Word and Object

new edition

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Wie Schiffer sind wir, die ihr Schiff auf offener See umbauen müssen, ohne es jemals in einem Dock zerlegen und aus besten Bestandteilen neu errichten zu können.
—Otto Neurath

Ontology recapitulates philology.
—James Grier Miller

1 Language and Truth

§1 Beginning with Ordinary Things

This familiar desk manifests its presence by resisting my pressures and by deflecting light to my eyes. Physical things generally, however remote, become known to us only through the effects which they help to induce at our sensory surfaces. Yet our common-sense talk of physical things goes forward without benefit of explanations in more intimately sensory terms. Entification begins at arm's length; the points of condensation in the primordial conceptual scheme are things glimpsed, not glimpses. In this there is little cause for wonder. Each of us learns his language from other people, through the observable mouthing of words under conspicuously intersubjective circumstances. Linguistically, and hence conceptually, the things in sharpest focus are the things that are public enough to be talked of publicly, common and conspicuous enough to be talked of often, and near enough to sense to be quickly identified and learned by name; it is to these that words apply first and foremost.

Talk of subjective sense qualities comes mainly as a derivative idiom. When one tries to describe a particular sensory quality, he typically resorts to reference to public things—describing a color as orange or heliotrope, a smell as like that of rotten eggs. Just as one sees his nose best in a mirror, removed to half the optimum focal distance, so also he best identifies his sense data by reflecting them in external objects.

Impressed with the fact that we know external things only mediately through our senses, philosophers from Berkeley onward have undertaken to strip away the physicalistic conjectures and bare the sense data. Yet even as we try to recapture the data, in all their innocence of interpretation, we find ourselves depending upon sidelong glances into natural science. We may hold, with Berkeley, that the momentary data of vision consist of colors disposed in a spatial manifold of two dimensions; but we come to

this conclusion by reasoning from the bidimensionality of the ocular surface, or by noting the illusions which can be engendered by two-dimensional artifacts such as paintings and mirrors, or, more abstractly, simply by noting that the interception of light in space must necessarily take place along a surface. Again we may hold that the momentary data of audition are clusters of components each of which is a function of just two variables, pitch and loudness; but not without knowledge of the physical variables of frequency and amplitude in the stimulating string.

The motivating insight, viz. that we can know external things only through impacts at our nerve endings, is itself based on our general knowledge of the ways of physical objects—illuminated desks, reflected light, activated retinas. Small wonder that the quest for sense data should be guided by the same sort of knowledge that prompts it.

Aware of the points thus far set forth, our philosopher may still try, in a spirit of rational reconstruction, to abstract out a pure stream of sense experience and then depict physical doctrine as a means of systematizing the regularities discernible in the stream. He may imagine an ideal "protocol language" which, even if in fact learned after common-sense talk of physical things or not at all, is evidentially prior: a fancifully fancyless medium of unvarnished news. Talk of ordinary physical things he would then see as, in principle, a device for simplifying that disorderly account of the passing show.

But this is a misleading way of depicting matters, even when the idea of a sense-datum "language" is counted frankly as metaphor. For the trouble is that immediate experience simply will not, of itself, cohere as an autonomous domain. References to physical things are largely what hold it together. These references are not just inessential vestiges of the initially intersubjective character of language, capable of being weeded out by devising an artificially subjective language for sense data. Rather they give us our main continuing access to past sense data themselves; for past sense data are mostly gone for good except as commemorated in physical posits. All we would have apart from posits and speculation are present sense data and present memories of past ones; and a memory trace of a sense datum is too meager an affair to do much good. Actual memories mostly are traces not of past sensations but of past conceptualization or verbalization.[1]

There is every reason to inquire into the sensory or stimulatory background of ordinary talk of physical things. The mistake comes only in

1. See Chisholm, *Perceiving*, p. 160.

seeking an implicit sub-basement of conceptualization, or of language. Conceptualization on any considerable scale is inseparable from language, and our ordinary language of physical things is about as basic as language gets.

Neurath has likened science to a boat which, if we are to rebuild it, we must rebuild plank by plank while staying afloat in it. The philosopher and the scientist are in the same boat. If we improve our understanding of ordinary talk of physical things, it will not be by reducing that talk to a more familiar idiom; there is none. It will be by clarifying the connections, causal or otherwise, between ordinary talk of physical things and various further matters which in turn we grasp with help of ordinary talk of physical things.

On the face of it there is a certain verbal perversity in the idea that ordinary talk of familiar physical things is not in large part understood as it stands, or that the familiar physical things are not real, or that evidence for their reality needs to be uncovered. For surely the key words 'understood', 'real', and 'evidence' here are too ill-defined to stand up under such punishment. We should only be depriving them of the very denotations to which they mainly owe such sense as they make to us. It was a lexicographer, Dr. Johnson, who demonstrated the reality of a stone by kicking it; and to begin with, at least, we have little better to go on than Johnsonian usage. The familiar material objects may not be all that is real, but they are admirable examples.

There are, however, philosophers who overdo this line of thought, treating ordinary language as sacrosanct. They exalt ordinary language to the exclusion of one of its own traits: its disposition to keep on evolving. Scientific neologism is itself just linguistic evolution gone self-conscious, as science is self-conscious common sense. And philosophy in turn, as an effort to get clearer on things, is not to be distinguished in essential points of purpose and method from good and bad science.

In particular we shall find, as we get on with organizing and adjusting various of the turns of phrase that participate in what pass for affirmations of existence, that certain of these take on key significance in the increasingly systematic structure; and then, reacting in a manner typical of scientific behavior, we shall come to favor these idioms as the existence affirmations "strictly so-called." One could even end up, though we ourselves shall not, by finding that the smoothest and most adequate overall account of the world does not after all accord existence to ordinary physical things, in that refined sense of existence. *Such* eventual departures from Johnsonian usage could partake of the spirit of science and even of the evolutionary spirit of ordinary language itself.

