . ."

Now, an impulse is an activity, *and nothing else.* Its character is not at all derived from the particular elements which happen to lie in the path of the activity, restraining or facilitating it. In the 'complete transformation' of the locomotion impulse through mediation, it appears to me that the impulse itself is not changed much by those factors which come to regulate the leg muscles. What is changed is only the path of discharge and the rhythm of tonus. Now, so long as we do not clearly separate the activity itself from the elements it immediately affects and those which affect it, we shall call the total complex '*the* impulse.' And, calling it that, we shall have to say that it is changed in quality whenever its rhythm or direction or rate of discharge is altered. But this way of looking at it is demonstrably improper, inasmuch as many elements involved in the discharge-zone of the impulse do not contribute to create the impulse. They are not constituents of the activity, but only of the field of action. They bear the same relation to the impulse that the iron filings in a magnetic field do to the magnetic force there. Their pattern is not identical with the pattern of the pure force, and they may be withdrawn without altering the latter in any respect. Had we time now to pursue this analysis, we should find that 'mediation' alters only a few factors; and that these are chiefly parts, not the activity, but of the field. Enough has been suggested, though, to show the dangers in the way of A2 hypotheses here.

If the danger is serious, when we are analyzing impulse, it becomes gigantic when we turn to perception. It is not very hard to hold apart, in one's thinking, the impulse from the impulse field, and to observe that the latter does not constitute the former, nor *vice versa.* But how different the undertaking

is with the perceptual reaction! What here is the activity and what the field of activity? And how are they related? What changes the one, and what the other? These questions the biological pragmatist has not answered wrongly; he has not yet faced them, so far as I know.

2. If former analysis is to be trusted, the doctrine of 'internal' relations finds absolutely no confirmation in biology. This is the irony of fate; for those who accept the doctrine build it into a metaphysic which they call 'organic.' They name it after the analogy of life because they are persuaded that life offers the most convincing illustrations of entities being constituted by their relations, and of parts depending upon the wholes in which they stand.

In this belief, the internalists follow a vague popular opinion. Men know that a human heart, torn from its natural lodging, immediately ceases to beat; and that its former owner loses all interest in daily affairs. Also, it is pretty well established that you cannot spoil a man's stomach without spoiling his temper — and so on. Like most easily formed opinions, however, this one has truth enough for most practical purposes, but falls short of the philosopher's full measure. For the evidence of modern inquiries is all in the opposite direction. Indeed, experimental zoölogy and surgery are performing feats which make one wonder whether there is a single relation that is 'organic' in the metaphysical sense of this adjective. Note these two following discoveries:

A. Organic parts do not depend upon the whole in which they naturally occur, except in an empty sense of the verb. — R. G. Harrison has grafted the anterior half of a frog of one species (*Virescens*) on to the posterior half of a specimen of another species (*Palustris*), and has successfully reared young frogs from the combination. Each half preserved the peculiarities of its species, and *there was no trace of any mutual influence between the halves.*[1]

A still more enlightening experiment was performed by E. Joest, who grafted the halves of two different species of earthworms together. There was no sign of reciprocal influence; so, to make

[1] Reported by Morgan, T. H., Experimental Zoölogy, New York, 1907, 299 ff.

certain that this was not due to the fact that both specimens were fully formed and thereby fixed in structure and function prior to grafting, Joest later removed a part of one of the components. Regeneration then set in. Now, the new part derived nourishment from blood that came from both components; nevertheless it grew true to its native part. The new material from the other part did not alter it at all.

We need not multiply instances, of which there are many. Analyze any one of them, and the metaphysician's dilemma appears readily. To defend the internalistic theory, he must say that each half of the grafted frog was changed in some unknown manner — and then the heavy, heavy burden of proof rests upon him — or else he must say that one half of a frog is just that half of just that frog, only so long as it is a half of that frog; and the very instant it is cut off, it is no longer a half of *that* frog. Should he choose this alternative, he would be defining the part by its participation in the whole; and this, as Perry has shown above,[1] is either a tautology or a *petitio principii*.

B. Organic wholes do not depend upon their individual parts for their total specific organic character. — As Perry has indicated, when a given event can be caused or maintained by any one of several other events or conditions, it is improper to speak of the former as being dependent upon any one of the latter. Bearing this in mind, we observe that an organism is, within wide limits, independent of the particular parts composing it. Now, if you grant that it is, within even a narrow range, you have ruled against the internalistic theory.

Many animals possess an astonishing regenerative power. Cut off a fish's tail, and a new one grows; and, oddly enough, the larger the piece you remove, the more rapid the new growth — within certain limits, of course. It need not concern us here how this feat is performed. The significant feature of it is that *those very characteristics of the organism which, according to any internal theory of relations, depend most completely upon the absolute integrity*

[1] Cf. 107 above.

of the entire complex are the very characteristics which are least affected by such subtraction of parts. That is, the uniqueness of a particular fish consists predominantly in that which we vaguely call its 'individual life.' This embraces, among other unknown elements, those accumulations of behavior which we call either 'habit' or 'experience.' Whatever else of the creature's nature may be suspected of commonness, this much at least is unique and private, in every legitimate sense of these adjectives. Now, so far is the fish from losing its identity and its specific life through loss of its tail, that the animal is able to construct a new organ which is, in structure and function, identical with its predecessor. Certainly, this seems to prove, in every manner except the empty one alluded to, that whatever genuine 'unity' the organism possesses is not dependent upon all its parts, and perhaps not upon any one, but on a congeries. It is typically related to its physiological parts as the ectoderm to the optic vesicle, in the frogs on which Lewis has demonstrated the existence of a 'formative stimulus.'[1] This investigator demonstrated that any part of the ectoderm in the embryo will grow the lens of an eye, if a piece of the optic vesicle is transplanted beneath it. Described in logical terminology, the relation between vesicle and ectoderm is asymmetrical; in terms of physics, the process of formation is irreversible; and, metaphysically, neither the active term nor the dynamic relation involved depends properly upon the passive term of the complex.

3. It is not only the neo-Hegelians who insist that organic reactions involve the 'total situation' in which the organism finds itself. This is held by not a few pragmatists, at least with respect to psychic reactions, such as thinking and perceiving. Something very much like it is also held by a few biologists, I believe, especially those who lay stress upon the organic process of 'learning by experience.' Like many other inaccurate hypotheses, this one contains a certain truth, insistence upon which is important, in an age which is tempted to oversimplify organic activity. But, for

[1] Lewis, H. W., Experimental Studies on the Development of the Eye in Amphibia, *J. Exp. Zool.*, 1905, 2.

all the merit of it, the hypothesis suffers from rough-and-readiness. In a broad way, it covers a multitude of facts; but, strictly construed, it covers absolutely none.

In the more primitive reactions, only one feature of a single stimulus is effective. Thus, in the light striking the cell wall of *Equisetum*, in geotropisms, and in other familiar instances. Now, we find this same behavior all the way up to the very highest known reaction; namely, that of mature selective attention and directive action in man. To be sure, it is not equally prominent in all types of reaction; notably in normal perception, which is an adjustment to a large number of simultaneous influences. But this reaction is the least typical of all; and, whether typical or not, it is not the only sort. For present purposes, this is all I wish to show. One instance of reaction to only a part of a situation is sufficient to prove some kind of organic pluralism. The problem of determining just what manner and degree of organic pluralism obtains, is much too vast for these pages.

4. I am quite aware that, in asserting planes, angles, numbers, ratios, and other such mathematical-geometrical characters to be stimuli of the peripheral sensory organs, in precisely the same sense that ether waves are, I am exposing myself to ridicule. For this ignominy, though, I shall blame the facts themselves; I see no other way of describing them. My difficulty is not in the least mitigated or removed by the fact that nearly everybody except the new realists finds it easy to describe them as 'intellectual abstractions,' 'constructs,' 'shorthand expressions,' and the like. In an earlier section of this essay, it was pointed out that, if we have a right to call the length of an ether wave the cause of the color of the sensed light, we must also declare the direction of the wave the cause of such phenomena as heliotropisms and the special modes of cell division these set up. With this description we must make earnest. When we say that length is a cause of color, we must mean by length just that which a geometer means by it. Anything else is sheer quibbling.

Is it not clear, now, that the biologist who accepts the results

of pure description is in a position to repudiate almost every modern philosopher's theory of knowledge? Unaided by esoteric lore about the Ego, he can discard the doctrine of Pearson and other positivists that geometrical entities are 'mere shorthand signs' for peculiarities of sensations; and the doctrine of Driesch that space is phenomenal (*i.e.* a form of experience, and not a form of the physical world independent of experience); and the doctrine of Bergson that mathematical-geometrical characters are static artifacts created by the 'vital force.' In discarding all such confused opinions, the biologist rips out the very foundations of the stately theories which their champions have erected; for these have all built on the belief that space and time give rise to paradoxes which can be solved only by pronouncing the whole situation 'unreal' in some manner. This belief is incompatible with the evidence upon which it is founded. If formal analysis is employed in securing evidences of biological principles, then the system within which these principles hold good cannot be other than the one in which the evidences themselves occur. Those thinkers who employ facts from one realm of existence, to prove that there is another wholly different realm, inevitably commit the fallacy of distinguishing indiscernibles.[1] This fallacy I shall now try to exhibit.

Pearson, Driesch, Bergson, and many others have all employed formal analysis and have accepted as evidence facts discovered by it, in spite of their broader conclusions against the validity of perception and thinking. Especially Driesch and Bergson watch the behavior of animals in space and time, and from their directions, rates of motion, rhythms, and arrangement of space structures in their own bodies or in external objects, they infer that there is a 'psychoid' or a 'vital force' at work, that it strives to accomplish certain things, and is related in a certain manner to a transcendent environment. Now, the contradiction in this procedure is palp-

[1] The situation just described is one which gives rise to a self-refuting system. Spaulding has amply dissected this latter; the ensuing pages will deal with a wholly different phase of the matter.

able. But, though palpable, it ought to be analyzed minutely, inasmuch as Driesch (and possibly Bergson) evidently believes that its ill effects are forestalled by a metaphysical presupposition viz. that, although all *specific* terms and relations in the phenomenal field are peculiar to this field, they are nevertheless *typical* of terms and relations in the noumenal field.

For instance, in the latter, there is a dualism of some sort, one member of which is that which we mean, in the phenomenal order, by 'psychoid' or 'ego' or 'vital force,' and the other member of which corresponds (mathematically) to the system which, in phenomena, we call the 'environment.' Furthermore, the 'psychoid' or 'organism' of the noumenal order is confronted with difficulties in its environment which it struggles to overcome, and the manner in which it succeeds in so doing is *typically* like that which the biologist observes in the phenomenal order. Thus the flatfish has a noumenal existence, and in this transcendental life it develops various activities of the same *type* as those which we call 'appetite,' 'struggle for existence,' 'sex impulse,' and so on. Some one of these activities involves the process of bringing a part of its organism into the same *type* of relation with a certain part of its environment as that which we designate empirically as adaptation to the color and pattern of the sea-bottom. And this relation obtains, not merely in general, but in each moment and in each variety of adaptation. That is, when the flatfish, having a certain blue-gray checker pattern on its back as a consequence of resting upon a blue-gray checker sea-bottom, shifts to a gray-brown sea-bottom of irregular design and there soon develops on its back a gray-brown pattern of irregular design, the difference between the former and the latter *noumenal* situation is of the same type as that between the blue-gray checker and the irregular gray-brown pattern of the sea-bottoms. Nevertheless, the noumenal difference is not a difference between colors and space forms, for these are only phenomenal.

According to the idealistic biologist, you may take any case of reaction and describe it in this manner. There is a noumenal

something which the noumenal organism selects from a noumenal complex; and it is like that which we call oxygen, while the selective process is like that which we describe as respiration. Moreover, the selected something is related to the complex from which it is selected as oxygen is to air. Or again: when the roots of a plant turn toward the center of the earth, they are noumenally reacting to a stimulus which though in itself spaceless, is related to the reaction as the centripetal pull of gravitation is related to the downward turn of the roots. Or again: there is a noumenal stimulus corresponding (mathematically) to light and a reaction (adjustment and selection) corresponding to vision; and the former is of such a character that the noumenal organism must develop a visioning organ (spaceless, of course) with a large number of structural differentiations which correspond to those differentiations which we observe in the lens, the retina, the cornea, the aqueous humor, the ciliary reflex, binocular accommodation, and many others.

The advantages of this parallelistic hypothesis are conspicuous. It avoids the fallacy of exclusive particularity,[1] by admitting that the *pattern* of the phenomenal series is, at least in some broader feature, not "mere experience." And, by the same concession, it is delivered from the ego-centric predicament; for it accepts certain processes as not being constituted, in their *pattern*, by the cognitive process (though constituted by it, with respect to their *elements*[2]).

