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WORDS, CONCEPTIONS and SCIENCE [1]

by

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GUA the chimpanzee was born in captivity on 15th November, 1930, in Cuba, and when she reached the age of seven months and a half she was adopted by Mr. and Mrs. Kellogg, of Bloomington, Indiana, to become a companion to their baby Donald who had just completed the fifth month of his life. During the following nine months the two infants were brought up in exactly the same way and their development recorded by identical tests, which showed a close parallelism in the development of the two. It is true that the child, though the younger, soon took the lead over the chimpanzee and retained this throughout, but the advantage was slight compared with the child's prospective intellectual superiority which was presently to become apparent. For while at the age of fifteen to eighteen months the mental development of the chimpanzee is nearing completion that of the child is only about to start. By responding to people who talk to it, it soon begins to understand speech and to speak itself. By this one single trick in which it surpasses the animal, it acquires the capacity for sustained thought and enters on the whole cultural heritage of its ancestors.

The operational principles of language which account for the entire intellectual superiority of man over the animals seem to be twofold. The first controls the process of linguistic representation, the second the operation of symbols to assist the process of thought. It is clear that language can assist thought only to the extent to which its symbols can be reproduced, stored up, transported, re-arranged and thus pondered more easily than the things which they denote. Linguistic symbols must be serviceable to this purpose: this is, briefly, the second operational principle of language, which I have called elsewhere the law of manageability. Although both principles are involved in all the developments of articulate thought, I am dealing here primarily with implications of the first principle, and mention the second only parenthetically for systematic completeness.

The first operational principle, which governs the process of linguistic representation, can be recognized as follows. Suppose you wanted to improve a language by increasing its richness indefinitely. We can get an idea of the enormous number of printed or written words that could be formed by different combinations of letters by envisaging the fact that from an alphabet of 23 letters we could construct 23^8, i.e. about 50,000 million eight-letter code words. This should allow us to replace each different sentence ever printed in the English language by a different printed word, so that this code word (which would function as a verb) would cover what that sentence asserts. This millionfold enrichment of the English language would completely destroy it; not only because nobody could remember so many words, but for the more important reason that they would be meaningless. For the meaning of a word is formed and manifested by its repeated usage and the vast majority of our eight-letter code words would be used only once or, at any rate, too rarely to acquire and express a definite meaning. It follows that a language must be poor enough to allow the same words to be used a sufficient number of times.

It is clear that the poverty of language can fulfil its functions only if our utterances are used consistently. Consistency is an unspecifiable quality. For since the world, like a kaleidoscope, never exactly repeats any previous situation (and indeed, if it did, we would not know it, as we would have no means of telling that time had passed in between), we can achieve consistency only by identifying manifestly different situations in respect to some particular feature, and this requires a series of personal judgements. First, we must decide what variations of our experience are irrelevant to the identification of this recurrent feature, as forming no part of it. Second, we must decide what other variations should be accepted as normal changes in the appearance of this identifiable feature, or should be taken, on the contrary, to discredit this feature altogether as a recurrent element of experience. Thus consistency implies that every time we use a word for denoting something, we perform (and accredit our performance of) an act of generalization, and that correspondingly the use of such a word be taken to designate a class to which we attribute a substantial character.

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1 This is an extract from a forthcoming book called Personal Knowledge, based on Professor Polanyi's Gifford Lectures of 1951-1952.

Moreover, by being prepared to speak in our language on future occasions we anticipate its applicability to future experiences, which we expect to be identifiable in terms of the classes accredited by our language. These expectations form a theory of the universe which we keep testing continuously as we go on talking about things. So long as we feel that our language classifies things well we remain satisfied that it is right and we shall continue to accept the theory of the universe implied in our language as true.

The nature of this universal theory which we accept by using a language can be more precisely understood as follows. Of the 2,000 - 3,000 English words in common usage to-day, each occurs on the average a hundred million times in the daily intercourse of people throughout Britain and the United States. In a library of a million volumes using a vocabulary of 30,000 words the same words will recur on the average more than a million times. A particular vocabulary of nouns, adjectives, verbs and adverbs thus appears to constitute a theory of all subjects that can be talked about, in the sense of postulating that these subjects are all constituted of comparatively few recurrent features, to which the nouns, adjectives, verbs and adverbs refer. Such a theory is somewhat similar to that of chemical compounds. Chemistry alleges that the millions of different compounds are composed of a very much smaller number of persistant and identical chemical elements. Since each element has a name and characteristic symbol attached to it we can write down the composition of any compound in terms of the elements which it contains. This corresponds to writing down a sentence in the words of a certain language.