Our boat stays afloat because at each alteration we keep the bulk of it intact as a going concern. Our words continue to make passable sense because of continuity of change of theory: we warp usage gradually enough to avoid rupture. And such, in the beginning, is the case for Johnsonian usage itself, since our questioning of objects can coherently begin only in relation to a system of theory which is itself predicated on our interim acceptances of objects. We are limited in how we can start even if not in where we may end up. To vary Neurath's figure with Wittgenstein's, we may kick away our ladder only after we have climbed it.

So the proposition that external things are ultimately to be known only through their action on our bodies should be taken as one among various coordinate truths, in physics and elsewhere, about initially unquestioned physical things. It qualifies the empirical meaning of our talk of physical things, while not questioning the reference. There remains abundant reason to inquire more closely into the empirical meaning or stimulatory conditions of our talk of physical things, for we learn in this way about the scope of creative imagination in science; and such inquiry is none the worse for being conducted within the framework of those same physical acceptations. No inquiry being possible without some conceptual scheme, we may as well retain and use the best one we know—right down to the latest detail of quantum mechanics, if we know it and it matters.

Analyze theory-building how we will, we all must start in the middle. Our conceptual firsts are middle-sized, middle-distanced objects, and our introduction to them and to everything comes midway in the cultural evolution of the race. In assimilating this cultural fare we are little more aware of a distinction between report and invention, substance and style, cues and conceptualization, than we are of a distinction between the proteins and the carbohydrates of our material intake. Retrospectively we may distinguish the components of theory-building, as we distinguish the proteins and carbohydrates while subsisting on them. We cannot strip away the conceptual trappings sentence by sentence and leave a description of the objective world; but we can investigate the world, and man as a part of it, and thus find out what cues he could have of what goes on around him. Subtracting his cues from his world view, we get man's net contribution as the difference. This difference marks the extent of man's conceptual sovereignty—the domain within which he can revise theory while saving the data.

In a general way, therefore, I propose in this introductory chapter to ponder our talk of physical phenomena as a physical phenomenon, and

our scientific imaginings as activities within the world that we imagine. Later chapters will treat more closely of details.

§2 The Objective Pull; or, *E pluribus unum*

'Ouch' is a one-word sentence which a man may volunteer from time to time by way of laconic comment on the passing show. The correct occasions of its use are those attended by painful stimulation. Such use of the word, like the correct use of language generally, is inculcated in the individual by training on the part of society; and society achieves this despite not sharing the individual's pain. Society's method is in principle that of rewarding the utterance of 'Ouch' when the speaker shows some further evidence of sudden discomfort, say a wince, or is actually seen to suffer violence, and of penalizing the utterance of 'Ouch' when the speaker is visibly untouched and his countenance unruffled.

For the man who has learned his language lesson, some of the stimuli evocative of 'Ouch' may be publicly visible blows and slashes, while others are hidden from the public eye in the depths of his bowels. Society, acting solely on overt manifestations, has been able to train the individual to say the socially proper thing in response even to socially undetectable stimulations. The trick has depended on prior concomitances between covert stimulation and overt behavior, notably the wincing instinct.

We can imagine a primitive use of 'Red' as a one-word sentence somewhat on a par with 'Ouch'. Just as 'Ouch' is the appropriate remark on the occasion of painful stimulation, so 'Red', under the usage which I am now imagining, is the appropriate remark on the occasion of those distinctive photochemical effects which are wrought in one's retina by the impact of red light. This time society's method of training consists in rewarding the utterance of 'Red' when the individual is seen looking at something red, and penalizing it when he is seen looking at something else.

Actually the uses of 'Red' are less simple. Commonly 'red', unlike 'ouch', turns up as a fragment of longer sentences. Moreover, even when 'Red' is used by itself as a one-word sentence, what evokes it is usually not the mere apprehension of something red; more commonly there has been a verbal stimulus, in the form of a question. But let us keep for a moment to the fictitious usage described in the preceding paragraph; for it, by its similarity to 'Ouch', will help to bring out also a certain contrast.

The critic, society's agent, approves the subject's utterance of 'Red' by observing the subject and his viewed object and finding the latter red. In part, therefore, the critic's cue is red irradiation of his own retina. A partial

symmetry obtains between the subject's cue for utterance and the critic's cue for approval in the case of 'Red', which, happily for the critic, was lacking in the case of 'Ouch'. The partial symmetry in the one case, and the lack of it in the other, suggest a certain superficial sense in which 'Ouch' may be spoken of as more subjective in reference than 'Red'; 'Red' more objective than 'Ouch'.

Exceptions are possible on either side. If the critic and the subject are fighting a fire and are scorched by the same sudden gust, then the critic's approval of the subject's 'Ouch' does not differ significantly from the imagined case of 'Red'. Conversely, a critic may approve a subject's 'Red' on indirect evidence, failing to glimpse the object himself. If we call 'Ouch' more subjective than 'Red', we must be taken as alluding thereby only to the most characteristic learning situations. In the case of 'Red', typically one's mentor or critic sees red; in the case of 'Ouch', typically he does not get hurt.

'Ouch' is not independent of social training. One has only to prick a foreigner to appreciate that it is an English word. But in its subjectivity it is a little unusual. Words being social tools, objectivity counts toward their survival. When a word has considerable currency despite the subjective twist, it may be expected, like the pronouns 'I' and 'you', to have a valuable social function of some exceptional sort. The survival value of 'Ouch', from a social point of view, is as a distress signal. And the word is of only marginal linguistic status, after all, being incapable of integration into longer sentences.