But there is another difficulty which it does not shun, and that is the identity of indiscernibles. So far as I know, neither the idealist nor his opponent has observed that the attempt to construe the general situation of organism-and-environment as a noumenal one results in the establishing of a one-to-one correspondence between the relational patterns of the phenomenal and

[1] Cf. 14, above.

[2] This, be it noted, is the exact reverse of Kant's original hypothesis. Kant regarded the patterns as created by the a priori synthesis, but the primordial elements as somehow connected with the 'things in themselves.'

the noumenal systems; and that *this correspondence is made significant only by making it not only a numerical but also a qualitative and structural correspondence.*

Take the adaptation of the flatfish. We would be setting up a one-to-one correspondence between the phenomenal and the noumenal orders, if we were to declare only that each discernible peculiarity in the flatfish's adaptive reaction resulted from some peculiarity in its noumenal environment. Schematically, this relation would be: —

S	1 2 3 4 5 6 7 8 9 . . . . .
S'	*a b c d e f g h i* . . . . .

in which S is the system of noumenal peculiarities, and S' the system of the phenomenal. The extent and degree of correspondence here is definable thus: for each element in S there is one and only one corresponding element in S', and for each element in S' there is one and only one element in S.

Now suppose that we make no further assumption. We have not advanced by the minutest degree toward a characterization of the biological situation. We have not indicated the specific character of the reaction of the 'psychoid' or 'ego' to the noumenal environment. We have not even said enough to indicate that there is a difference between types of reaction; *e.g.* between dodging and eating, between breathing and perceiving, between coughing and conjecturing. All that has been said is that in each reaction each peculiarity of it meets some special peculiarity of the objective situation. But we cannot pronounce the noumenal operation 'vital' in the biological sense, unless the phases of its activities are typically related to the environmental factors with which they deal in the same general manner as the activities we see animals performing are related to the environment we see them dealing with. In short, *so long as we assert merely that, to a reflex involving, say, nine distinct acts there corresponds an environmental complex having nine distinct efficient features, we have said nothing that could give anybody the slightest reason for inferring that*

there is a 'psychoid,' or that there is an operation there like those vital processes which we perceive, or that the vital processes differ from one another (are specialized), or that they differ from inorganic events.

To make sure, therefore, that the problems raised by reaction, adaptation, evolution, mutation, heredity, and the like are genuine problems, the biologist of conservative idealism is driven to affirm a likeness of pattern between the noumenal and the phenomenal differentiations. Schematically, this likeness may be thus stated: —

$$S \qquad 1 \begin{Bmatrix} E: m\ n\ o\ p \\ R: w\ x\ y\ z \end{Bmatrix} \cdots\cdots$$

$$S' \qquad a \begin{Bmatrix} E': m'\ n'\ o'\ p' \\ R': w'\ x'\ y'\ z' \end{Bmatrix} \cdots\cdots$$

in which S is again the system of noumenal peculiarities, and S' the system of the phenomenal; and E and R the environment and reaction phases of the noumenal system, and E' and R' those of the phenomenal: and the small letters are the distinct features within the phases after whose symbols they are written. Furthermore, there must be indicated the relation between E and R, within each system; and this relation must correspond *in kind* to its numerical correspondent in the other system. For instance, this relation is sometimes that of selection: *e.g.* one or more of the elements of E is picked out by $R: w\ x\ y\ z$. Or, again, the relation may be that of avoiding an element of E by the system $R: w\ x\ y\ z$. And so on. If this qualitative correspondence of relation is not assumed, then surely, the 'psychoid' and the vital process cannot be assumed (or inferred) to be anything more than products of the cognitive act; for the evidence that there is such a thing as an organism, distinct from inorganic stuff, is all derived from just these peculiar relations between spatially demarcated complexes (living bodies) and their surroundings. There is a biological problem, just because such bodies select some environmental elements, move toward others, perceive others, assimilate others, and

ignore others. And this biological problem is more than a problem of epistemology, in so far as these organic activities are more than cognitive distinctions — are, in short, real *behavior* in the ordinary sense of this word.

But how far has this concession led the idealistic biologist? *It has led him to wipe out every namable difference between S and S'.* This appears as soon as he attempts to interpret a specific case. Take, once more, the imitative adaptation of the flatfish. The elements of the environment to which the creature reacts are, in terms of percepts (our percepts or the fish's, as you will), some pebbles of various sizes and shapes and colors, distributed in a certain irregular manner. The adjustment to the environment, again in phenomenal terms, consists in the reproduction of this same pattern of pebbles on the back of the flatfish (whether for protection or for concealment from intended prey or for some other purpose is here utterly irrelevant). To make the matter still more specific, let us say that there is a sprinkling of round grayish pebbles over a brownish sand; the adaptation will then approximate this effect, eventuating in round grayish spots on a brownish background (within morphological limits of accuracy). The schematic account of this situation then is

$$S \qquad 1 \begin{cases} E\colon\ m \neq n \neq o \neq p \ \ldots \\ R\colon\ w \neq x \neq y \neq z \ \ldots\ldots \end{cases}$$

$$S' \qquad \mathbf{a} \begin{cases} E'\colon\ m' \neq n' \neq o' \neq p' \ \ \ldots \\ R'\colon\ w' \neq x' \neq y' \neq z' \ \ \ldots\ldots \end{cases}$$

In which $\neq$ represents, in each case, a *specific* distinction between the entities adjacently symbolized. *Eg.* in E': $m' \neq n'$, it represents the specific difference between a round, grayish pebble and brownish sand. And in R': $w' \neq x'$, it represents the specific difference between a round grayish spot made by the flatfish's chromatophores and the brownish background made by adjacent chromatophores. Please note that it does not indicate merely that the terms it relates are logically different. It represents the

concrete difference between them; hence always specific characters of them.

The biologist's difficulty now appears. He must say that the relation between E and R is typically like that between E' and R', namely that of imitative adaptation to E by R. For, if it is not imitative adaptation, then the relation of E' to R' indicates nothing at all about the real situation. Secondly, $m \neq n$ is typically like $m' \neq n'$; that is, the difference between a round grayish pebble and brownish sand is, in some underlying respect, identical with the difference between the two noumenal entities which set up the noumenal reaction. That this must be the case, under the biologist's supposition, follows from the hypothesis (included in the latter) that the phenomenal system is the *result* of the dynamic relations between 'things in themselves' and the 'psychoids' or 'egos'; and hence not a factor in the noumenal system. That is to say, the flatfish does not adapt to the *perceived* differences between round grayish pebbles and brownish sand; it adapts to a peculiarity in the noumenal environment. But, in order to use what we see happening when the flatfish copies the color of the sea-bottom, as evidence of a real process of adaptation, we are compelled to say that the noumenal situation includes a difference in part identical with just this specific color difference; and we are so compelled, let me add, just because this specific difference between grayish and brownish is the one produced by the flatfish reaction, and is moreover the only clue we have as to what is going on.

Now, inasmuch as this is true of each distinguishable feature in the reaction, and in every other reaction which we might scrutinize, it follows that the noumenal system consists of entities whose relations to one another are, at least in some fundamental respect, identical with the relations perceived by an observer; and the noumenal reactions to those relations also are, in some fundamental respect, identical with perceived reactions, and, finally, there is the same fundamental partial identity between the relation of E to R and that of E' to R', in each given instance. But if by hypothesis

we do not know the noumenal entities that are involved, we have no means of distinguishing the noumenal order from the phenomenal, other than these very relations. *But these do not distinguish the two systems; on the contrary, so far as they testify, they identify the pair, reduce it to a single system.* The supposition that there is a system beyond that which we perceive thus appears gratuitous.

The reader may suspect that this conclusion gains a specious power through our having chosen as our illustration an extreme case of imitative adaptation. To satisfy himself that this has not happened, let him select for himself some other type of reaction; say one as far removed as possible from imitation. Let him analyze closely the reactions of a dog at which he throws stones. The animal, far from imitating his action, concentrates attention upon evading the missiles. The dog moves its body now to the right, now to the left, now forward, and now backward, according to the trajectory of the oncoming stone. If, now, these organic activities are real; if they do not derive their peculiarities from the percipient of them, then the dog is trying to avoid being struck by stones. If the latter be regarded as noumenal, as well as phenomenal, then they behave in a manner corresponding qualitatively to the perceived motions of a perceived stone; and their action includes characteristics in part (if not altogether) identical with such perceived characteristics as 'two degrees to the right,' 'fifteen degrees to the left,' 'upward,' 'downward,' 'parabolic motion,' and so on. By what differentia, now, is such noumenal activity to be held apart in our minds from ordinary perceived motions? There is none such. Noumenal and phenomenal are, for us, indiscernibles, and therefore identical, provided we assume the reality of organic reactions. There is no reason for inferring that there is any 'situation' beyond that which we are directly familiar with. There are only undiscerned items and complications in the situation we deal with. This last remark must be guarded against an easy misinterpretation. It sounds like epistemological positivism, but is not. I am not saying that there are only 'phenomena,' as the positivist understands the term.

Rather are there no phenomena, and no noumena, but only things, events, conditions, circumstances all in a universe which no mind has split into two realms. The positivist identifies phenomena with appearances and then describes the latter as 'mental states,' with the result that he limits human knowledge to 'the immediate' or to 'pure experiences' and denies to it all 'things in themselves.' Here is not the place to criticize this thesis; suffice it to state dogmatically that it is rejected here.

IV

SOME DEFECTS IN MODERN THEORIES OF CONSCIOUSNESS

1. *The Morphological Fallacy.* — If, as is above maintained, there is only one situation within which things happen; and if knowing is therefore itself a factor in that situation, it seems pretty clear that no analysis of the inner peculiarities of cognition and cognized entities (as such) will, of itself, explain the status of cognition. Here we must expect just what we have always found to hold true in physics, in politics, and in the affairs of daily life: things reveal themselves most nakedly, not in their own nakedness but rather when clothed in all their powers and activities and relations to other things.

In the natural scientist's unqualified acceptance of this point of view with reference to consciousness no less than to electricity or tariffs, the difference between descriptive biology and speculative philosophy appears. The biologist sets out with the situation described in the opening of Part I; accepting the presence of organisms in an environment and of many types of action between these, he undertakes to specify the relations which the constituents of this enormously complex situation bear, one to another. For him, the situation within which cognizing develops is enormously greater than the situation which is cognized at any moment. If he is interested at all in consciousness, he seeks out its relation to the nervous system and to the many physical influences acting on it and to the behavior which it sets up or qualifies. For him, there-

fore, a description of whatever peculiarities may appear *within* the cognitive field is useful by way of supplying symptoms that may assist him in a diagnosis of that strange fever called knowing. But it never crosses his mind to accept those structural peculiarities as sure revelations of the mind's nature. That were no less folly than to imagine that a few cross-sections of a nerve cell would disclose the inmost secrets of nerve life and the utility of nerves generally.

All that he knows cries out against such an error. The psychical functions generally do not terminate in perception or any other type of cognition, but in various bodily readjustments; and they oddly seem to operate, with respect to any given matter, so as to eliminate themselves after a while. As the aim of thinking is to act without thought, so the goal of consciousness seems to appear in the progressive dropping of percept elements and of members of a reflective series, as the individual develops a habit of dealing with the particular cognized matters. In short, they are conspicuously steps in a process, and are to be understood in the light of it.

How unlike all this is the procedure of the philosopher who goes on the assumption that epistemology is fundamental to all other sciences! Consistently he believes that an analysis of the 'contents of consciousness' will disclose the nature of consciousness; and so, for several generations, his kind have been describing their feelings and the flux of their immediate experiences, firm in their conviction that introspection will carry them into the heart of reality. From Locke to Bergson, so it has run on, and — as any natural scientist might guess — from confusion to confusion. Strange as it may sound in an introspectionist's ears, the underlying error of this method may be fairly described as the morphological fallacy, which is the mistake of identifying the structure of an organic cross-section with the structure and function of the organism as a whole. The stream of sensory characters does not 'look like' an ordinary cross-section, to be sure; it is a very lively motion, full of lightning-like flashes and serpentine weavings

of many, many things. But it is, for all that, only one phase in the much more comprehensive organic process, and presumably bears pretty much the same relation to this latter that the cross-sectional motions in some one plane of a chemism bear to the total chemism. Suppose one might peer into a constellation of corpuscles with a microscope of transcendent power. One would there see, from any one given point of view, a vast tangle of motions, and yet discover nothing that would betray the peculiar character of the chemism; for all the motions that were significant might occur in planes parallel to the observer's line of vision, and their bearings might furthermore lie wholly beyond the microscopic field. Now, just such a situation is given in every act of introspection. An infinity of elements which are absent count heavily in the total organic process of which the moment's sensations are but a phase, and there is, within the introspected field, absolutely nothing which indicates what those external factors are or how the present factors relate to them. To overlook this rather obvious fact and to construe the introspected field as the legible sign post on the highroad to ultimate reality is to perpetrate the grossest of abstractions.