To talk about things is to apply the theory of the universe implied by our language to the particulars of which we speak. Such talk is therefore continuous with the process by which the theories of the exact sciences are brought to bear on experience. But the connection is still closer with the descriptive sciences. To classify things in terms of features for which we have names, as we do in talking about things, requires the same kind of connoisseurship as the naturalist must have for identifying specimens of plants or animals. So the art of speaking precisely by applying a rich vocabulary exactly resembles the delicate discrimination practised by the expert taxonomist. Denotation is an art, and whatever we say about things assumes our endorsement of our own skill in the practice of this art.

Last February Donald Kellog turned twenty-four. By now he may have completed his studies at a university and be on his way to become a capable doctor, lawyer or clergyman, destined perhaps to become an authority on medicine, law or theology, or even a pioneer whose greatness will only dawn on generations yet to come - while Gua the chimpanzee, his playmate and intellectual rival until the age of a year and a half, will never have got beyond the stage of intelligence which they both reached as infants. Donald has acquired all his superior knowledge by setting in motion the operational principles of language. This enabled him to profit by an education presented in terms of speech, or print and of other linguistic symbols and possibly even to enlarge this heritage of knowledge by discoveries of his own.

Knowledge acquired by education may be of various kinds. It may be medical knowledge, legal knowledge, etc., or simply the general knowledge of an educated person. We are clearly aware of the extent and special character of our knowledge, even though focally aware of hardly any of its innumerable items. Of these particulars we are aware only in terms of our mastery of the subject of which they form part. This sense of mastery is similar in kind to the inarticulate knowledge of knowing one's way about a complex topography, but its range is enhanced by the aid of verbal and other linguistic pointers, the peculiar manageability of which enables us to keep track of an immense amount of experience, and to rest assured of having access, when required, to many of its countless particulars. Consciousness of our education resides ultimately, therefore, in our conceptual powers, whether applied directly to experience or mediated by a system of linguistic references. Education is latent knowledge of which we are aware in our sense of intellectual power based on this knowledge.

The power of our conceptions lies in identifying new instances of certain things that we know. This function of our conceptual framework is akin to that of our perceptive framework, which enables us to see ever new objects as such, and to that of our appetities, which enables us to recognize ever new things as satisfying to them. It appears likewise akin to the power of practical skills, ever keyed up to meet new situations. We may comprise this whole set of faculties, our conceptions and skills, our perceptual framework and our drives, in one comprehensive power of anticipation.

Owing to the unceasing kaleidoscopic changes which at every moment manifestly renew the state of things throughout the world, our anticipations must always meet things that are to some extent novel and unprecedented. Thus we find ourselves relying jointly on our anticipations and on our capacity ever to re-adapt these to novel and unprecedented situations. This is true in the exercise of skills, in the shaping of our perception, and even in the satisfaction of appetites; every time our existing framework deals with an event anticipated by it, it has to modify itself to some extent accordingly. And it is most strikingly true of the educated mind; the capacity continually to enrich and enliven its own conceptual framework by assimilating new experience is the mark of an intelligent personality. Thus our sense of possessing intellectual control over a range of things always combines an anticipation of meeting certain things which will be novel in some unspecifiable respects, with a reliance on ourselves to interpret them successfully by appropriately modifying our framework of anticipations.

This is no truism. The oddity of our thoughts in being much deeper than we know and in disclosing their major import unexpectedly to later minds, is a token of their contact with reality. Copernicus anticipated in part the discoveries of Kepler and Newton because the rationality of his system was an intimation of a reality, incompletely revealed to his eyes. Similarly, John Dalton (and long before him the numerous precursors of his atomic theory) beheld and described the dim outline of a reality which modern atomic physics has since disclosed in precisely discernible particulars.

> . . . what the dead had no speech for, when living,
> They can tell you, being dead.

Such major feats demonstrate on a large scale the powers which I have claimed for all our conceptions, of making sense beyond any specifiable expectations in respect to unprecedented situations.