The usual premium on objectivity is well illustrated by 'square'. Each of a party of observers glances at a tile from his own vantage point and calls it square; and each of them has, as his retinal projection of the tile, a scalene quadrilateral which is geometrically dissimilar to everyone else's. The learner of 'square' has to take his chances with the rest of society, and he ends up using the word to suit. Association of 'square' with just the situations in which the retinal projection is square would be simpler to learn, but the more objective usage is, by its very intersubjectivity, what we tend to be exposed to and encouraged in.

In general, if a term is to be learned by induction from observed instances where it is applied, the instances have to resemble one another in two ways: they have to be enough alike from the learner's point of view, from occasion to occasion, to afford him a basis of similarity to generalize upon, and they have to be enough alike from simultaneous distinct points of view to enable the teacher and learner to share the appropriate occasions. A term restricted to squares normal to the line of sight would meet the

first requirement only; a term applying to physical squares in all their scalene projections meets both. And it meets both in the same way, in that the points of view available to the learner from occasion to occasion are likewise the points of view available to teacher and learner on simultaneous occasions. Such is the way with terms for observable physical objects generally; and thus it is that such objects are focal to reference and thought.

'Red', unlike 'square', is a happy case where a nearly uniform stimulatory condition is shared by simultaneous observers. All the assembled retinas are irradiated by substantially the same red light, whereas no two of them receive geometrically similar projections of the square. The pull toward objectivity is thus a strong pull away from the subjectively simplest rule of association in the case of 'square', and much less so in the case of 'red'. Hence our readiness to think of color as more subjective than physical shape. But some pull of the same kind occurs even in the case of 'red', insofar as reflections from the environment cause the red object to cast somewhat different tints to different points of view. The objective pull will regiment all the responses still as 'red', by activating myriad corrective cues. These corrective cues are used unconsciously, such is the perfection of our socialization; a painter has even to school himself to set them aside when he tries to reproduce his true retinal intake.

The uniformity that unites us in communication and belief is a uniformity of resultant patterns overlying a chaotic subjective diversity of connections between words and experience. Uniformity comes where it matters socially; hence rather in point of intersubjectively conspicuous circumstances of utterance than in point of privately conspicuous ones. For an extreme illustration of the point, consider two men one of whom has normal color vision and the other of whom is color-blind as between red and green. Society has trained both men by the method noted earlier: rewarding the utterance of 'red' when the speaker is seen fixating something red, and penalizing it in the contrary case. Moreover the gross socially observable results are about alike: both men are pretty good about attributing 'red' to just the red things. But the private mechanisms by which the two men achieve these similar results are very different. The one man has learned 'red' in association with the regulation photochemical effect. The other man has painfully learned to be stimulated to 'red' by light in various wavelengths (red and green) in company with elaborate special combinations of supplementary conditions of intensity, saturation, shape, and setting, calculated e.g. to admit fire and sunsets and to exclude grass; to admit blossoms and exclude leaves; and to admit lobsters only after boiling.

Different persons growing up in the same language are like different bushes trimmed and trained to take the shape of identical elephants. The anatomical details of twigs and branches will fulfill the elephantine form differently from bush to bush, but the overall outward results are alike.

§3 The Interanimation of Sentences[1]

'Ouch' was a one-word sentence. 'Red' and 'Square', when used in isolation in the ways lately imagined, are likewise best looked upon as sentences. Most sentences are longer. But even a longer sentence may still be learned as a single unit, like 'Ouch', 'Red', and 'Square', by a direct conditioning of the whole utterance to some sensory stimulation. Characteristically Humean problems, of how we acquire various ideas, may often be by-passed by representing the words in question simply as fragments of sentences which were learned as wholes.

Not that all or most sentences are learned as wholes. Most sentences are built up rather from learned parts, by analogy with the way in which those parts have previously been seen to occur in other sentences which may or may not have been learned as wholes.[2] What sentences are got by such analogical synthesis, and what ones are got directly, is a question of each individual's own forgotten history.

It is evident how new sentences may be built from old materials and volunteered on appropriate occasions simply by virtue of the analogies. Having been directly conditioned to the appropriate use of 'Foot' (or 'This is my foot') as a sentence, and 'Hand' likewise, and 'My foot hurts' as a whole, the child might conceivably utter 'My hand hurts' on an appropriate occasion, though unaided by previous experience with that actual sentence.

But think how little we would be able to say if our learning of sentences were strictly limited to those two modes: (1) learning sentences as wholes by a direct conditioning of them to appropriate non-verbal stimulations, and (2) producing further sentences from the foregoing ones by analogical substitution as in the preceding paragraph. The sentences afforded by mode (1) are such that each has its particular range of admissible stimulatory occasions, independently of wider context. The sentences added by

1. The phrase is adapted from Richards.
2. This process, and the primacy of the sentence, were already appreciated in ancient India. See Brough, "Some Indian theories of meaning," pp. 164–167.

(2) are more of the same sort—learned faster thanks to (2), but no less capable of being learned in mode (1). Speech thus confined would be strikingly like bare reporting of sense data.

The objective pull described in §2 would indeed be there. The stimulations eliciting 'It is square' would indeed take in the odd lot of suitably circumstanced skew projections that social pressure requires. Yet the effect of this objective pull by itself is superficial: a mere warping of the pigeonholes; a gerrymandering, in the public interest, of the range of stimulations which each report embraces. Our idiom would remain very much the inadequate sort of idiom imagined in §1: the fancifully fancyless medium of unvarnished news. As there remarked, there would be no access to the past, beyond the negligible yield of an occasional memory trace of an unconceptualized stimulation.

What more is needed in order to capitalize the riches of past experience is hinted in the remark (§1) that actual memories are mostly traces not of past sensation but of past conceptualization. We cannot rest with a running conceptualization of the unsullied stream of experience; what we need is a sullying of the stream. Association of sentences is wanted not just with non-verbal stimulation, but with other sentences, if we are to exploit finished conceptualizations and not just repeat them.