There is not a little dash of irony in this circumstance. For those thinkers who devote most attention to the structure and activities of the primitive flux of consciousness are the very men who find most fault with the 'abstractions' and 'artificialities' of concepts (and even of percepts). They insist, with Bergson, that the reality of things consists in the totality of their actions.[1] But, in the very next breath, they assert that, in the flux of immediate experiences, there appear the deepest qualities of reality, such as 'unity,' 'homogeneity,' 'indivisibility,' 'pure activity.' Now, I am not here urging a material argument against the genuineness of these various predicates; I am only saying that, *if* one does hold to the biological point of view, one cannot so exalt the revealing power of the flux. To pronounce it *the* real and to label the intellectual and other conditions to which it leads 'purely

[1] Cf. Matière et Mémoire, 25, etc.

practical' or 'abstract' is possible, *not through formal analysis, but only through some presupposition about the very situation which is to be analyzed.* As was indicated in Part I, an analysis of any event must cover, without prejudice, all the specific stages of the event. The investigator cannot draw a line between any two conspicuously different phases of it and call what lies on one side the real event and what lies on the other its consequences or later circumstances. He has the right to do something like this only after he has discovered that the later phases do not depend *exclusively* upon the former. If they do so depend, then former and latter are equally real constituents of a single process. It is just this precaution, however, which the introspectionist does not observe.

This accusation may be clearer, if put in the form of a figurative query. Suppose that all light in the world around us were very much mixed up; all wave lengths running together, and all fused in innumerable foci, except where they had passed through certain rock crystals, liquids, and optic structures of animals. Would a physicist be warranted in saying that the inmost nature of light is revealed only in its interpenetrating mode, and that, when spread out in a spectrum, it had suffered a serious diminution of its reality? Certainly not; for that would be the morphological fallacy, the picking out of a single form from a variety of forms belonging to one and the same entity-complex and attributing to it a metaphysical supremacy, without having proved that all the other forms are genuinely (not verbally) dependent upon it.

2. *The pragmatic point of view midway between the morphological and the biological.* — It was Dewey who broke the magic spell of introspectionism and epistemology by insisting upon the philosophers' return to the natural and illuminating biological point of view. And he followed up this excellent advice with a reinterpretation of the nature of reflective thinking, after the biologist's manner. Wholesome as this reform has been, however, it has not yet been thorough enough in its outworking. The direction of reform has been sensed more acutely than has the way of pursuing it. All the pragmatists and the others who have thus far endeavored to

describe mental operations biologically still fight with the weapons of the enemy. They investigate the morphology of the cognitive field. Thus Dewey accurately describes the broad situation within which cognition arises and the general tendency of the cognitive process; but he deems of little relevancy the specific structure of the material reacted to and of the material that gets into the cognitive field. Furthermore, he describes the reaction chiefly in terms of the ideas, meanings, and impulses which become conscious *within* the reaction itself; and does not concern himself with its relation to other reactions of the organism further than to point out that these latter all make for a solution of a difficulty, a readjustment. He shows how one idea leads to another, how a percept is tested by another, how the ease of acting on a belief lends to the latter a kind of value, and so on. He does not pretend to indicate the precise relation of these movements to extracognitive conditions, such as blood temperature, conduction currents, colloids, and all the host of material factors which never figure discretely in the natural operations of cognizing of the natural environment and reacting to it.

Now, this analysis of the cognitive-reactive situation is necessary, just as introspective analysis is. But it certainly does not cover all the factors which shape and reveal what happens within the cognitive field. It carries us much nearer to the biological situation, but falls short of the latter in that it omits from consideration the *specific* relation between cognizing and other organic functions, as well as the *specific* relation between things 'in' and things 'out of' consciousness. The inquiry ends with the indisputable observation that cognition facilitates practical conduct, makes for success, assists the agent in adjusting himself to the environment. Thus we are still left with the whole biological issue on our hands: *what kind* of adjustment does cognition facilitate which marks it off from breathing, perspiring, dodging, and all the other bodily activities? And in what respect does a thing cognized differ from the same thing uncognized, if at all?

3. *Analyses by new realists suffer chiefly from incompleteness.*

—It has been observed by several American realists that their British brethren have not attacked the problem of consciousness. They have successfully separated the problem of the entities from the problem of cognizing, and they have dealt with the former more thoroughly than any philosophers have, for many, many years. But the latter problem is neglected, and so, when broached at all, is answered vaguely. Thus it is when Alexander talks of consciousness as a 'mental activity.' The difficulty of this description is worth glancing at.

"Now what makes one thought-process different from another is, I find, nothing but this difference of mental direction. . . . I have no doubt that the thing called my consciousness exists, and that it is mental activity. But it is not different in quality as I am conscious of blue, or green, or the sun. . . . My consciousness is one and the same thing working only in different directions. . . . I make no difference between . . . activity itself, activity-consciousness, and the consciousness of activity." [1]

Here something real is being described, and accurately. The organism does aim at some things, and addresses itself to them in such a manner that they fall upon the cognitive field. I should not hesitate to say that the organism throws such selected objects upon the cognitive field no less physically than it throws them upon the retinas. Now, the activity of aiming and choosing certainly neither constitutes nor is constituted by the things aimed at or chosen. It is so no more here than in the case of digestion or respiration. The lungs select oxygen, but do not change their 'quality' as organs with every change of air. They decide what shall fall within the respiratory field; they shut out noxious fumes that assail them and expel carbon dioxide. And so too in what Alexander calls 'mental activity.'

Accepting the description, though, I must still wonder whether it is not unenlightening to call consciousness 'mental activity.' To define consciousness as that which works in different directions

[1] Alexander, S., The Nature of Mental Activity, *Pro. of Aristotelian Soc.*, 1907–1908, 220, 225.

is to put it in a class with every other organic activity. It does not distinguish it from the antitoxic reactions of the blood. Certainly it is not poetry, but sober description, to say that the antitoxic chemisms set up by the diphtheria bacilli entering the blood are directed at these bacilli. Certainly the bactericides get to them and 'fix them,' and certainly they do nothing else. Is their manufacture not a directed activity? And is not the aiming itself quite different from anything that a modern chemist would pronounce a chemical action? Is it not that peculiar, little understood event which, in our ignorance, we cover with the blanket term 'organic reaction'? And is not this term the more accurate, inasmuch as we do not know what the aiming is?

Well, if it is, then the same must be said of the term, 'mental activity.' The aiming at things, in order to know them, certainly is not the same as knowing them. Neither is it the same as thinking about them, for the sake of more information. It is no more like cognizing than attending is like seeing. Indeed, I should call it a case of attention, provided people would kindly divest this term of its unfortunate psychological disguise. Attending is a stretching out toward something; it is not a feeling nor a knowing nor a thinking, any more than it is a digesting or a breathing. It is rather the going to meet or to find some environmental character. It cannot be described in terms of the character sought, for this varies from case to case, while the attending does not. It would conduce to clarity, both in biology and psychology, if attention were admitted to be a general organic attitude and not a specialized function like cognizing. We might then speak of the phagocytes as attending to bacteria without our falling into grotesque panpsychism or idealism. But there is little hope of such a clearing up. Psychologists will continue to bungle along, firm in the conviction that whatever appears in connection with psychic activities is necessarily psychic, just as the physicist thinks that all occurrences in the material order are exclusively physical.

American realists have recognized that the problem of consciousness is the problem of finding the differentia of the cognitive activ-

ity and that of the cognitive field. And so they have been trying to discern the unique contribution which cognition makes to life and to the entities which it groups peculiarly. At least three, Woodbridge, Holt, and Montague, have named characteristics which are truly enlightening; of these I would here mention only the one Woodbridge brings out, as the others are discussed elsewhere in this volume.

In a noteworthy essay[1] Woodbridge sets forth that consciousness involves a type of relation between entities which obtains nowhere else; namely, the relation of implying one another. That the relation referred to is really present, and that it is significant, I have no doubt. But it stands in need of extensive explanation, even as the relations pointed out by Holt and Montague do. We must know more about it, before it illuminates us. For instance, is it what logicians mean by implication? Is it established by a psychic reaction, or revealed by it, or is it the reaction itself? How is it connected, if at all, with what the psychologist calls 'simple association'? Woodbridge raises these queries in his readers' minds when he says that bread implies nourishment, and that implication is deeper than the inferential relation between propositions. But I do not believe the queries can be answered, until the whole biological situation has been resurveyed, and the relations between environment and organism stated more precisely. This, if I mistake not, is Woodbridge's own belief. And the same restrictive judgment must be passed upon every other realistic hypothesis. Consciousness is not described in terms of the total organic situation out of which it develops and of which it is an integral phase. One hypothesis deals only with the relation of percept to object, in terms of these alone. Another analyzes simply the structure of logical entities. A third considers merely the manipulating of percepts in an organic readjustment. A fourth focuses upon the psychophysical processes. Is it not possible, therefore, that all may be, on the whole, equally valid just because each attends to something different? And may their harmony not

[1] The Nature of Consciousness., *J. of Phil., Psychol., etc.*, 2, 119.

appear, as soon as consciousness is investigated, as a feature of a big situation which involves not only feelings and flux and thinking, but also an organism, — blood and sinew and nerves and impulses and appetites, — and also physical things, — electricity, light, matter? At all events, the bare possibility of this is a sufficient warrant for attempting to realize it.

4. *The biological point of view.* — It must now be clear that no investigation of consciousness is truly biological unless it first describes consciousness in terms of the three basic factors: stimulus, reagent, and organic instrument (structure-function). The problem may be stated in three corresponding forms.

First of all, consciousness involves a specific environment. This we must discover and describe. The cognitive function copes with some peculiarity of the environment which no other function handles. As the stomach does something which no other organ does, so too the central nervous system, and, more specifically, the cognitive reagent.

Secondly, consciousness involves a *directed* activity. That is, it is not simply set going by some stimulus; but, when set going, it heads somewhere. Perhaps it is not purposive; but assuredly it has a direction just as truly as each individual case of magnetic pull or of gravitation has a direction. (Whether its direction is purely spatial, or spatio-temporal, or of some other order, is a special question.) It 'gets somewhere.' It accomplishes something. But what? This also is to be discovered and described.

Finally, consciousness involves the operation of an organic structure, and, according to all that we know about structures and functions, the structure somehow modifies that which, in affecting it, eventuates in cognition. Now are any peculiarities of consciousness due to the structure? If not, what does the structure accomplish? Once more we must discover and describe.

From the biological point of view, these three problems are irreducible and equally important. Let any one of them be ignored, and the presumptions are heavily against anybody's answering unequivocally the two central questions: In what respect does

an entity 'in' consciousness differ from an entity 'out of' consciousness? And what does consciousness accomplish?

V

THE BIOLOGICAL STATUS OF CONSCIOUSNESS

THE reader will kindly note that this section proposes to discuss only the status of consciousness in the realm of life. It will offer no completed hypothesis, but will only describe the conditions under which consciousness arises. The most that can be claimed of this description is that it narrows very closely the range of possible interpretations.

1. *The general structure of the environment.* — It is a singular fact that no modern philosopher nor speculative biologist has formally analyzed the broader features of the world in which individual organism exists. No fact shows so strikingly as this one how the anthropocentric world-view has dominated contemporary thought. Pick up any textbook on psychology, and you will find extensive descriptions of sensory qualities and nervous structures, but of the external field of stimulating entities not a word, save such platitudes as these: "Luminous bodies affect the retina with ether waves." — "Pulses of air are heard as sounds," etc. To be sure, the experimental psychologist is constantly driven to analyze special physical features, in connection with his special problem. He informs himself about acids, salts, and alkaloids, if studying taste and smell; and about light, when investigating vision. But always he attends to their minute peculiarities, never to their common and collective properties and conditions of activity, with respect to organisms. By such properties and conditions I mean such as either shoot through all or most of the physical entities with which organisms deal, or else are involved in the coexistence and coactivity of those entities.

Three properties or conditions of this sort are (*a*) space, (*b*) time, and (*c*) the causal relation. There may be many others, but these

are obvious; and so, too, is their biological importance. Every living creature finds itself in a world full of things distant from it and from one another in space and in time. Some of these things it seeks, others it shuns; and the precise relation of particular things to its body in space and in time is a life-or-death matter. Be one's metaphysical theory about space and time what it will, in any case one must grant that potatoes in the lungs instead of in the stomach would affect a man's welfare more substantially than the loftiest philosophy ever written; and that the history of species and of civilization might be largely written in terms of 'before' and 'after.' The individuals which have survived and shape empires and ideals are those whose ancestors have been reaching conclusions, having inspirations, carrying out plans of action, winning help, reaching places of safety a little sooner than somebody else. As for the value of mastery over causes, this has been dilated upon since Roger Bacon; and has never been doubted by the ordinary man.