We entrust the life and guidance of our thoughts to our conceptions, because we believe that their manifest rationality is due to their being in contact with domains of reality of which they have grasped one aspect. This is why the Pygmalion at work in us when we shape a conception is ever prepared to seek guidance from his own creation; and yet in reliance on his contact with reality is ready to reshape his creation, even while he accepts its guidance. We grant authority over ourselves to the conceptions which we have accepted, because we acknowledge them as intimations - derived from our contact with reality - of an indefinite prospect of novel occasions which we may hope to master by developing these conceptions further, relying on our own judgement in its continued contact with reality.

I have shown that the educated mind relies for most of its knowledge on verbal clues. It follows then that its conceptual framework will be developed mostly by listening or speaking, and that its conceptual decisions will usually entail also a decision to understand or use words in a novel fashion. In any case, every use of language to describe experience in a kaleidoscopic world applies language to a somewhat unprecedented instance of its subject-matter, and thus somewhat modifies both the meaning of language and our conceptual framework. I implied this already when I spoke of denotation as an art.

A re-interpretation of language can take place at a number of different levels. (1) The child learning to speak practises it receptively. (2) Poets, scientists or scholars can propose linguistic innovations, and teach others to use them. (3) Reinterpretation takes place also at an intermediate level in the everyday use of language, which modifies it imperceptibly, without any conscious effort at innovation.

I shall deal with all three of these cases in turn.

(1) The first of the three levels of the re-interpretation of language is that of the child learning to speak. Its early guesswork may appear floundering and foolish to adults, but the conjectural character of linguistic usage which it reveals, is necessarily inherent in all speech and remains inherent in ours to the end. A child will point at the washing fluttering in the wind and call it 'weather', and call the pegs fastening the laundry 'small weather' and the windmill 'big weather'. Such infantile false generalizations in guessing the meaning of words are known as 'childish verbalism', but the mistakes persisting in adult life are quite similar. Few people seem to know, for example, that the common adjective 'arch' means 'cunning' or 'playfully roguish'. Even exceptionally well educated persons may tell you that it

means 'oily', 'ingratiating', or 'ironical' or 'Pretending to be aristocratic'. We have a comparatively safe knowledge of the most frequently used words, but this assured vocabulary is surrounded in our thoughts by a swarm of half-understood expressions which we hardly ever venture to use at all.

This hesitation reflects a sense of intellectual uneasiness, which induces us to grope for greater clarity and coherence. A child who uses the word 'weather' for rain, clothes, pegs and windmills has an unsatisfying and hence unstable conception of weather in which all those disparate things are amalgamated. I can still remember a puzzling conception I had as a child in which guns and luggage were fused together in view of the fact that I could not distinguish between the German words 'Gewehr' and 'Gepäck' which applied to the two respectively. Dylan Thomas tells how he fused in childhood the two meanings of 'front', designating the entrance to the house and the battlefield in France, and wondered at the curious consequences flowing from the hybridization. Rarer words like 'epicene' or 'cynosure' evoke in most of us confused and uncertain conceptions combining disjointed clues, borrowed mostly from the meaning of similarly sounding words. Scholars continue to conjecture about precisely what conceptions are covered by such Greek terms as 'arete' and 'sophrosyne'; their guesses are guided by criteria of fitness similar to those on which the child relies in its fumblings to understand speech.

(2) Confusion may prevail for a long time also in some branch of the natural sciences and be finally resolved only in conjunction with a clarification of terms. The atomic theory of chemistry was established by John Dalton in 1808 and generally accepted almost at once. Yet for about fifty years in which the theory was universally applied its meaning remained obscure. It came as a revelation to scientists when in 1858 Cannizaro distinguished precisely the three closely related conceptions of atomic weight, molecular weight and equivalent weight (weight per valence) which had been used until then in an indeterminately interchangeable manner. The appositeness of Cannizaro's interpretative framework brought new clarity and coherence into our understanding of chemistry.

As another example we may recall how during almost a century after the first appearance of Mesmer, men of science felt that they had either to accept the false claims of 'animal magnetism' or reject all the evidence in its favour as illusory or fraudulent, until at last Braid resolved the false dilemma by suggesting the new conception of 'hypnotism'. Great pioneers of hypnotism like Elliotson had fallen tragic victims to the confusion prevailing for lack of a conceptual framework in which their discoveries could be separated from specious and untenable admixtures.