Mode (2) above is already, in a way, an associating of sentences with sentences; but only in too restrained a way. Further interverbal associations are required which provide for the use of new sentences without tying them, even derivatively, to any fixed ranges of non-verbal stimuli.

The most obvious case of the verbal stimulation of verbal response is interrogation. It was already remarked in §2 that 'Red' as a one-word sentence usually needs a question for its elicitation. The question may be simply 'What color is this?'. In this case the stimulus eliciting 'Red' is a compound one: the red light assails the eye and the question the ear. Or the question may be 'What color will you have?' or 'What color did it use to be?'. In such a case the stimulus eliciting 'Red' is the verbal one unaccompanied by red light; though its power to elicit 'Red' depends, of course, on an earlier association of 'Red' with red light.

The opposite dependence is also common: the power of a non-verbal stimulus to elicit a given sentence commonly depends on earlier associations of sentences with sentences. And in fact it is cases of this kind that best illustrate how language transcends the confines of essentially phenomenalistic reporting. Thus someone mixes the contents of two test tubes, observes a green tint, and says 'There was copper in it.' Here the sentence is elicited by a non-verbal stimulus, but the stimulus depends for

its efficacy upon an earlier network of associations of words with words; viz., one's learning of chemical theory. Here we have a good glimpse of our workaday conceptual scheme as a going concern. Here, as at the crude stage of (1) and (2), the sentence is elicited by a non-verbal stimulus; but here, in contrast to that crude stage, the verbal network of an articulate theory has intervened to link the stimulus with the response.

The intervening theory is composed of sentences associated with one another in multifarious ways not easily reconstructed even in conjecture. There are so-called logical connections, and there are so-called causal ones; but any such interconnections of sentences must finally be due to the conditioning of sentences as responses to sentences as stimuli. If some of the connections count more particularly as logical or as causal, they do so only by reference to so-called logical or causal laws which in turn are sentences within the theory. The theory as a whole—a chapter of chemistry, in this case, plus relevant adjuncts from logic and elsewhere—is a fabric of sentences variously associated to one another and to non-verbal stimuli by the mechanism of conditioned response.

Theory may be deliberate, as in a chapter on chemistry, or it may be second nature, as is the immemorial doctrine of ordinary enduring middle-sized physical objects. In either case, theory causes a sharing, by sentences, of sensory supports. In an arch, an overhead block is supported immediately by other overhead blocks, and ultimately by all the base blocks collectively and none individually; and so it is with sentences, when theoretically fitted. The contact of block to block is the association of sentence to sentence, and the base blocks are sentences conditioned in the modes (1) and (2) to non-verbal stimuli. Perhaps we should think of the arch as tottering on an earthquake; thus even a base block is supported, now and again, only by the other base blocks via the arch.[3]

Our example 'There is copper in it' is an overhead block, along with 'Copper oxide is green' and others. One of the base blocks is perhaps the sentence 'The stuff has gone green', a sentence directly conditioned to the sensory stimulation got from the test tube.

In the series of sentence-to-sentence associations ultimately linking 'The stuff has gone green' with 'There was copper in it', all steps but the last are evidently unspoken. Some may be sketchily and inaudibly spoken, but more are just skipped as the theory becomes second nature. Such skipping,

3. The analogies of the fabric and the arch are well supplemented by the more detailed analogy of the net which Hempel develops, *Fundamentals of Concept Formation*, p. 36.

which exceeds the arch analogy, seems a basically humdrum affair: a transitivity of conditioning.

Another point that exceeds the arch analogy is the difference between occasion sentences like 'There was copper in it', true anew for each of various experimental occasions (§9), and eternal sentences like 'Copper oxide is green', true for good (§40). The occasion sentence is elicited from the practicing chemist time and again. The eternal sentence may well be elicited from him just once, in his youth, by the university examiner. The eternal ones tend most of all to drop out under the transitivity of conditioning, leaving no trace except implicitly in the patterning of conditioning of residual sentences.

What comes of the association of sentences with sentences is a vast verbal structure which, primarily as a whole, is multifariously linked to non-verbal stimulation. These links attach to separate sentences (for each person), but the same sentences are so bound up in turn with one another and with further sentences that the non-verbal attachments themselves may stretch or give way under strain.[4] In an obvious way this structure of interconnected sentences is a single connected fabric including all sciences, and indeed everything we ever say about the world; for the logical truths at least, and no doubt many more commonplace sentences too, are germane to all topics and thus provide connections.[5] However, some middle-sized scrap of theory usually will embody all the connections that are likely to affect our adjudication of a given sentence.

4. Aldrich has vividly summarized and criticized my view of these matters, in part as follows: "Amplifying and modifying his own image of the universe of discourse as a field of force bounded by 'experience' of the 'external world' . . . , I suggest, in view of *some* of Quine's remarks, that there are two forces that interpenetrate or fuse to constitute the field: the 'empirical' force extending into the field from 'outside' and thus being stronger near the periphery; and the formal or logical force, whose principle is simplicity and symmetry of laws, radiating out from the center. . . . But in another and contrary vein Quine . . . seems to say . . . that the external or empirical force is operative only at the edge, 'from outside.' *Inside*, the central force for simplicity, convenience, and elegance has a field day, all by itself" (pp. 18–19). What he misses in this engaging last remark is that the peripheral sentences, those most firmly linked to non-verbal stimulations, are linked *also* to other sentences; and thus it is that the external force is communicated inward. On this duality of forces, see further the bipolar representation in Smith.

5. This point has been lost sight of, I think, by some who have objected to an excessive holism espoused in occasional brief passages of mine. Even so, I think their objections largely warranted. See e.g. Hofstadter, pp. 408ff.