Now, is it not likely that, just as the special differentiations of organic form and function are connected with special characters of elements in the environment, so the more inclusive are connected with the commoner features of the environment as a whole? And, inasmuch as every organ save the central nervous system deals specifically with some special material which encounters it from moment to moment, and inasmuch as the central nervous system specifically reacts to all kinds of materials, even those in remote spaces and remote times; is it not probable that the deepest utility as well as the deepest peculiarities of cognition can be understood only through an analysis of the deepest peculiarities of the whole space-and-time order of nature?

These questions have never before been raised, at least not with the earnestness which they deserve. Consider, for instance, the manner in which philosophers have scrutinized space. With the exception of the Aristotelians and the materialists, who have at least accepted the full reality of space, even though they have not reckoned sufficiently with it, philosophers have handled this mode of the environment in one or more of the following three ways:

(*a*) they have depicted its supposed paradoxes — so from Zeno to Bergson; or (*b*) they have regarded it as either an idea or a mere form of apprehension and have traced its genesis and the arrangement of its psychic constituents — thus from Locke through Kant to modern psychology and metaphysic; or finally (*c*) they have joined with the mathematicians and have analyzed the pure form of externality, as it is conceived in geometry, but have not regarded their results as having any bearing upon the biological situation. In this persuasion Mr. Russell finds himself when he declares that projective geometry is 'wholly *a priori*,' taking nothing from experience and having 'like Arithmetic, a creature of the pure intellect for its object.' [1]

Of these three attitudes, only the last bears off in the right direction. Certainly geometers have analyzed space with exceeding rigor. But, when they have not believed their subject matter purely intellectual, they have not been interested sufficiently in its possible biological bearings to describe the environment in terms of it. Indeed, most of them are so sure that geometry is 'a creature of the pure intellect' that they look with pity upon the thick-witted realist who, doubting that the pure intellect has any creatures of its own, seeks the facts of geometry in the world-order.

2. *The environment as a space complex.* — Suppose we look at the spatial bearings of the world in which animals have to seek their food and drink and shelter and mates. And let us try to find just those relations which obviously 'make a difference' or 'generate a problem' for the creature which has to inhabit the space. First to be noticed are these:

(*a*) Objects important to life are mostly masses of matter giving off various types of energy. (The term 'energy' is here used in its colorless meaning, and does not imply any physical hypothesis.) Thus, all articles of food and drink; each is located narrowly at some region in space. So, too, are most places of shelter and refuge; so too are other animals, foes, prey, clan mates, and creatures of the

[1] Foundations of Geometry, Cambridge, 1897, 118. Perhaps Mr. Russell would qualify this statement to-day.

opposite sex. So, too, is the sun, on whose light life depends. So too are most objects which assist an animal in finding its bearings and making its way up and down the earth. Indeed, there seems to be only one universal commodity which is not localized but diffuse, and that is air.

(*b*) Most of these objects are centers of influences extending far beyond the masses of matter which men commonly call 'the things themselves.' For instance, the sun sends forth ether vibrations; objects reflect these vibrations according to their own chemical structure and so give off peculiar configurations of light (color-form complexes). Fire emits heat, and mountain lakes make their coolness felt at a distance. Flowers send forth odors, and so do most animals.

(*c*) In most cases, these influences go out in all directions of space. The objects are, in the wider sense of the term, radioactive.

(*d*) An animal is related to practically all the elements of its environment through these radial lines of energy. The only elements to which it is not so related are those which it takes bodily into its organism. And even with these it is radially related up to the moment of receiving them.

(*e*) In all observed instances, the character of any part of a given energy radius is a (continuous) function of the distance from the energy center. (It may at the same time be a function of some other variable too.) Heat, light, gravitation, odor, and whatever other qualities are radiated vary from point to point along each energy radius in some inverse ratio to the distance of the particular point from the energy center.

(*f*) Each energy radius is, in its geometrical form, a real line. That is to say, with respect to its spatial features alone, it is a continuous series, viz. one which satisfies Dedekind's postulate, the postulate of density, and Huntington's postulate of linearity.[1] Unlike a pure geometrical line, however, it is infinite in only one direction at most, and possibly finite in both directions. Strictly

[1] Cf. Huntington, E. V., The Continuum as a Type of Order, *Annals of Math.*, Second Series, 6, 15.

speaking, then, it is a segment of a geometrical line. But, inasmuch as the environment of any given animal lies wholly within such segments and the problems generated by space derive from the linearity of the segments (as will be shown), this circumstance makes no material difference in our present inquiry.

(*g*) Each energy radius is not only a spatial line, in the above sense, but also a continuum of physical qualities other than spatial. Superimposed, as it were, upon the point series between my eye and the sun is a series of ether conditions. While this superimposed continuum may not be of the same structure as the point system, it is always some kind of a continuum or a series of continua which pass from one to the other through 'critical points' (which involve some kind of qualitative change).

(*h*) Energy radii from indefinitely many energy centers intersect, sometimes without reciprocal modification, sometimes with it. Rays of light intersecting in a focus are not altered by that mere act. But they are when passing through glass, which refracts, reflects, and absorbs certain of their characters.

Two types of problem are generated by this circumstance: first, the locating of an energy center; and secondly, discovering the specific characters of an energy center, as distinct from those derived from intersections with radii from other centers.

These two problems just named are, strictly speaking, not generated by the environmental character exclusively; but rather by it in combination with the specific needs of the animal. Though the latter do not belong in our present enumeration, I shall cite them because they derive partly from an important quality of physical qualities. The animal sometimes needs to get an object 'in itself' (that is, the energy center) and sometimes it needs only a distant influence of such an object. Consider a man and a hearth fire, on a bitter winter's night. So long as he wishes only to warm his hands or his back, his problem is not to get the burning wood as he might get food, but rather to hold just the most favorable distance from it. If, however, a spark shoots out on to a rug, his problem is to pick it up or stamp it out; and now it is

not an influence but an energy center itself to which he must adjust himself. Likewise with respect to the other than spatial characters of the fire. Sometimes he must know whether it is wood or coal that is burning.

(*i*) No single point on an energy radius determines, contains, or indicates its own *distance* from its own energy center. For distance between points is an external relation in both the purely logical and the geometrical sense of the term. The points, as such, do not constitute the distance, nor are they constituted by it; and the distance *is* their externality, not their position.

(*j*) No single point on an energy radius determines, contains, or indicates its own *direction* from the energy center. This may be simply stated in the usual language of geometry. Two points are required to determine a line; for the line, as Mr. Russell phrases it, "may be regarded as a relation of the two points, or an adjective of the system formed by both together." [1] Hence, if only one point is given, all lines passing through it are qualitatively indistinguishable.

Observations (*i*) and (*j*) do not depend upon geometrical demonstration for their accuracy. Anybody may verify them empirically. In his Essay toward a New Theory of Vision, Berkeley said: "Distance being a line directed endwise to the eye, it projects only one point on the fund of the eye — which point remains invariably the same, whether the distance be longer or shorter." [2] Though the definition of distance the Bishop here gives is inaccurate, the gist of his remark is correct. Indeed, it holds good not only of single points but of many (though not all) point-complexes. Thus, taken in isolation, a perceived line may be a short one near at hand or a longer one farther away or a prodigious stretch at a great distance. Only certain combinations of real points in certain relations determine their energy centers' directions and distances. Hence,

[1] Foundations of Geometry, 120.

[2] His inference from this, namely, that distance could not be seen, was unwarranted; and for reasons which will soon be indicated.

(*k*) *Direction and distance are functions (mathematical) of certain types of complexes, at least in so far as the kind of system above described is concerned.* So stated, the fact will strike many persons as paradoxical. And yet it is nothing but the exemplification, in the physical world, of the facts on which projective geometry is founded. These facts appear, in brief, to be identical with those which describe the environment in its dynamic relation to organisms. Indeed, the latter relation can be stated wholly in terms of projective geometry; and when so stated, it reveals just that peculiar state of affairs which involves consciousness.

(*l*) *The projective relation obtains in systems of externality which do not contain metrical values.* — Geometers have recognized that quantity is logically posterior to quality, at least in spatial relations. Qualitative identity is presupposed by every quantitative identity. "Hence," to quote Russell, "all figures whose differences can be exhaustively described by quantity . . . must have an identity of quality, and this must be recognizable without an appeal to quantity. It follows that, by defining the word 'quality' in geometrical matters, we shall discover what sets of figures are projectively indiscernible." Now it appears that the pure qualities of space are (*a*) points and (*b*) their differentiating relation, namely, the line. The relation between two points is the straight on which they lie. "This," Russell says, "gives that identity of quality for all pairs of points on the same straight line which is required. . . . If only two points are given, they cannot, without the use of quantity, be distinguished from any two other points on the same straight line; for the qualitative relation between any two such points is the same as for the original pair, and only by a difference of relation can points be distinguished from one another."[2] Conversely, too, a straight is only the relation between two of its

[1] I do not attempt to demonstrate here that projective geometry is non-quantitative. I shall only indicate it and leave the reader to such treatises as Veblen, O., and Young, J. W., A Set of Assumptions for Projective Geometry, *Amer. J. of Math.*, 1908, 347, etc.; Russell, B., *loc. cit.*, III, Section A.; etc. The latter is recommended to the layman.

[2] *Loc. cit.*, 130.

points and is distinguished from another only by them. Hence, given only one point, any pair of straights is qualitatively indistinguishable from any other.

I wish to emphasize at once that there is nothing mysterious in this fact, and also that it is not peculiar to a recondite branch of geometry. It is true of all kinds of entities. *A character which defines an entity as a member of a certain class cannot distinguish it within that same class.* Suppose we learned just what it is that makes a horse a horse; that is, the complex of characters which distinguishes the equine quality from the asinine, the bovine, etc.[1] We should not possess the information necessary to distinguish a Percheron from a Clydesdale, or a Morgan from a French Coach. Qualitatively — which here means 'with respect to equinity' — all horses are, *qua* horses, indistinguishable. A platitude of elementary logic in this context, our observation becomes enormously difficult and obscure to many thinkers when it refers to space classes. They cannot perceive that what makes a position a position and a line a line is not the same as that which makes one point ten feet from another, or to the left of another. And, missing this, they are simply bewildered by our earlier statement that directions and distances (spatial quantities) are functions of point-line *complexes*, not of point-quality and linearity.

(*m*) In both pure geometrical projection and physical projection there are certain complex relations which are constant qualitatively, regardless of the distance or direction of the related elements from the projection center. In pure geometry the fundamental relation of this type is the anharmonic ratio. If through any four points in a straight four straights be passed meeting in any point, and if another straight meet these same four, then the four new points of intersection have the same anharmonic ratio as the original four points.[2] Or conversely; all lines cutting any

[1] For the present argument it is irrelevant that organic types are not sharp, stable things, as they were once supposed.

[2] For a proof that this ratio does not involve distances or angles, cf. Russell, *loc. cit.*, 122, 125.

four lines that meet in one point have therein the same anharmonic ratio. In physical projections wholly different qualities of radial systems exhibit a logically similar constancy. Thus, a pencil of light rays from a given luminous point may be cut at any point by a curve whose generating center is the luminous point; and the sum of heat or light energy at all such cuts is a constant.

How many such projective constants there are, nobody knows; but geometry, physics, and psychology bring forward facts indicating that the variety of types is exceedingly great. When we come to discuss the peculiarities of the cognitive field, we shall encounter some striking kinds. Comparing them, we discern a highly significant fact which, on closer inspection, turns out to be no accidental feature of the projected matter but an intrinsic feature of the projective relation. It is this:

(*n*) *The relations which are constant and determinate in any given projection are, in the logical sense, transverse to the lines of projection.*—To make this clear, let us look at the generic properties of projection as exemplified in the very simple specimen; namely, the projection of points upon a plane. As its properties have been thoroughly worked out, we may turn to it without fear of confusion. I shall employ special names as generic terms which, when applied to cases of projection of higher order, will not be colored with the specific suggestions of geometry.

(*i*) If, from a fixed point S, lines be drawn to different points, $A, B, C, \cdot\cdot$ and if these lines are cut by a plane in points $A', B', C', \ldots$, the latter are termed the projects of the given points upon the plane.

(*ii*) I shall designate as 'the projection system' the total complex consisting of the three parts: (*a*) the fixed point S, (*b*) the collection of points, $A, B, C, \cdot\cdot\cdot$; and (*c*) the plane of the points $A', B', C', \cdot\cdot\cdot$ I shall designate the collection of points, $A, B, C, \cdot\cdot\cdot$, as the projected complex; and the collection of points, $A', B', C', \cdot\cdot\cdot$, the project-complex; and the plane of $A', B', C', \cdot\cdot\cdot$ as the projection field. The point S I shall name the projectorial referent.