Cannizaro and Braid made conceptual discoveries, which they consolidated by an improvement of language; their better understanding of their subject-matter enabled them to speak about it more appositely. Such linguistic innovation is linked in the same way to the shaping of new conceptions as the learning of an established language is linked to the acquiring of current conceptions of its subject-matter. As in the case of childish verbalism, the confusions of which I have given examples in the natural sciences, consisted in a deficiency of intellectual control, which caused uneasiness and was remediable by conceptual and linguistic reform.

When a child confuses homonyms or fuses the meanings of similarly sounding words, or when it is perplexed by verbally formulated problems, to which it has long known the answer in practice, its use of language is obscuring what had previously been clear to its tacit understanding. Such childish sophistication can be cured by teaching children to understand and use speech in accordance with their anterior inarticulate understanding of the subject-matter. Modern analytic philosophy has demonstrated that this may hold also in philosophy. Philosophic problems may sometimes be dissolved by defining the meaning of their terms in accordance with our unsophisticated understanding of their subject-matter.

But purely speculative problems are not always so fruitless. The paradox raised by Einstein as a schoolboy about the behaviour of light in a laboratory moving with the speed of light, was resolved only by his reform of the concept of simultaneity and his conjoint establishment of special relativity. Such clarification of meaning is a discovery, requiring the highest degree of originality.

(3) Language is continuously re-interpreted in its everyday use without the sharp spur of any acute problem, and some kindred questions of nomenclature are usually settled in a similarly smooth fashion in science. The general principle which governs those occasions has already been stated; I shall reassert it now as follows. In this kaleidoscopic world our anticipatory powers have always to deal with a somewhat unprecedented situation and they can do so in general only by undergoing some measure of adaptation. More particularly: since every occasion on which a word is used is in some degree different from every previous occasion, we should expect that the meaning of a word will be modified in some degree on every such occasion. For example, since no owl is exactly like any other, to say 'This is an owl', a statement which ostensibly says something about the bird in front of us, implies also something new about the term 'owl', that is, about owls in general.

This raises an awkward question. Can we safely sanction the practice of adapting the meaning of words so that what we say shall be true? If we can say of an unprecedented owl, belonging perhaps to a new species: 'This is an owl.' using this designation in an appropriately modified sense, why should we not equally well say of an owl: 'This is a sparrow' meaning a new kind of sparrow, not known so far by that name? Indeed, why should we ever say one thing rather than another, and not pick our descriptive terms at random? Or alternatively, if our terms are to be defined by conformity to their present applications, would any statement say more than 'this is this', which is clearly useless?

I shall try to answer this by an illustration from the exact sciences. When heavy hydrogen (deuterium) was discovered by Urey in 1932 it was described by him as a new isotope of hydrogen. At a discussion held by the Royal Society in 1934 the discoverer of isotopy, Frederic Soddy, objected to this on the grounds that he had originally defined the isotopes of an element as chemically inseparable from each other, and heavy hydrogen was chemically separable from light hydrogen. No attention was paid to this protest and instead a new meaning of the term 'isotope' was tacitly accepted. The new meaning allowed heavy hydrogen to be included among the isotopes of hydrogen, in spite of its unprecedented property of being chemically separable from its fellow isotopes. Thus the statement 'There exists an element deuterium which is an isotope of hydrogen' was accepted in a sense which re-defined the term isotope so that this statement, which otherwise would be false, became true. The new conception abandoned a previously accepted criterion of isotopy as superficial and relied instead only on the identity of nuclear charges in isotopes.

Our identification of deuterium as an isotope of hydrogen thus affirms two things: (1) That there exists in the case of hydrogen and deuterium an instance of a new kind of chemical separability pertaining to two elements of the same nuclear charge; (2) that these elements are to be regarded as isotopes in spite of their separability, merely on the grounds of their equal nuclear charge. The new observations referred to in (1) necessitated the conceptual and linguistic reforms decreed in (2). They rendered the linguistic rule 'all "isotopes" are chemically inseparable' untenable and compelled its replacement by a new usage reflecting the truer conception of isotopy derived from these observations. For to retain the original conception of isotopy, by which the chemical differences between light and heavy hydrogen would be classed with the chemical differences between two elements filling different places of the periodic system, would have been misleading to the point of absurdity. This demonstrates the principle which must guide us when adapting the meaning of words so that what we say shall be true: the corresponding conceptual decisions must be right - their implied allegations true.