The firmness of association to non-verbal stimuli, the power of such association to withstand the contrary pull of a body of theory, grades off from one sentence to another. Roughly imaginable sequences of nerve hits can confirm us in the statement that there is a brick house on Elm Street, beyond the power of secondary associations to add or detract. Even where the conditioning to non-verbal stimulation is so firm, however, there is no telling to what extent it is original and to what extent it results from a shortcutting, by transitivity of conditioning, of old connections of sentences with sentences. Beneath the uniformity that unites us in communication there is a chaotic personal diversity of connections, and, for each of us, the connections continue to evolve. No two of us learn our language alike, nor, in a sense, does any finish learning it while he lives.

§4 Ways of Learning Words

At the beginning of §3 we noted the contrast between learning sentences as wholes and building them of parts. The first ones learned are learned as wholes, we saw, some being indeed one-word sentences. As the child progresses, he tends increasingly to build his new sentences from parts; and thus it is that one usually speaks of learning a new word rather than a new sentence. But even the sophisticated learning of a new word is commonly a matter of learning it in context—hence learning, by example and analogy, the usage of sentences in which the word can occur. It therefore remained appropriate, throughout §3 and not just at the beginning of it, to treat sentences and not words as the wholes whose use is learned—though never denying that the learning of these wholes proceeds largely by an abstracting and assembling of parts. Now let us think more specifically about the parts.

What counts as a word, as against a string of two or more, is less evident than what counts as a sentence. The principles behind the printer's use of spaces are dim, and the relevance of such principles to any considerations of our own is doubly so. We might even be tempted to throw printers' precedent to the winds and call any sentence a word, on a par with 'Ouch', if it is learned as a whole rather than by building from parts. But this plan is poor; it would cause wordhood to vary capriciously from person to person and it would make wordhood for each person a function of his own forgotten infantile history. Actually no rationalization of the word will be needed here. Printers' practice, however accidental, gives the word 'word' a denotation good enough for anything that I shall have to say.

The learning of words, in this rough and ready sense of the word, partakes of a contrast correlative to that between learning sentences as wholes and building them of parts. In the case of words it is a contrast between learning a word in isolation—i.e., in effect, as a one-word sentence—and learning it contextually, or by abstraction, as a fragment of sentences learned as wholes. Prepositions, conjunctions, and many other words are bound to have been learned only contextually; we get on to using them by analogy with the ways in which they have been seen to turn up in past sentences. It is mostly just substantives, adjectives, and verbs that will occasionally have been learned in isolation. Which of them are learned thus, and which only contextually, will vary from person to person. Some, certainly, e.g. 'sake', will be learned only contextually.

The same would seem plausible for terms like 'molecule', which, unlike 'red', 'square', and 'tile', do not refer to things that can be distinctively pointed out. Such terms can, however, be inculcated also by yet a third method: description of the intended objects. This method could be grouped under the head of the contextual, but it deserves separate notice.

What makes insensible things intelligibly describable is analogy, notably the special form of analogy known as extrapolation. Thus consider molecules, which are described as smaller than anything seen. This term 'smaller' is initially meaningful to us through some manner of association with such observable contrasts as that of a bee to a bird, a gnat to a bee, or a mote of dust to a gnat. The extrapolation that leads to talk of wholly invisible particles, microbes for example, can be represented as an analogy of relation: microbes are supposed to compare in size to the motes of dust as these do to the bees. If microbes elude scrutiny, no wonder; so does the dust most of the time. Microscopes confirm the doctrine of microbes, but are not at all needed in understanding it; and the descent to yet smaller particles, molecules and others, taxes the imagination equally little.

Once we have imagined molecules with the help thus of size analogies, we bring other analogies to bear. Thus, applying dynamical terms first learned in connection with visible things, we represent molecules as moving, bumping, bouncing. Such is analogy's power to make sense of the insensible.

But analogy in the primary sense, as we might call it, relates things that are already known apart from the analogy. To say that molecules are conceived by analogy to motes or other observed particles is evidently to depart from that sense of analogy. If we locate the analogy rather in the relation of smallerness, as I have done in suggesting that the smallerness relation of molecules or microbes to motes is understood by analogy to

the observed smallerness relation of motes to gnats and the like, we still depart from analogy in the primary sense; the analogy is still not one between things (or relations) known apart from the analogy. We can, however, put the matter as an analogy also in the primary sense. What stand in this analogy are the whole observable solids on the one hand and observable swarms ordinarily so-called, e.g. of motes or gnats, on the other.

This analogy is of course very limited. A supplementary aid to appreciating the dynamics of the molecules of a solid is found in the different analogy of a stack of bedsprings. And the fact is that what one learns of molecules by analogy at all is meager. One must see the molecular doctrine at work in physical theory to get a proper notion of molecules, and this is not a matter of analogy, nor of description at all. It is a matter of learning the word contextually as a fragment of sentences which one learns to bring forth as wholes under appropriate circumstances.

In the case of some of the terms that refer or purport to refer to physical objects, the value of analogy is more limited still than in the molecular instance. Thus in the physics of light, with its notoriously mixed metaphor of wave and particle, the physicist's understanding of what he is talking about must depend almost wholly on context: on knowing when to use various sentences which speak jointly of photons and of observed phenomena of light. Such sentences are like cantilever constructions, anchored in what they say of familiar objects at the near end and supporting the recondite objects at the far end. Explanation becomes oddly reciprocal: photons are posited to help explain the phenomena, and it is those phenomena and the theory concerning them that explain what the physicist is driving at in his talk of photons.[1]

One tends to imagine that when someone propounds a theory concerning some sort of objects, our understanding of what he is saying will have two phases: first we must understand what the objects are, and second we must understand what the theory says about them. In the case of molecules two such phases are somewhat separable, thanks to the moderately good analogies which implement the first phase; yet much of our understanding of "what the objects are" awaits the second phase. In the case of the wavicles there is virtually no significant separation; our coming to under-

1. On the indirectness of the connection between theoretical terms and terms of observation see Braithwaite, *Scientific Explanation*, ch. 3; Carnap, "Methodological character of theoretical concepts"; Einstein, p. 289; Frank, ch. 16; Hempel, both works.

stand what the objects are *is* for the most part just our mastery of what the theory says about them. We do not learn first what to talk about and then what to say about it.