(*iii*) The term 'order' shall designate the order of dimensionality of a complex. Thus, Euclidean space is of the third order; the space-time system is of the fourth order (at least); and so on.

These are, I believe, all the fundamental definitions needed for an understanding of the generic properties of projection (as distinct from specifically spatial projection). What, now, are these generic properties? They are four in number :

(*i*) If the projected complex is of the nth order, then the projection field may be of the $(n + a)$th order.

This follows directly from the fact that the projection field is external to the projected complex and also to the projectorial referent. This externality may constitute a dimension over and above the dimensions of either the projected complex or of the projectorial referent. This is readily seen in the specific case of point projections upon a plane.

This projection system is of the third order, for the plane (A', B', C' D') is external to both S and the points A, B, C, D. Hence the line AS *and* that plane form a tri-dimensional complex.

(*ii*) In this construction the projection field necessarily is (*a*) transverse to the relation between the projected complex and the projectorial referent, and (*b*) external to both of these. It is clearly seen in the specific case above given. The elements of the projected complex there are points, but the relations between the elements of the project complex are lines. Secondly, the relation between any given element of the projected complex and the projectorial referent is a line, but a line of a plane other than the projection field and hence of another dimension than any in the latter. It is also worth while to note, thirdly, that the relations between the elements (points) of the projected complex are lines of other planes than that of the projection field.

(*iii*) The relations between the elements of the project-complex are of a different dimension from (*a*) the relations within the elements of the projected complex, and (*b*) the relations between the projected complex and the projectorial referent.

(*iv*) The relations of elements to one another within the project-complex are a function of (*a*) the character of the projection field, (*b*) the relation of the projectorial referent to this field, (*c*) the relation of the projectorial referent to the projected complex, and (*d*) the relation of the elements of the projected complex to one another. Thus, in the figure above, the relation of A' to B' depends upon the structure of the projection field — *e.g.* whether it is a plane or a certain curved surface or some other type. No less does it depend upon the distance and direction of S from the projection field and from the projected complex, and upon the relation of A to B.

These properties of a projection system are, I believe, strictly generic. They are to be found wherever there is any kind of a projective field typically related to a projectorial referent and to a projected complex. And it matters not what the specific dimensions of the complex are; whether they be the familiar space and time dimensions, or some other kinds, such as color dimensions. The properties seem to be those of 'pure projection,' just as commutativity is a property of pure number and free mobility a property of pure space. Now, if this is a correct opinion, it is natural to wonder whether some specimens of projection are to be found outside of pure geometry. It seems to me that a remarkable one is given in the organic situation of which consciousness is a phase.

3. *The three factors of the biological situation correspond to the three factors of the projection system.*—The reagent is the projectorial referent, the environment is the projected complex, and the cognitive field is the projection field. The difficulty which most of us find in comprehending this is due to two circumstances: first, to the naïve view of the projective relation, as a throwing of simulacra on a screen; and secondly, to the almost inevitable tendency to conceive the true projective relation as occurring *within* tri-dimensional space, instead of being a relation between the spatio-temporal order and a higher one. The first of these difficulties I have tried to clear up in earlier passages; the second will

be at least mitigated, I trust, by the following account of the reagent and its projection field.

(*a*) The reagent is distinct from (*i*) that to which it responds, and (*ii*) its own response. Earlier in this essay it was shown that reactions of the ordinary kind cannot be adequately stated in terms of their stimuli alone, but that there must be assumed some entity (not necessarily psychical) whose attitude or reference to the stimuli defines the reactive relation. It is opportune now to show this same fact in connection with consciousness.

The difference between the stimulus pattern and that of the reaction is hardly worth dilating upon, so evident is it. If I see a box three feet long and two feet deep, I do not become a box three feet long and two feet deep. If I hear that a man fell dead in Broadway yesterday, I do not fall dead in Broadway yesterday. In short the reaction is not a simple duplicate of the physical circumstances inducing it. It bears off in its own peculiar direction. The clearest case of this is the time reaction. Past and present stimuli set up reactions which are regulated by future conditions; and the time pattern of the reactions contains future elements, which, of course, are not in the physical stimulus at all.

Before we attempt to explain how this pattern difference is brought about, let us observe the second peculiarity, namely the externality of whatever does establish the before-mentioned difference. Here again, I am stating only a commonplace in language stripped of presuppositions. I refer to the well known fact that what a man does, as a result of cognizing some situation is not deducible from the internal structure of that situation *alone*; and still less from the internal structure of the resulting act *alone*. His conduct is determined primarily by something which philosophers call by various names, such as 'impulse,' 'appetite,' 'vital force,' 'psychoid,' or 'ego.' [1]

[1] These last three designations are so steeped in bad metaphysics that their use leads almost inevitably to a misconception of the whole situation. I cite them here, simply to indicate that those thinkers who employ them are referring to a real factor in the life process.

Sound a horn in the presence of ten men. One hearer will clap his hands to his ears and cry: "Stop that din!" A second will fall into a revery of pleasant melancholy. A third will dance. A fourth will stand at attention, like a soldier. Now, these different behaviors are not deductions from that which is cognized. They are chiefly *attitudes* toward it. The attitude may be taken, for aught I know, by some group of cortical cells, or by the blood, or by a blithesome archangel; but it is taken, and both the agent and the act are not parts of the situation toward which the attitude is taken. Likewise of the ensuing conduct. In the mere sound of a horn there is no potentiality of clapping a pair of hands to one's ears, nor of revery, nor of dancing, nor of unconsciousness. Nor do these powers lurk in the consciousness of the sound. To adopt the overworked and inadequate phrase of the biologist, they are all activities which the cognized sound releases, as the drop of a trigger releases the explosive forces of gunpowder. More precisely, the cognized sound is the critical element in a process involving much more than the element and specifically *determined*, though not incited, by other factors than that element.

(*b*) The relations to which the reagent responds through the help of consciousness are relations among spatio-temporal entities, but they are not spatio-temporal relations, in the strict adjectival sense. That is, they are not distances nor directions nor magnitudes nor durations. These latter and other similar kinds are, in the cognitive field, terms among which relations of wholly different orders obtain. What these specifically cognitive relations are is a question too extensive for the pages alloted me; but I should like to say at least that Woodbridge has long since pointed out the most important class, namely, implications. These certainly are not spatio-temporal relations, in the proper sense of being developed or present as efficiences in physical and chemical processes; and yet they are not created by being known, they are not mental devices, but real relations between real entities. Or, to put it in a phrasing that escapes the suspicion of subjectivism: the stimuli, as physico-chemical processes, are really implicated

with many other events (entities) in the universe, but *this implication is not present within the chemisms any more than the direction or distance of a point from another is present within the point.* The implication is a relation between entities, not internal to any one entity; hence the relation appears only when the complex of involved entities does, just as linearity, straightness, curvature, etc., appear only when a complex of points does.

What, now, is the complex in which implicative relations appear? The answer to this question designates the unique status of consciousness in the world. The complex embraces the entire physical universe, past, present, and future, together with all types of relations.

(*c*) *The reagent is so related to the projection field and to the projected complex, that, in some dimensions, the projection field lies between it and the projected complex.* This is only an exact way of stating that our organic adjustment to physical things is 'through' the field of consciousness.

The projection field, or the 'field of consciousness,' is, in the strict logical sense of the adjective, transverse to the objects projected upon it. Transverse means different with respect to a given dimension. This is precisely the relation of the cognitive field with respect to the elements in it. The latter are spatio-temporal, but the relations between them in the cognitive field are not spatio-temporal. None of them can be reduced to length, breadth, thickness, duration, or to any complex of these. For the very same reason, then, that length is a dimension different from breadth, a cognitive relation is of a dimension different from any spatio-temporal one. And the field of cognitive relations is in that different dimension. It is transverse to the four spatio-temporal dimensions and is therefore of the $(4 + a)$th order. If we agree to define the physical world as the spatio-temporal system *exclusively,* then consciousness is not physical.[1] But this does not imply

[1] It may be well to add that I should reject this definition. I do not see any strong evidence for supposing that physical entities are *mere* complexes of extension and duration.

that the objects of consciousness are not physical. Nor does it even imply that cognitive relations are not relations between physical things.

The broader features of the whole process may now be summarized: Consciousness enables the organism to adjust itself in various manners to entities external to it in space and in time at the moment of the specific conscious state. I do not say that consciousness consists in the specific adjustment; this is predominantly impulse and motor performances. But consciousness is the crucial advance toward this adjustment. It makes possible my regulating my behavior, here and now, to physical objects which have ceased to exist, to others which have not yet come into existence, and to existent objects which are not affecting me in space at the present instant. An incidental feature of this capacity is the cognizing of purely imaginary and impossible objects and of behaving toward them. Sometimes I take them seriously, and then, so far as their immediate efficiency is a criterion, they are just as real as physical things; and I am victimized by my own consciousness. But usually I am only curious about them, or I laugh at them, as I do at the Walrus and the Carpenter.

What must be involved in this procedure? Note first that the environment which enters the cognitive field is four-dimensional. The organism which adjusts to it variously is also four-dimensional. I am genuinely conscious of all three dimensions of space, and also of time; no one of these dimensions goes lost in entering the cognitive field. And I react in these four dimensions too; my muscles not only move in the three dimensions of space, but they defer or accelerate their motions in time. The transition from the cognized complex to adjustment involves a projection of the former upon a field of the $(4 + a)$th order. The specific relations within the projection are functions of the characters of the four-dimensional complex that is projected. But, although they are functions of these, the specific relations within the projection are of a different order. Precisely the same holds of the prosection characters and the organic adjustments they induce.

In less exact language the function of consciousness, when viewed with respect to its direction, is to make efficient in the four-dimensional organism those types of relations which are peculiar to fields of the $(4 + a)$th order.

Or again, in language grievously tainted with old philosophical errors, consciousness is that efficiency whereby we regulate our conduct according to principles which are 'above' space and time. This way of stating the case is not illuminating, in spite of its familiarity. It leads us into all the stock puzzles of epistemology, just because it describes only the result of consciousness and not the specific relation of the involved factors to one another. It is therefore to be discarded in favor of the less simple but more descriptive account above given in outline.

4. If the biological situation constitutes a projection complex, as has been maintained, then all those events which, in psychology, are called illusions and errors are not *products* of consciousness, but they are peculiar and inevitable characteristics of the whole projection system. They stand in the same relation to the 'total situation' that a projected point does to a purely geometrical projection system. Space does not permit an adequate exposition of this matter here; but I cannot dismiss it without a brief statement. For, as Holt and Montague have shown, the crucial problem for the new realism, as for every other theory of cognition, is the problem of error (in all forms). And the acutest critics of the new realism urge that its fatal flaw is its acceptance of the full 'objective' nature of illusions and error and its simultaneous refusal to put illusory objects, together with all their colors, shapes, and behaviors, identically in the very space and time in which they immediately appear. If the charge is true, it is deadly. But I believe it owes its strength wholly to a misunderstanding of the relational character of the "organic situation" in which consciousness develops, and of the entities which enter into that situation. *This situation contains a host of entities which are projectively indiscernible and which therefore must possess, in any given projection field, multiple values.* These entities are not merely *construed*

erroneously; they are genuinely indeterminate with reference to our spatio-temporal systems of which they are true parts or phases.

In any projective system, any given project-complex is the projection of an infinite number of real or merely possible projected complexes. Thus, if from the point S the lines SP, SQ, and SR be drawn cutting another line in A', B', and C'; then A' is the projection of each point in the line SP, B' of each in SQ, C' of each in SR, Given only S and the projection plane and the values A', B', C', therefore, each of the latter is the true projection of an indefinite system of genuine indiscernibles and has therefore multiple value.

In order to determine which the real projected complex is at a given instant, we must test it with other systems of points, M, N, O, which must be varied, while S, the projection plane and A', B', C', are constant. If, then, A', B', C', does not vary with variations of M, N, O, the latter complex is not the real projected one. And so on. Please note that this elimination involves a series of operations, much more than mere projecting. It includes a directive activity, comparison of project complexes, and selection among these.

These projective indiscernibles are precisely the relations which we find, much more complicated, in the much higher order of projection on the cognitive field. Substitute for points enormously intricate entities of the fourth order or higher. Substitute for the projection plane a field of unknown higher order. Substitute for S a projectorial referent which, instead of being of zero dimensionality, may be of a high order. And you then have (*i*) a center to which a distant complex is related; (*ii*) this relation a function of space and time and perhaps other dimensions; (*iii*) and the projective relations among the projects transverse to the dimensions in which the projected complex is related to the organic center. For example: When I think that yesterday's sunset means rain this afternoon, I am external to the sunset and the rain in space and in time; my relation to them is a function of space and time (and probably more variables), but what I think *about* the

sunset is not, in itself, a complex of spatio-temporal relations, but rather a complex of suggestions, implications, discriminations, and the like, some of whose terms may be spatio-temporal, however.