So we call a new kind of owl an owl, rather than a sparrow, because the modification of the conception of owls by which we include the bird in question as an instance of 'owls' makes sense, while a modification of our conception of sparrows by which we would include this bird as an instance of 'sparrows' makes nonsense. The former conceptual decision is right and its implications true in the same sense in which the decision to accept deuterium and hydrogen as isotopes, in a modified sense of this term, is right and its implications true. So also in both cases, of owls and isotopes, the alternative decisions are wrong and their implications untrue. There is only this difference between the two cases: the adaptation of the isotope concept to accommodate the observations on deuterium and hydrogen can be specified in terms of an amendment to the definition of isotopy; the adaptations of a morphological concept like that of 'owl' by which it is made to include novel specimens can usually not be so specified.

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* Proc. Roy. Soc. (A), 144, 1934, 11-14.

The adaptation of our conceptions, and of the corresponding use of language to new things that we identify as new variants of known kinds of things, is achieved subsidiarily while our attention is focused on making sense of a situation in front of us. So we do this in the same way in which we keep modifying, subsidiarily, our interpretation of sensory clues merely by striving for clear and coherent perceptions, or enlarging our skills without focally knowing how, by practising them in ever new situations. The meaning of speech thus keeps changing in the act of groping for words, without our being focally aware of the change, and our gropings invest words in this manner with a fund of unspecifiable connotations. Languages are the product of man's groping for words in the process of making new conceptual decisions, to be conveyed by words.

Different languages are alternative conclusions arrived at by the secular gropings of different groups of people at different periods of history. They sustain alternative conceptual frameworks, interpreting all things that can be talked about in terms of somewhat different allegedly recurrent features. The confident use of the nouns, verbs, adjectives and adverbs, invented and endowed with meaning by a particular sequence of groping generations, expresses their particular theory of the nature of things. In learning to speak every child accepts a culture constructed on the premises of the traditional interpretation of the universe, rooted in the idiom of the group to which it was born, and every intellectual effort of the educated mind will be made within this frame of reference. Man's whole intellectual life would be thrown away should his interpretation framework be wholly false; he is rational only to the extent to which the conceptions to which he is committed are true.

Different vocabularies for the interpretation of things divide men into groups which cannot understand each other's way of seeing things and of acting upon them. For different idioms determine different patterns of possible emotions and actions. If, and only if, we believe in witches may we burn people as witches; if, and only if, we believe in God will be build churches; if we believe in master races we may exterminate Jews and Poles; if in class war we may join the Communist Party; if in guilt, we may feel remorse and punish offenders; if only in guilt-complexes we may apply psycho-analysis instead; and so on. 'Acts follow thoughts,' says the Dhammapada, as the 'wheel follows the hoof of the ox.'

Modern writers have rebelled against the power exercised by words over our thoughts and have expressed this by deprecating words as mere conventions, established for the sake of convenient communication. This is just as misleading as to say e.g. that the theory of relativity is chosen for convenience. We may properly ascribe convenience only to a minor advantage in the pursuit of a major purpose. It is nonsense, for example, to compare the convenience of interpreting sudden death in the idiom of witchcraft with the convenience of using instead a medical terminology; or to compare the convenience of describing political opponents as such, with that of calling them spies, monsters, enemies of the people, etc. Our choice of language is a matter of truth or error, of right or wrong - of life or death.

The understatement that language is a set of convenient symbols used according to the conventional rules of a 'language game' originates in the tradition of nominalism which teaches that general terms are merely names designating certain collections of objects - a doctrine which, in spite of the difficulties admittedly attached to it, is accepted to-day by most writers in England and America, in abhorrance of its metaphysical alternatives, like essences and Platonic ideas. The question how the same term can apply to a series of indeterminately variable particulars is avoided by admitting that terms may have an 'open texture', * Such open terms, however, lack any definite meaning; so the nominalist has either to refrain from enquiring how they can be applied, except arbitrarily, to experience; or, alternatively, to invoke a set of vague regulative principles - without asking on what authority these rules are to be accepted and how themselves applied, unless arbitrarily, in view of their own vagueness. All these deficiencies are overlooked in an overriding desire to avoid reference to metaphysical notions or at least to cover these up under a cloak of nominalist respectability.

I suggest that we should be more frank in facing our situation and acknowledge our faculty for recognizing real entities, the designations of which form a rational vocabulary.

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* See F. Waismann, 'Verifiability', in Flew, Logic and Language, I, Oxford, 1952, p. 117 ff.