Picture two physicists discussing whether neutrinos have mass. Are they discussing the same objects? They agree that the physical theory which they initially share, the preneutrino theory, needs emendation in the light of an experimental result now confronting them. The one physicist is urging an emendation which involves positing a new category of particles, without mass. The other is urging an alternative emendation which involves positing a new category of particles with mass. The fact that both physicists use the word 'neutrino' is not significant. To discern two phases here, the first an agreement as to what the objects are (viz. neutrinos) and the second a disagreement as to how they are (massless or massive), is absurd.

The division between the words that are to be viewed as referring to objects of some sort, and the words that are not, is not to be drawn on grammatical lines. 'Sake' provided an extreme illustration of this point. An illustration in another vein is 'centaur'. An illustration in a third vein is 'attribute', there being philosophical disagreement over whether there are attributes. The question what there is will be scrutinized later (ch. 7). But meanwhile we see that the differences in ways of learning words cut across the grammatical differences and also across the referential ones. 'Centaur', though true of nothing, will commonly be learned by description of its purported objects. Also of course it could be learned contextually. 'Sake' can be learned only contextually. 'Tile', which does refer to objects, may be learned either in isolation as a one-word sentence, or contextually, or by description. 'Molecule', which also (let us grant) refers to objects, will be learned both contextually and by description. Similarly for 'photon' and 'neutrino', except that the descriptive factor is less than in the case of 'molecule'. 'Class' and 'attribute', finally, whether or not we grant that they refer to objects, will pretty surely be learned in context only.

§5 Evidence

Words can be learned as parts of longer sentences, and some words can be learned as one-word sentences through direct ostension of their objects. In either event, words mean only as their use in sentences is conditioned to sensory stimuli, verbal and otherwise. Any realistic theory of evidence must be inseparable from the psychology of stimulus and response, applied to sentences.

The pattern of conditioning is complex and inconstant from person to person, but there are points of general congruence: combinations of questions and non-verbal stimulations which are pretty sure to elicit an affirmative answer from anyone fit to be numbered within the relevant speech community. Johnson struck such a combination, putting himself in the way of a stimulus that would trigger an affirmative response from any of us to the question whether a stone is there.

Calling a stone a stone at close quarters is an extreme case. Evidence is deliberately marshaled only when there is more nearly an equilibrium between the sensory conditioning of an affirmative response and the contrary conditioning, mediated by the interanimation of sentences. Thus the question under deliberation may be whether something glimpsed from a moving car was a stone. That it was a stone, and that it was a crumpled paper, are two ready responses; and the tendency to the former is inhibited by the tendency to the latter, via sentential interconnections at the level of common-sense physical theory. Then one "checks," or seeks overwhelming evidence, by returning to the spot to the best of his judgment and so putting himself in the way of stimulations more firmly and directly associated with the attribution of stonehood or paperhood.

If the thing was glimpsed rather from a moving train, the checking operation may be impracticable. In this event the question may be left frankly unresolved "for lack of evidence," or, if one cares a lot, tentatively resolved in the light of any available "circumstantial evidence." Thus if the region next traversed looks boulder-strewn, and signs of man are scarce, we may guess that the thing was stone rather than paper. What we are doing when we amass and use circumstantial evidence is to let ourselves be actuated as sensitively as possible by chain stimulations as they reverberate through our theory, from present sensory stimulations, via the interanimation of sentences.

Dr. Johnson's affirmative was firmly enough conditioned to the given stimuli, among others, to withstand any contrary pull via the interanimation of sentences; but in the general case evidence is a question of center of gravity. Commonly we have to be governed by a delicate balancing of varied forces transmitted across the fabric of sentences from remotely relevant stimuli. Sometimes this is because, as in the train, strong stimuli such as Johnson's are inaccessible, or because some fairly strong one is countered by the combined pull of many lesser forces from across the fabric. And often it is because the sentence at stake is one that is understood solely through a conditioning of it to other sentences.

Prediction combines what the car example illustrates with what the train example illustrates. Thus we may reach a verdict of stonehood by the

indirect method of the train example, and still return to the spot to check. Our prediction is that the ensuing close-range stimulations will be of the sort that vigorously elicit verdicts of stonehood. Prediction is in effect the conjectural anticipation of further sensory evidence for a foregone conclusion. When a prediction comes out wrong, what we have is a divergent and troublesome sensory stimulation that tends to inhibit that once foregone conclusion, and so to extinguish the sentence-to-sentence conditionings that led to the prediction. Thus it is that theories wither when their predictions fail.

In an extreme case, the theory may consist in such firmly conditioned connections between sentences that it withstands the failure of a prediction or two. We find ourselves excusing the failure of prediction as a mistake in observation or a result of unexplained interference. The tail thus comes, in an extremity, to wag the dog.

The sifting of evidence would seem from recent remarks to be a strangely passive affair, apart from the effort to intercept helpful stimuli: we just try to be as sensitively responsive as possible to the ensuing interplay of chain stimulations. What conscious policy does one follow, then, when not simply passive toward this interanimation of sentences? Consciously the quest seems to be for the simplest story. Yet this supposed quality of simplicity is more easily sensed than described. Perhaps our vaunted sense of simplicity, or of likeliest explanation, is in many cases just a feeling of conviction attaching to the blind resultant of the interplay of chain stimulations in their various strengths.