Now is it not a familiar experience that (*i*) no *single* complex in the cognitive field ever has a term that is not of multiple value, and (*ii*) conversely, with reference to a single cognitive situation, there is an indefinite number of projective indiscernibles for each project element? Thus: a perceived line, at a given single instant, suggests or implies a line of the length m at the distance n and in the direction a; but, so long as no other cognitive situation is introduced and the behavior of the percept in the new situation is not compared with its behavior in the former, the implied line may not be the one which is actually projected at the instant. A longer line at a greater distance may be perceived, and in perception may be at the instant genuinely identical with the implied line; which is to say merely what everybody knows directly, viz. that many things different in other contexts are identical in one perception, *i.e.* are there indiscernibles, having all one perceptual projection, precisely as all the points in the line SP have one common projection in the given plane, under the given circumstances.

And is it not also a matter of common observation that the same holds of concepts, no less than of percepts? It is not an accidental feature of visual space, but is involved wherever a purely projective (non-metrical) relation is. Thus, the specific, momentary 'idea' I entertain *is* the projection of an indesignate multitude of entities each one of which implies and is implied by the very same other entities when projected into the particular cognitive field. I think, in a given cognitive situation, of 'a brown mare that is gentle and saddle-broken.' The specific connotation of this complex term is set by me; I, the organism, select a definite project complex, embodying definite implicative, discriminatory relations (such as: 'a horse which my boys can ride,' 'a horse that is not afraid of trolley cars,' etc.). Now, what of the extra-cognitive complexes, of which this may be the projection? They are indefinitely numerous, and *there is in the projection itself abso-*

lutely no indication limiting their number. They are, with reference to my 'idea,' projective indiscernibles.

5. *The alleged mental character of hallucinatory objects.* To philosopher and ordinary man alike, these entities have always been stumbling blocks in the way to radical realism. And realists have done little to remove them, prior to the recent courageous analyses of Alexander and Nunn. The position these investigators are now defending is, I believe, fundamentally correct; and when people thoroughly understand it, they will wonder why everybody hadn't discovered it centuries ago. They are far from understanding it, though. Even such an acute reader as Lovejoy finds in it only a subtle flouting of the unchallengeable facts. For this two circumstances are responsible: the first is that the naïve realist's difficulty here is traceable to his presuppositions, and of these he is not clearly aware; the second is that Alexander and Nunn have thus far given us no explanation, no description of the structure of a universe in which hallucinatory objects can arise, and so their hypothesis seems to be a mere 'blanket.' To made this appearance all the worse, they treat only the *stuff* of hallucinatory objects as real, leaving the erroneous *meanings* more or less products of a construing mind. This is all too perilously like old-fashioned dualism, to please any realist. It must be displaced by an interpretation *which makes equivocal values and 'misconstructions' of every sort no less independent of cognition than true propositions are.* Now, the first step in this direction is the clearing up of the two circumstances I have alluded to. This I shall endeavor to do by scrutinizing the common-sense verdict about hallucinations and its underlying presuppositions. Lovejoy has admirably summarized that verdict as follows:

"Spatial objects may at least in some cases really exist in some realm or medium other than that of real space. Such a realm or medium, so far as I can see, is precisely what people ordinarily mean by 'consciousness'; and the kind of object that has its subsistence therein is what they ordinarily mean by an 'image' or 'representation.' But the existence of an object in this me-

dium evidently is not properly describable as the momentary entrance of a real and perduring spatial thing into a new relation with other things; for in the case of the hallucination the particular thing that is 'in consciousness' does not perdure and does not, though perceived as spatial, exist in the same real space in which other objects are still — by the new realist and by common sense — supposed to exist." [1]

Lovejoy here defends a view which is inevitable so long as the cognitive situation is not viewed as the projective field of a projection system. From this new standpoint, however, his opinion is seen to be based on the two following implicit fallacies:

1. "The entity A enters a new relation r; therefore every character of A enters this same relation identically." This is the necessary presupposition of the statement that the hallucinatory object cannot be the real object entering into new relations *because* the former does not possess all the characters of the latter. For, clearly, if only a single feature of a thing could enter into a given relation, and if the thing, in that relation, could manifest only one of its properties, then there would be ground for Lovejoy's inference.

Now, how about the presupposition? Can it be defended? I do not see how, for it is an extreme variety of our old enemy, the internal relation theory. Virtually it identifies the thing-in-relation with the thing-in-itself. It alleges that all the qualities and relations of a thing are so tightly knit together 'organically' (in the metaphysical, unbiological sense, of course) that all of them must equally share in each new relation into which the thing enters. If some of them do not, then the 'real' thing is not in the given relation; there is an 'appearance,' a 'mental state' in its stead. The instant you test such a hypothesis, however, its impossibility becomes visible. It means that a bay horse cannot be physically related to the camera which photographs him because the animal, in relation to the camera, is only a few inches

[1] Lovejoy, Reflections of a Temporalist on the New Realism, *J. of Phil., Psychol., etc.*, 8, 596.

long, shows only one eye, is only gray, etc. Or if an object enters a magnetic field, all its qualities must be in the magnetic relation, hence, its color, flavor, shape, weight, texture, market value, and a thousand other features are all magnetized. If the physicist cannot find them in this relation, by the aid of delicate registering instruments, the thing itself is not there.[1]

2. "A hallucinatory complex does not exist at that place in space where it appears to exist; therefore it does not exist in real space *anywhere.*" This fallacy is based upon the unnoticed presupposition that consciousness is the mere knowing of physical things, as these are 'in themselves.' Of course, if one clings to this naïve doctrine, the fact of error and hallucination leads irresistibly to a dualism. But once regard both the physical things and their cognized phases as relational complexes, and the whole perplexity vanishes, simply by your recognizing that the character of a space complex, such as a man seen in a hallucination, is physically determined by its relations to many other entities. In this respect, space characters do not differ at all from color characters.

A hillside which is green near at hand, under a certain light, is bluish green a little farther off, bluish gray at a greater distance, and blue from a still remoter vantage point. That these are its real physical colors the spectroscope proves. From this fact, we readily infer to-day that color is not a mysterious essence inside of the hill, but a character which is a function of many things, ether, air, angles, distances, etc. Now is it not obvious that a character which is constituted by such a complex cannot be located in any one part of that complex *exclusively?* You might as well try to put the circularity of a circle into one of the points of the circumference. Of course, what you can do is to discern in the relation of such a point to other points a peculiarity which, *given a sufficient linear continuum,* will constitute a circumference. And this is the very thing you must do with the color of the distant hill. Color is

[1] This fallacy underlies Bergson's theory of cognition, in which he maintains that knowledge never gives us 'the real thing' inasmuch as it gives us only a few of its selected characters.

not in a point, as though it were an 'essence' whose 'appearances' emanated therefrom. Color is a character of a considerable extent of ether which is disturbed in a certain manner. Like all other physical characters, it varies with the number, arrangement, and character of ether units and other things; and, in the sense which Perry has defined the term 'dependence,' the color depends upon the total complex either as an effect upon its exclusive cause or as the whole upon its own parts. Some reasonably naïve people can grasp this and assent to it. But the old essence-substance notion troubles them when they try to think in the same manner of space characters. How about the size and shape of the hill? Is it not many thousand times as big as a man? And shaped like a sugar loaf? And at just one place in the universe, at a given instant? I grant that one must be quite sophisticated to answer these queries in a thoroughly relationalistic manner. We have all become so accustomed to construe space in terms of measure that every other interpretation of it sounds absurd. Our practical dealings with space are all metrical, of course. The important questions of daily life are: How far? How near? How much to the right? How many degrees to the left? And they are answered largely by our muscles, which carry our limbs across the appropriate stretches. Now, there is no denying that one position and only one lies at a given distance and direction from another position. Hence, if the relation between the two positions were *exclusively* that of distance and direction, in the proper quantitative sense, we should have to agree with the popular view that an object which 'seems' to occupy a position which is not its 'real' one, in terms of measure, is 'not really' the latter object at all, but only a phantasm of the brain. That this opinion has prevailed among philosophers no less than among laymen is due to a mere motor instinct, coupled with ignorance of modern geometry and the profounder types of space relations.

As soon as we construe elements in the cognitive field as a project-complex, we detect the error in the inference that, because a space object that is cognized has not the same metrical values as

the object which it purports to be, therefore it is (*a*) not in real space and (*b*) not the real object. The fallacy rests upon the presupposition that two entities which are indiscernibles in one relation and discernibles in another cannot both fall within the continuum to which one of them indisputably belongs. That this is false may be proved, not only by formal logic, but still more convincingly by an appeal to a concrete case in which it does not hold. By formal logic: A is a member of the class M, and in this relation (alone) it is indistinguishable from B, which is also a member of M; now, if A is distinguishable from B in some other relation than that of membership in M, we cannot infer that A is not (*a*) a member of M nor (*b*) a part of B, in case B is a complex. Such an inference would be the ordinary fallacy of accident. This can be shown concretely in projective geometry. Here all pairs of points on a given line are indistinguishable in themselves; that is, so long as other points and lines are not determinately given and certain operations performed. In other words, their distances are indiscernible, hence the 'absolute locus' of each point. But from this fact, does the geometer infer that the point A of the line M cannot be 'really' in M, because A is projectively indistinguishable from B, of the line M? Or that A is a member of some other class N? Not at all. He admits the obvious, namely, that *entities in certain relations are real indiscernibles, and that their identity in such complexes as are determined only by those relations is just as genuine as their differences in complexes otherwise determined.*

Were the philosopher to be no less scrupulous, he must say that optical and other sensory illusions, hallucinations, and delusions are not entities in some other continuum than that in which they exist 'immediately,' but rather entities so related to others in that continuum that they are, in that particular relation, identical in quality, efficiency, and every other respect. Thus, there is a class of complex entities in space and time so related in one respect (which I should like to call a 'direction,' but for the narrow meaning popularly read into the term) that the complex of members A, B, C, . . . is identical with the complex of members M, N, O, . . .

The former complex is, when described in its other, more inclusive relations, a stone wall in a given place; the second complex is a man who, at the given moment, is eating his breakfast a hundred miles away from the stone wall. I, having a hallucination, see the man where the stone wall 'really' is; but this fact does not prove that either the man or the wall is not in real space: it is only an illustration of the fact that two spatial things may be projectively related in a cognitive field not less than in a field of lower order, so that they are there identical (indiscernible).

6. *Conclusion.* — Here our formal analysis of the biological situation must halt, for lack of space in which to describe the other factors, such as the cognizing reagent, the motor response to relations in the cognitive field, and the mechanism by which this response is effected. Short as our journey has been, though, we have come upon not a few important facts. The realistic implications of ordinary biological description clear up, in large measure, the problem of error, which is the central issue in every theory of consciousness. Practically every argument for a separate realm of consciousness or spirit rests its case ultimately upon the apparently certain fact that many things 'in' the mind do not exist in the external world, although they do seem to. This indiscernibility of seeming from being, in the field of immediate experience, has almost invariably been construed as proving that, in immediate experience, it is not the 'things in themselves' we are dealing with, but entities of some other and unique order. Now, we have seen that (*a*) the indiscernibility of seeming from being can be naturally attributed not to the terms but to the relation in which they stand; and (*b*) this relation is of a genus familiar to the modern geometer; and (*c*) exists in the space order; and (*d*) is not confined to space but is common to 'forms of externality' or dimensional structures.

From these facts the biologist is free to draw an inference which has extremely high probability, namely, that organisms have developed elaborate projection systems in the central nervous systems just because the physical world-order is so full of charac-

ters which, with reference to the position occupied by a given organism at any given instant, are indiscernibles and yet, in other relations, are different from one another. At each moment a factor of the environment must be given in several projections, or (what amounts to the same thing) a sufficient number of distinct elements must be given, to make the character as a whole discernible. This conjecture, which we cannot here set forth in detail, leaves us with a view of error exactly opposite to that traditionally championed. *Error is not a product of the nervous system, but the nervous system is a contrivance to deal with a physical state of affairs of which error is only a very intricate instance.*

APPENDIX

APPENDIX

THE PROGRAM AND FIRST PLATFORM OF SIX REALISTS[1]

PHILOSOPHY is famous for its disagreements, which have contributed not a little towards bringing it into disrepute as being unscientific, subjective, or temperamental. These disagreements are due in part, no doubt, to the subject matter of philosophy, but chiefly to the lack of precision and uniformity in the use of words and to the lack of deliberate coöperation in research. In having these failings philosophy still differs widely from such sciences as physics and chemistry. They tend to make it seem mere opinion; for through the appearance of many figurative or loose expressions in the writings of isolated theorists, the impression is given that philosophical problems and their solutions are essentially personal. This impression is strengthened by the fact that philosophy concerns itself with emotions, temperaments, and taste. A conspicuous result of this lack of coöperation, common terminology, and a working agreement as to fundamental presuppositions is that genuine philosophical problems have been obscured, and real philosophical progress has been seriously hindered.

It is therefore with the hope that by coöperation genuine problems will be revealed, philosophical thought will be clarified, and a way opened for real progress, that the undersigned have come together, deliberated, and endeavored to reach an agreement. Such coöperation has three fairly distinct, though not necessarily successive stages: first, it seeks a statement of fundamental principles and doctrines; secondly, it aims at a program of constructive work following a method founded on these principles and doctrines; finally, it endeavors to obtain a system of axioms, methods, hypotheses, and facts, which have been so arrived at and formulated that at least those investigators who have coöperated can accept them as a whole.

After several conferences the undersigned have found that they hold certain doctrines in common. Some of these doctrines, which constitute a realistic platform, they herewith publish in the hope of carrying out

[1] Reprinted from the *J. of Phil., Psychol.*, etc., 1910, 7, 393.

further the program stated above. Each list has a different author, but has been discussed at length, revised, and agreed to by the other conferees. The six lists, therefore, though differently formulated, are held to represent the same doctrines.

By conferring on other topics, by interchange of ideas, and by systematic criticism of one another's phraseology, methods, and hypotheses, we hope to develop a common technique, a common terminology, and so finally a common doctrine which will enjoy some measure of that authority which the natural sciences possess. We shall have accomplished one of our purposes if our publications tempt other philosophers to form small coöperative groups with similar aims.

EDWIN B. HOLT, *Harvard University.*
WALTER T. MARVIN, *Rutgers College.*
W. P. MONTAGUE, *Columbia University.*
RALPH BARTON PERRY, *Harvard University.*
WALTER B. PITKIN, *Columbia University.*
E. G. SPAULDING, *Princeton University.*

I

1. The entities (objects, facts, etc.) under study in logic, mathematics, and the physical sciences are not mental in any usual or proper meaning of the word 'mental.'

2. The being and nature of these entities are in no sense conditioned by their being known.

3. The degree of unity, consistency, or connection subsisting among entities is a matter to be empirically ascertained.

4. In the present stage of our knowledge there is a presumption in favor of pluralism.

5. An entity subsisting in certain relations to other entities enters into new relations without necessarily negating or altering its already subsisting relations.

6. No self-consistent or satisfactory logic (or system of logic) so far invented countenances the 'organic' theory of knowledge or the 'internal' view of relations.

7. Those who assert this (anti-realistic) view, use in their exposition a logic which is inconsistent with their doctrine.

EDWIN B. HOLT.

II

1. Epistemology is not logically fundamental.[1]

2. There are many existential, as well as non-existential, propositions which are logically prior to epistemology.[2]

3. There are certain principles of logic which are logically prior to all scientific and metaphysical systems.

One of these is that which is usually called the external view of relations.

4. This view may be stated thus: In the proposition, "the term a is in the relation R to the term b," aR in no degree constitutes b, nor does Rb constitute a, nor does R constitute either a or b.

5. It is possible to add new propositions to some bodies of information without thereby requiring any modification of those bodies of information.

6. There are no propositions which are (accurately speaking) partly true and partly false, for all such instances can be logically analyzed into at least two propositions one of which is true and the other false. Thus as knowledge advances only two modifications of any proposition of the older knowledge are logically possible; it can be rejected as false or it can be analyzed into at least two propositions one of which is rejected.

[1] Some of the principles of logic are logically prior to any proposition that is deduced from other propositions. The theories of the nature of knowledge and of the relation of knowledge to its object are for this reason logically subsequent to the principles of logic. In short, logic is logically prior to any epistemological theory. Again, as theories of reality are deduced and are made to conform to the laws of logic they too are logically subsequent to logic; and in so far as logic is logically present in them it is itself a theory or part of a theory of reality.

[2] The terms 'knowledge,' 'consciousness,' and 'experience' found in common sense and in psychology are not logically fundamental, but are logically subsequent to parts at least of a theory of reality that asserts the existence of terms and relations which are not consciousness or experience. *E.g.* the psychical is distinguished from the physical and the physiological.

Now idealism has not shown that the terms 'knowledge,' 'consciousness,' and 'experience' of its epistemology or of its theory of reality are logically fundamental or indefinable, nor has it succeeded in defining them without logically prior terms that are elsewhere explicitly excluded from its theory of reality. In short, idealistic epistemologists have borrowed the terms 'knowledge,' 'consciousness,' and 'experience from psychology, but have ignored or denied the propositions in psychology that are logically prior. In other words, epistemology has not thus far made itself logically independent of psychology nor has it freed itself logically from the common-sense dualism of psychology. On the contrary, epistemology from Locke until to-day has been and has remained, in part at least, a branch of psychology.

As corollaries of the foregoing:

7. The nature of reality cannot be inferred merely from the nature of knowledge.

8. The entities under study in logic, mathematics, physics, and many other sciences are not mental in any proper or usual meaning of the word 'mental.'

9. The proposition, "This or that object is known," does not imply that such object is conditioned by the knowing. In other words, it does not force us to infer that such object is spiritual, that it exists only as the experiential content of some mind, or that it may not be ultimately real just as known.

WALTER T. MARVIN.

III

I. *The Meaning of Realism.*

1. Realism holds that things known may continue to exist unaltered when they are not known, or that things may pass in and out of the cognitive relation without prejudice to their reality, or that the existence of a thing is not correlated with or dependent upon the fact that anybody experiences it, perceives it, conceives it, or is in any way aware of it.

2. Realism is opposed to subjectivism or epistemological idealism which denies that things can exist apart from an experience of them, or independently of the cognitive relation.

3. The point at issue between realism and idealism should not be confused with the points at issue between materialism and spiritualism, automatism and interactionism, empiricism and rationalism, or pluralism and absolutism.

II. *The Opposition to Realism.* Among the various classic refutations of realism the following fallacious assumptions and inferences are prominent:

1. The Psychological Argument: The mind can have for its direct object only its own ideas or states, and external objects, if they exist at all, can only be known indirectly by a process of inference, of questionable validity and doubtful utility. This principle is fallacious because a knowing process is never its own object, but is rather the means by which some other object is known. The object thus known or referred to may be another mental state, a physical thing, or a merely logical entity.

2. The Intuitional Argument: This argument stands out most promi-

nently in the philosophy of Berkeley. It has two forms. The first consists of a confused identification of a truism and an absurdity. The truism: *We can only know that objects exist, when they are known.* The absurdity: *We know that objects can only exist when they are known.* The second form of the arguments derives its force from a play upon the word 'idea,' as follows: *Every 'idea' (meaning a mental process or state) is incapable of existing apart from a mind; every known entity is an 'idea' (meaning an object of thought)*; therefore, *every known entity is incapable of existing apart from a mind.* It is to the failure to perceive these fallacies that idealism owes its supposedly axiomatic character.

3. The Physiological Argument: Because the sensations we receive determine what objects we shall know, therefore the objects known are constructs or products of our perceptual experience. The fallacy here consists in arguing from the true premise that sensations are the *ratio cognoscendi* of the external world, to the false conclusion that they are therefore its *ratio fiendi* or *essendi.*

III. *The Implications of Realism.*

1. Cognition is a peculiar type of relation which may subsist between a living being and any entity.

2. Cognition belongs to the same world as that of its objects. It has its place in the order of nature. There is nothing transcendental or supernatural about it.

3. The extent to which consciousness pervades nature, and the conditions under which it may arise and persist, are questions which can be solved, if at all, only by the methods of empiricism and naturalism.

W. P. MONTAGUE.

IV

1. The object or content of consciousness is any entity in so far as it is responded to by another entity in a specific manner exhibited by the reflex nervous system. Thus physical nature, for example, is, under certain circumstances, directly present in consciousness.

In its historical application, this means that Cartesian dualism and the representative theory are false; and that attempts to overcome these by reducing mind and nature to one another or to some third substance, are gratuitous.

2. The specific response which determines an entity to be content of

consciousness does not directly modify such entities otherwise than to endow them with this content status. In other words, consciousness selects from a field of entities which it does not create.

In its historical application, this implies the falsity of Berkeleian and post-Berkeleian idealism in so far as this asserts that consciousness is a general *ratio essendi*.

3. The response which determines an entity to be content may itself be responded to and made content in like manner. In other words, the difference between subject and object of consciousness is not a difference of quality or substance, but a difference of office or place in a configuration.

In its historical application, this implies the falsity not only of the Cartesian dualism, but of all idealistic dualisms that, because they regard subject and object as non-interchangeable, conclude that the subject is either unknowable, or knowable only in some unique way such as intuitively or reflexively.

4. The same entity possesses both immanence, by virtue of its membership in one class, and also transcendence, by virtue of the fact that it may belong also to indefinitely many other classes. In other words, immanence and transcendence are compatible and not contradictory predicates.

In its historical application, this implies the falsity of the subjectivistic argument from the ego-centric predicament, *i.e.* the argument that because entities are content of consciousness they can not also transcend consciousness; it also implies that, so far as based on such subjectivistic premises, the idealistic theory of a transcendent subjectivity is gratuitous.

5. An entity possesses some relations independently of one another; and the ignorance or discovery of further relations does not invalidate a limited knowledge of relations.

In its historical applications, this implies the falsity of the contention of absolute idealism that it is necessary to know all of an entity's relations in order to know any of its relations, or that only the whole truth is wholly true.

6. The logical categories of unity, such as homogeneity, consistency, coherence, interrelation, etc., do not in any case imply a determinate degree of unity. Hence the degree of unity which the world possesses can not be determined logically, but only by assembling the results of the special branches of knowledge. On the basis of such evidence, there is a

present presumption in favor of the hypothesis that the world as a whole is less unified than are certain of its parts.

In its historical application, this implies that the great speculative monisms, such as those of Plato, Spinoza, and certain modern idealists, are both dogmatic and contrary to the evidence.

RALPH BARTON PERRY.

V

The realist holds that things known are not products of the knowing relation nor essentially dependent for their existence or behavior upon that relation. This doctrine has three claims upon your acceptance: first, it is the natural, instinctive belief of all men, and for this, if for no other reason, puts the burden of proof upon those who would discredit it; secondly, all refutations of it known to the present writer presuppose or even actually employ some of its exclusive implications; and, thirdly, it is logically demanded by all the observations and hypotheses of the natural sciences, including psychology.

Involved more or less intimately in a realistic view are the following:

1. One identical term may stand in many relations.

2. A term may change some of its relations to some other terms without thereby changing all its other relations to those same or to other terms.

3. What relations are changed by a given change of relation cannot always be deduced merely from the nature of either the terms involved or their relation.

4. The hypothesis that 'there can be no object without a subject' is pure tautology. It is confessedly a description of the cognitive situation only; and it says, in effect, that everything experienced is experienced. It becomes significant only by virtue of the wholly unwarranted assumption that doctrines 1, 2, and 3, above given, are false. This assumption, however, is fatal to the idealist's supposed discovery, inasmuch as it means that there can be no true propositions. In conceding this, the idealist refutes himself.

5. In no body of knowledge, not even in evidences about the nature of the knowledge relation, can we discover that possible knowledge is limited or what its limits may be.

6. Entities are transcendent to the so-called 'knowing mind' or 'consciousness' only as a term is to the relations in which it may stand, viz.

in two radically different manners: first, as the term is not identical with the particular relation in which it stands, so too a thing in the knowledge relation is not the relation itself; secondly, as the term may enter into or go out of a particular relation, without thereby being changed essentially or destroyed, so too can an object of knowledge exist prior to and after its entrance into or removal from the knowledge relation. Transcendence thus means, in the first place, distinctness and, in the second place, functional independence.

7. There may be axiomatic truths or intuitive truths. But the fact that a truth belongs to either of these classes does not make it fundamental or important for a theory of knowledge, much less for a theory of reality. Like all other truths, it too must be interpreted in the light of other relevant truths.

8. Though terms are not modified by being brought into new contexts, this does not imply that an existent cannot be changed by another existent.

WALTER B. PITKIN.

VI

1. Realism, while admitting the tautology that every entity which is known is in relation to knowing or experience or consciousness, holds that this knowing, etc., is eliminable, so that the entity is known as it would be if the knowing were not taking place. Briefly, the entity is, in its being, behavior, and character, independent of the knowing. This position agrees with common sense and with science in holding (1) that not all entities are mental, conscious, or spiritual, and (2) that entities are knowable without being known.