At any rate, simplicity considerations in some sense may be said to determine even the least inquisitive observer's most casual acts of individual recognition. For he is continually having to decide, if only implicitly, whether to construe two particular encounters as repeated encounters with an identical physical object or as encounters with two distinct physical objects. And he decides in such a way as to minimize, to the best of his unconscious ability, such factors as multiplicity of objects, swiftness of interim change of quality and position, and, in general, irregularity of natural law.[1]

The deliberate scientist goes on in essentially the same way, if more adroitly; and a law of least action remains prominent among his guiding principles. Working standards of simplicity, however difficult still of formulation, figure ever more explicitly. It is part of the scientist's business to generalize or extrapolate from sample data, and so to arrive at laws

1. For a brilliant logical paradigm of this enterprise see Carnap's *Aufbau*, where he sketches what he calls the *dritte Stufe*.

covering more phenomena than have been checked; and simplicity, by his lights, is just what guides his extrapolation. Simplicity is of the essence of statistical inference. If his data are represented by points on a graph, and his law is to be represented by a curve through the points, he draws the smoothest, simplest such curve he can. He even forces the points a little bit to make it simpler, pleading inaccuracy of measurement. If he can get a still simpler curve by omitting a few of the plotted points altogether, he tries to account for them separately.

Simplicity is not a desideratum on a par with conformity to observation. Observation serves to test hypotheses after adoption; simplicity prompts their adoption for testing. Still, decisive observation is commonly long delayed or impossible; and, insofar at least, simplicity is final arbiter.

Whatever simplicity is, it is no casual hobby. As a guide of inference it is implicit in unconscious steps as well as half explicit in deliberate ones. The neurological mechanism of the drive for simplicity is undoubtedly fundamental though unknown, and its survival value overwhelming.

One incidental benefit of simplicity that can escape notice is that it tends to enhance a theory's scope—its richness in observable consequences. For, let θ be a theory, and let C be the class of all the testable consequences of θ. The theory θ will have been suggested to us by some set K of prior observations, a subclass of C. In general, the simpler θ is, the smaller the sample K of C that will have sufficed to suggest θ. To say this is just to repeat the earlier remark: that simplicity is what guides extrapolation. But the relationship can also be described in inverted form: given K, the simpler θ is, the more inclusive C will tend to be. Granted, subsequent checking on C may do away with θ; meanwhile the gain in scope is there.[2]

Simplicity also engenders good working conditions for the continued activity of the creative imagination; for, the simpler a theory, the more easily we can keep relevant considerations in mind. But another quality which is perhaps equally valuable on this score is familiarity of principle.

Familiarity of principle is what we are after when we contrive to "explain" new matters by old laws; e.g., when we devise a molecular hypothesis in order to bring the phenomena of heat, capillary attraction, and surface tension under the familiar old laws of mechanics. Familiarity of principle also figures when "unexpected observations" (i.e., ultimately, some undesirable conflict between sensory conditionings as mediated by the interanimation of sentences) prompt us to revise an old theory; the

2. On the benefits of simplicity see further Kemeny, "The use of simplicity in induction."

way in which familiarity of principle then figures is in favoring minimum revision.

The helpfulness of familiarity of principle for the continuing activity of the creative imagination is a sort of paradox. Conservatism, a favoring of the inherited or invented conceptual scheme of one's own previous work, is at once the counsel of laziness and a strategy of discovery. Note, though, the important normative difference between simplicity and conservatism. Whenever simplicity and conservatism are known to counsel opposite courses, the verdict of conscious methodology is on the side of simplicity. Conservatism is nevertheless the preponderant force, but no wonder: it can still operate when stamina and imagination fail.

Yet another principle that may be said to figure as a tacit guide of science is that of sufficient reason. A lingering trace of this venerable principle seems recognizable, at any rate, in the scientist's shunning of gratuitous singularities.[3] If he arrives at laws of dynamics that favor no one frame of reference over others that are in motion with respect to it, he forthwith regards the notion of absolute rest and hence of absolute position as untenable. This rejection is not, as one is tempted to suppose, a rejection of the empirically undefinable; empirically unexceptionable definitions of rest are ready to hand, in the arbitrary adoption of any of various specifiable frames of reference. It is a rejection of the gratuitous. This principle may, however, plausibly be subsumed under the demand for simplicity, thanks to the looseness of the latter idea.

§6 Posits and Truth

We may think of the physicist as interested in systematizing such general truths as can be said in common-sense terms about ordinary physical things. But within this medium the best he achieves is a combination θ of ill-connected theories about projectiles, temperature changes, capillary attraction, surface tension, etc. A sufficient reason for his positing extraordinary physical things, viz. molecules and subvisible groups of molecules, is that for the thus-supplemented universe he can devise a theory θ' which is simpler than θ and agrees with θ in its consequences for ordinary things. Its further consequences for his posited extraordinary things are incidental.

(As it happens, he does a bit better. Besides being simpler than θ, his θ' excels θ on the score of familiarity of underlying principles; cf. §5. Moreover, even those of its consequences that can be stated in common-sense

3. See Birkhoff, Lecture II.

terms about ordinary things exceed those of θ, and apparently without including sentences that there is reason to deny.)

If by some oracle the physicist could identify outright all the truths that can be said in common-sense terms about ordinary things, still his separation of statements about molecules into true and false would remain largely unsettled. We can imagine him partly settling that separation by what is vaguely called scientific method: by considerations of simplicity of the joint theory of ordinary things and molecules. But conceivably the truths about molecules are only partially determined by any ideal organon of scientific method *plus* all the truths that can be said in common-sense terms about ordinary things; for in general the simplest possible theory to a given purpose need not be unique.