2. The fact that terms are in the cognitive relation does not imply that the terms are mutually dependent on, or capable of modifying, either each other or the relation, any more than this dependence, etc., is implied for any two terms in any other relation. The proposition that there is this dependence, etc., constitutes the 'internal view' of relations.[1] Most of

[1] To hold the 'internal view' means, in my opinion, to hold that, in order that a relation may relate, the relation must either (1) penetrate its terms, or (2) be mediated by an underlying (transcendent) reality. From the penetration there is deduced (*a*) modification, or (*b*) similarity, or (*c*) the generation of a contradiction. Cf. my paper, The Logical Structure of Self-refuting Systems, *Phil. Review*, 19, 277–282.

those systems which are opposed to realism can be shown to presuppose this 'internal view,' but this view can be shown to be self-contradictory and to presuppose the 'external view.'

3. That position which is based in part on the acceptance and the consistent use and development of the implications of these logical doctrines which are presupposed as a condition for any position being stated, argued, and held to be true, has, thereby, a strong presumption created in favor of its truth.[1]

4. There is at least one logical doctrine and one principle which are ultimately presupposed by any system which is held to be true. That doctrine is the 'external view' of relations, and the principle is that truth is independent of proof, although proof is not independent of truth. The first of these means, briefly:

5. (1) That both a term and a relation are (unchangeable) elements or entities; (2) that a term may stand in one or in many relations to one or many other terms; and (3) that any of these terms and that some of these relations could be absent or that other terms and relations could be present without there being any resulting modification, etc., of the remaining or already present terms or relations.

6. By this 'external view' it is made logically possible that the knowing process and its object should be qualitatively dissimilar. (Cf. 1.)

7. The principle (cf. 4) means, that, while on the one hand no proposition is so certain that it can be regarded as exempt from examination, criticism, and the demand for proof, on the other hand, any proposition, if free from self-contradiction, may be true (in some system). In this sense every proposition is tentative, even those of this platform.

Corollary. — It is impossible to get a criterion, definition, theory, or content for the concept 'absolute' by which it can be absolutely known or proved that any criterion, definition, theory, or content is absolutely true, *i.e.* is more than tentative. The most that can be claimed for such a criterion, etc., is that it may be absolutely true, although not proved to be.

[1] Such a system *I hold* to be realism, its chief feature being the interpretation of the cognitive relation in accordance with the 'external view.' This 'external view' can be held to be true quite consistently with itself, and is in this sense, I hold, self-consistent, as is also, in my opinion, realism. Accordingly I hold further that realism is not a merely dogmatic system, and that, as self-consistent, it refutes and does not merely contradict certain opposed systems which, as based on the 'internal view,' are self-refuting.

8. Any entity may be known as it really is in some respects without its being known in all respects and without the other entities to which it is related being known, so that knowledge can increase by *accretion*.

9. Knowing, consciousness, etc., are facts to be investigated only in the same way as are other facts, and are not necessarily more important than are other facts.

10. The position stated in this platform, which is a position concerning knowing as well as other things, can apply to itself, as a special instance of knowledge, all its own propositions about knowledge.[1]

EDWARD GLEASON SPAULDING.

NOTE ON PROFESSOR HOLT'S ESSAY

WITH a view to a clearer understanding by the reader of the theories of error and consciousness set forth by Holt and myself, I here summarize what seem to me to be the main points at issue between us:

I. I disagree with Holt's theory that specific qualities are mere temporal condensations of primitive and qualitatively simple pulses, on the ground that such temporal condensation constitutes the attribute of *intensity*. When in a series of stimuli there occur positive intervals of empty time between their effects on the sensory center, we experience the series as a succession of discretes. If the series of stimuli increases in rapidity to the point when the intervals between their effects on the sensory center fall to zero, we experience the series as a single continuously enduring quality. When the succession of stimuli becomes so rapid that their effects upon the sensory center actually overlap or interpenetrate, we get not a new quality but an increase in the original intensity of the old quality — an increase which is proportioned to the degree of the overlapping or temporal condensation. In short, Holt's concept of temporal condensation provides a good analytic definition of the category of intensity, and for that very reason it cannot be used to express qualitative difference.

II. I disagree with Holt's doctrine that contradictions are objective and related after the manner of opposing forces, and hence with his conclusion that these objective contradictions constitute the content of an

[1] I hold that for this reason the position here stated is self-critical, and that it is this which distinguishes it from a large class of historical systems, notably phenomenalism, subjective and objective idealism, and absolutism.

erroneous experience and cause its occurrence. The unreal object or content of an error *subsists* extra-mentally but it does not contribute in any causal manner to its being apprehended. It is the nature of the unreal, or merely subsistent, to be sterile of consequences. It can be known but it cannot cause itself to be known, and apart from being known it has no efficiency. The non-existent bent stick cannot cause us to perceive it, but an existent straight stick, partly immersed in water, can produce by reason of the different refracting powers of water and air an effect upon the eye and brain of the same kind as would have been produced by a stick that was really bent, with the result that a non-existent bent stick becomes the object of an (erroneous) apprehension.

III. The most serious difference between Holt's conclusions and my own concerns the nature of consciousness. We both agree that extra-organic objects produce in the brain effects which more or less resemble their causes and which are the means by which those causes are perceived. But we differ as to the manner in which these brain effects are instrumental to perception. In the first part of Holt's paper, he appears to me to adduce evidence that would support the view that the objects of which we are conscious are within the brain. He speaks (1) of the effects produced in the nervous system as being true parts of the extra-organic objects which cause them, and of the object being present in its effects, as a man's expression is truly present in his portrait; (2) of the temporal condensations of neural vibrations as the basis for the experience of secondary qualities; (3) of the non-psychical character of illusory objects, as implied by their similarity to the distorted images on a photographic plate.

It seems to me that these arguments, if valid, would obviously imply that the objects of which we are conscious constitute the system of effects projected upon the brain; and that, when this conclusion is disavowed the foregoing evidence loses all its relevancy. As I understand it, it is this conception of consciousness as consisting of the intra-organic projections of extra-organic objects that is defended by Pitkin in his article. Now despite the plausibility of the projection theory it is, I believe, open to certain insuperable objections which however need not be mentioned here, for it seems that after all Holt rejects it as explicitly as I do, and in the last part of his article sets forth what appears to me the wholly different conception of consciousness as a 'specific response' to extra-organic objects which by virtue of being thus responded to become the field of objects in consciousness.

The whole question of the nature of consciousness thus seems to hinge on the meaning of the 'specific response.' But I cannot find any adequate statement of what this response is. In spite of its alleged 'specific' character, consciousness, it seems to me, might as well be identified with X. If by the response Holt means anything physical, such as an organic movement or efferent nerve current, my objections would be those set forth in my article against the theory that consciousness is behavior. If, on the other hand, the specific response which constitutes consciousness is not behavior or movement, the only alternative seems to me to be that of identifying it with the relation of self-transcending implication, which the brain-states sustain to their extra-organic causes. But this is the view which I have defended and which Holt rejects.

W. P. MONTAGUE.

NOTE ON PROFESSOR MONTAGUE'S ESSAY

As the reader of our two essays will readily see, my view of consciousness differs widely from that of Montague. A fundamental feature of this difference is to be found in the concept of self-transcendent reference, on which Montague's theory hinges; for, according to him, "it is the self-transcending implications of these brain-states that constitute our consciousness of the spatio-temporal world in which we live." And the germ of such self-transcendence seems to be found in the causal relation: "Each event-element has over and above its own qualities and its own position in space and time, something which implies or refers to other events. It is both an agent and a patient of what is not itself." Now whether or not a case of self-transcendent reference is anywhere to be found, I do not think that one is found in the relation between brain-states and their correlated contents of consciousness. The brain-state, as I believe, does not refer by self-transcendence to the object that is at the moment content of consciousness, but it is a *specific response* to that object. Nor, again, do I find such self-transcendence in the case of causality, for here I discover nothing but the constant function of an independent variable (generally time).

Again, Montague and I differ in our understanding of error. I do not look on error as primarily or even generally attributable to anything that could be called the 'distorting' influence of the physiological mechanism of perception and thought. It seems to me that the extra-mental world is

teeming with contradictions and unrealities, and that these can come to consciousness by virtue of a psychical process, which presents no elements of 'distortion.'

The application of Montague's view and of mine to the empirical facts of psychology, and of modern logic, must decide as to which is the better descriptive and explanatory principle.

E. B. Holt.

NOTE ON THE ESSAYS OF PROFESSORS HOLT AND MONTAGUE

THERE is much in these two essays which I should like to discuss, if space permitted. Holt's theory of time-density and of cognitive cross-sections and Montague's rejection of the projective hypothesis interest me most acutely. I agree fundamentally with Holt in his two doctrines, though I am not at all sure that time-density yields qualitative characters. It may well be, as Montague suggests, that it yields only the intensity series. This is a matter calling for thorough investigation, and I hope we may soon attack it. But Holt's underlying contention is still sound. The alleged simple qualities and their unique specificities are 'form qualities' and their simple constituents are minute physical events. These events are packed together, now in space, now in time, and again, perhaps, in both continua. If time-density yields intensity, space-density probably yields quality; but touching this, I confess to much ignorance.

As for Montague's rejection of the projective hypothesis, I believe it is due to his supposing that projection is the simple casting of simulacra upon a screen. This is a very natural misunderstanding, for all cases of spatial projection do involve the generating of new figures definitely related to the projected figures. But these new figures are not the projective *relation*. They are only the *terms* of the relation. And it is just this, their relation to other terms, which constitutes the peculiarity called error, or, more precisely, multiple value or indiscernibility.

Montague, I believe, opposes the projective hypothesis chiefly on the ground that it leaves the sentient organism in possession of nothing more than its own brain states, to wit, the images projected upon some parts of the nervous system. Now, there are such images, at least in the more finely organized sensory systems; but they are *incidental* products of the projective relation, and not the significant nature of it. The efficient projective relations are not, as it were, *inside* the individual sensory elements; they obtain *between* the latter, or, in other cases, between the organism (its position or condition) and the external entities reacted to. In short, they are not merely odd chemical properties of the cortex; they

are not physical properties at all. Hence there is no danger of reducing the mind to knowledge only of its brain states, inasmuch as these are merely terms in the projective relation, and not the relation itself.

Montague and Holt and I agree that, whatever consciousness is, it is somehow connected with the activity of getting 'beyond space and time'; that is, of adjusting variously to events beyond the organism's own skin and to conditions more than material. But I differ from Montague in locating the device by which this adjustment is effected. I regard the implicative relation as *transverse* to the physical field of its terms. The latter are in space and time; and their physical relations are all spatio-temporal. But the implicative relation is not. It cuts across the physical field, but it does not cut in any spatio-temporal dimension. (This is also Holt's opinion, if I mistake not.) Against this view Montague looks upon the implicative relation as being *longitudinal* to the physical field, actually in and through it, running from cause to effect, and hence having a genuine historical flow. It is imbedded in the stuff of things as electric charges are, as velocities, stresses and strains and pulls are. It is, indeed, one phase of causation.

But for me this hypothesis engenders difficulties, of which I mention only three:

1. Implication cannot be a mere counter-phase of causation, inasmuch as we find the implicative relation between terms which are not causally related in any series. For instance, one unreal may imply another: the death of the Emperor of the United States implies the death of the head of the ruling American house. I know that Montague denies that this is a genuine implication, as he denies all implying between unreals. But to discuss this would be to open the whole field of modern logic; so I leave the reader with the problem and I pass to a more obvious instance of non-causal implication, namely that between timeless entities. The triangle implies a constant sum of interior angles; but the angles are neither the cause nor the effect of the triangle, they are only parts of it; and the geometrical proposition is one about the whole implying something about its parts. Again, one event may imply another which is simultaneous with it and not causally connected. Thus sunlight in New York City implies darkness in Hong Kong; here the two events are effects of the same complex causes, not effects or causes of each other.

2. If causes and effects reciprocally imply each other, then the proximate cause implies its effect, and *vice versa*. Hence, the last brain state before

the cognizing of an object ought to be at least one of the implicates given in that instant of consciousness. But this is not the case.

3. If, on the other hand, this implicative relation is transitive, the percipient knows immediately some term in the implicative series beyond his own brain state. But why does he know the one which, let us say, is located at a given point in space? Why does he perceive the sun, instead of an ether wave, two inches or eighteen thousand miles from his retina? Why does the implication stop anywhere? Surely the cause-effect series is prodigiously long, and the implicative relation is demonstrably transitive; hence the brain state might well be expected to imply all its impliers, and thus simple perception ought to yield us the longed-for all-in-all knowledge about the flower in the crannied wall. The answer to this difficulty cannot be that an effect implies its simplest cause only; for the proximate cause is the simplest always, yet it is never implied.

I raise these queries because I believe that they lose their awkwardness as soon as we give up the longitudinal hypothesis and accept the transverse. If I mistake not, my differences with Montague reduce almost wholly to this issue.

WALTER B. PITKIN.

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