Actually the truths that can be said even in common-sense terms about ordinary things are themselves, in turn, far in excess of any available data. The incompleteness of determination of molecular behavior by the behavior of ordinary things is hence only incidental to this more basic indeterminacy: *both* sorts of events are less than determined by our surface irritations. This remains true even if we include all past, present, and future irritations of all the far-flung surfaces of mankind, and probably even if we throw in an in fact unachieved ideal organon of scientific method besides.

Considered relative to our surface irritations, which exhaust our clues to an external world, the molecules and their extraordinary ilk are thus much on a par with the most ordinary physical objects. The positing of those extraordinary things is just a vivid analogue of the positing or acknowledging of ordinary things: vivid in that the physicist audibly posits them for recognized reasons, whereas the hypothesis of ordinary things is shrouded in prehistory. Though for the archaic and unconscious hypothesis of ordinary physical objects we can no more speak of a motive than of motives for being human or mammalian, yet in point of function and survival value it and the hypothesis of molecules are alike. So much the better, of course, for the molecules.

To call a posit a posit is not to patronize it. A posit can be unavoidable except at the cost of other no less artificial expedients. Everything to which we concede existence is a posit from the standpoint of a description of the theory-building process, and simultaneously real from the standpoint of the theory that is being built. Nor let us look down on the standpoint of the theory as make-believe; for we can never do better than occupy the standpoint of some theory or other, the best we can muster at the time.

What reality is like is the business of scientists, in the broadest sense, painstakingly to surmise; and what there is, what is real, is part of that

question. The question how we know what there is is simply part of the question, so briefly contemplated in §5, of the evidence for truth about the world. The last arbiter is so-called scientific method, however amorphous.

Scientific method was vaguely seen in §5 as a matter of being guided by sensory stimuli, a taste for simplicity in some sense, and a taste for old things. From a study of the considerable literature on scientific method, a more detailed body of canons could be brought together; though it is customary to doubt that the thing can be done finally and definitively. At any rate scientific method, whatever its details, produces theory whose connection with all possible surface irritation consists solely in scientific method itself, unsupported by ulterior controls. This is the sense in which it is the last arbiter of truth.

Peirce was tempted to define truth outright in terms of scientific method, as the ideal theory which is approached as a limit when the (supposed) canons of scientific method are used unceasingly on continuing experience.[1] But there is a lot wrong with Peirce's notion, besides its assumption of a final organon of scientific method and its appeal to an infinite process. There is a faulty use of numerical analogy in speaking of a limit of theories, since the notion of limit depends on that of "nearer than," which is defined for numbers and not for theories. And even if we by-pass such troubles by identifying truth somewhat fancifully with the ideal result of applying scientific method outright to the whole future totality of surface irritations, still there is trouble in the imputation of uniqueness ("*the* ideal result"). For, as urged two pages back, we have no reason to suppose that man's surface irritations even unto eternity admit of any one systematization that is scientifically better or simpler than all possible others. It seems likelier, if only on account of symmetries or dualities, that countless alternative theories would be tied for first place. Scientific method is the way to truth, but it affords even in principle no unique definition of truth. Any so-called pragmatic definition of truth is doomed to failure equally.

After that reflection, there may be some consolation in the following one. If there were (contrary to what we just concluded) an unknown but unique best total systematization θ of science conformable to the past, present, and future nerve-hits of mankind, so that we might define the whole truth as that unknown θ, *still* we should not thereby have defined truth for actual single sentences. We could not say, derivatively, that any single sentence S is true if it or a translation belongs to θ, for there is in general no sense in equating a sentence of a theory θ with a sentence S

1. Peirce, vol. 5, paragraph 407.

given apart from θ. Unless pretty firmly and directly conditioned to sensory stimulation, a sentence *S* is meaningless except relative to its own theory; meaningless intertheoretically.[2] This point, already pretty evident from §3 and from the parable of neutrinos in §4, will be developed in more detail in chapter 2.

It is rather when we turn back into the midst of an actually present theory, at least hypothetically accepted, that we can and do speak sensibly of this and that sentence as true. Where it makes sense to apply 'true' is to a sentence couched in the terms of a given theory and seen from within the theory, complete with its posited reality. Here there is no occasion to invoke even so much as the imaginary codification of scientific method. To say that the statement 'Brutus killed Caesar' is true, or that 'The atomic weight of sodium is 23' is true, is in effect simply to say that Brutus killed Caesar, or that the atomic weight of sodium is 23.[3] That the statements are about posited entities, are significant only in relation to a surrounding body of theory, and are justifiable only by supplementing observation with scientific method, no longer matters; for the truth attributions are made from the point of view of the same surrounding body of theory, and are in the same boat.

Have we now so far lowered our sights as to settle for a relativistic doctrine of truth—rating the statements of each theory as true for that theory, and brooking no higher criticism? Not so. The saving consideration is that we continue to take seriously our own particular aggregate science, our own particular world-theory or loose total fabric of quasi-theories, whatever it may be. Unlike Descartes, we own and use our beliefs of the moment, even in the midst of philosophizing, until by what is vaguely called scientific method we change them here and there for the better. Within our own total evolving doctrine, we can judge truth as earnestly and absolutely as can be; subject to correction, but that goes without saying.

2. Rynin, in "The dogma of logical pragmatism" (p. 390), has argued to the contrary as follows: "Unless the component statements themselves have truth-values, they can make no contributions to the truth-values of the system as a whole. . . . But if a statement is true, then it is verifiable; and if false, then falsifiable; and if either, then meaningful. . . . Not merely *could* an individual statement be meaningful outside the whole of science, but . . . it *must be* if it can function within a system of science." The middle step, on verifiability, is where my dissent comes.

3. For the classic development of this theme see "The concept of truth" in the Tarski volume.