THE PHYSIOLOGICAL BASIS OF LINGUISTIC DEVELOPMENT AND OF THE ONTOGENY OF MEANING, PART III

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V. Some General Phenomena of Language

Section 1. The Directionality of Thought

Most of us would admit, and perhaps as readily forget, that thought is movement. From some position of rest thought starts, and moves toward some other point, as if along a line. Where there is motion there must surely be line, however 'imaginary,' and direction along the line. Attraction and repulsion seem to be the chief alternative possibilities, the opposed directions, of this linear progress of thought from a starting point to some other point of rest. And language is only a symbolic record of this actual progress. The words 'Yes' and 'No,' for example, symbolically represent opposite motor attitudes of the speaker. Negation is a reversal of movement. And the difference between these two words is manifestly behavioural. The relation between these opposite directions in which thought moves, has been called by C. K. Ogden 'psychological opposition,' as distinguished from 'logical' opposition.

It has been pointed out rather frequently of late, that the Formal or Aristotelian Logic places too great reliance on grammatical forms, that is, imperfectly distinguishes between thoughts and words, thinking and wording. Certainly it tends to conceal, and in the opinion of many students it misconstrues, the actual movement of thought. We propose to present here a few cases in which the movement and directionality of thought can be readily distinguished from, or should we say *in*, the merely 'logical' pattern of words. For the more this movement and directionality are perceived, the more obvious it becomes that thought *is* action, is behaviour.

As perception is exploration and re-creation of reality, so thought is a repetition of such previous explorations, but without the reality for guidance, and therefore with much freedom as to what familiar patterns shall now be created.

Firstly, the case of opposition, mentioned above; which has been admirably brought out by Miss L. W. Lockhart [1] and by Mr. C. K. Ogden.[2] The classical view of logical opposition is fundamentally wrong. Instead of starting with the acting and reacting organism in a definite situation, logic starts with verbal abstractions, 'terms' and 'contradictory terms,' such as Black and not-Black, which it treats as immutable and mutually exclusive. And these extreme contradictory terms do not define any linear series of positions that connects them, nor do they have an intermediate point of neutrality—state of physiological rest. The terms are conceived as substantive, and as wholly discrete.

Psychological opposition, on the contrary, is not substantive but directional—determined not by the supposedly dissimilar nature of two heterogeneous substances but by the labile thought of an agent, in a definite direction. And if the logicians were not interested exclusively in barren abstractions, they would know that between any two *genuine* extremes, such as Black and White, thought can always move from a middle point of neutrality towards either extreme; that any two genuine opposites are separated by *distance*, a series of intermediate values, such as a series of Grays, and not by any such metaphysical cut, having no width, as that between X and not-X. Anywhere along this series of intermediate values one can, to be sure, more or less arbitrarily declare a cut, some point of neutrality or rest. And it is often desirable to do so. To quote from Ogden: "The passage from Concave to Convex has a zero point; the passage from Pleasure to Pain is by way of a neutral state; between the positive and negative quantities of algebra there is a zero, and this series gives us the most perfect of all symbols of opposition. Nothing, neu-

[1] L. W. Lockhart, Word economy, a study in applied linguistics, *Psyche Miniatures* (Gen. Series), 1931, no. 38.

[2] C. K. Ogden, Opposition, a linguistic and psychological analysis, *Psyche Min.* (Gen. Ser.), 1932, no. 41.

trality, and zero signify stability." [3] But there is always a passage, motion, from this zero point outward to two extremes.

Logical contradiction does not represent a real opposition. No *real* contrast is involved in the terms 'Black' and 'not-Black.' The term 'not-Black' is too all-inclusive to leave any useful contrast remaining between itself and black. As C. K. Ogden says, "All logical dichotomies are false oppositions; there is no confrontation in the contrast." [4] Writing on the same point, L. W. Lockhart says that "nothing of value has been contributed by the logicians." For, "The view that the only true contradictory or opposite is that produced by the negation of a quality, since a quality and its negation are together all-embracing and mutually exclusive, is inadequate because it leaves out of account just those very relationships which are universally held to constitute opposition. If negation is the only accredited sort of opposite, and contraries, *i.e.*, comparable but separate qualities, are all at the same level of difference, then 'white' is no more the opposite of 'black' than 'red' is, and 'north' no more the opposite of 'south' than 'south' is of 'west'; while 'not-greatest' would be the opposite of 'greatest' and 'least' would be classed without distinction of any sort among a number of other contraries such as 'greater,' 'great,' 'less'—a most unsatisfactory conclusion at which to arrive." [5]

In order to escape these absurdities of formal logic, we must accept the psychological view of opposition, that "opposites are directions or areas diagrammatized by the total stretches on either side of the cut." [6]

The following are further illustrations of the directionality of thought:

(*a*) Direction of deduction: From the proposition '*A* took poison,' inference may proceed in two opposite directions, depending on which way the thought moves—

[3] C. K. Ogden, *op. cit.*, p. 28.
[4] Idem, *op. cit.*, p. 26.
[5] L. W. Lockhart, *op. cit.*, p. 67.
[6] C. K. Ogden, *op. cit.*, p. 93.

'*A* took arsenic' implies '*A* died.'
'*A* took arsenic' implies '*A* had arsenic to take.'

The same is obvious in the case of 'logical conversion' where the subject and predicate of a logical proposition change places according as we look from S to P or in the opposite direction, from P to S. Thus:

Some S is P	Some P is S.
(convertend)	(converse)

(*b*) Directionality of thought is fundamental in that grammatical conversion known as the change from the active into the passive voice. A sentence is said to be in the active voice when the nominative of the sentence is also the agent of the activity denoted by the verb or participle. Almost all linguists agree that the active voice is the natural form of expression in all languages. The change from active into passive voice implies that a process which has been thought (explored, re-created) in one direction can also be thought through in the opposite direction. Thus, in the sentence 'Jack beat Jill,' the thought is more or less complete. But let us suppose that after suffering ill-treatment at the hands of Jack, Jill runs to her mother's arms sobbing convulsively, so that for the time being she can give no articulate information as to who has abused her. And naughty Jack has disappeared from the scene of action. The troubled mother finds that her little daughter *has suffered* a beating, but she is in the dark as to who the culprit is. Her thought is obliged to start from the sobbing Jill, 'Jill has been beaten'—. From here it tries to go on to the missing culprit, re-creating the various possibilities. When Jill is composed enough to speak the name 'Jack,' the mother can complete her thought,—'beaten by Jack.' The two 'voices' (active and passive) exist because either aspect of a negotiation may be presented first to the attention of someone who is interested to re-create the process. E. T. Owen has shown in an interesting way how the passive voice makes possible an inversion of thought, such that one may start a sentence with the person or object

which is uppermost in one's mind.[7] Here the direction along which thought moves is from the more important to the less important, from the thinker's point of view.

(*c*) The mathematical operations of addition and subtraction also bring out the directionality of thought. Adding means advancing in one direction from zero, the point of neutrality. Subtracting means proceding in the reverse direction; as Natorp has shown.[8]

(*d*) Directionality of thought is also evident in many of the ambiguities of language.

Concerning the phrase 'ancient times' Francis Bacon remarked that although it is customary so to designate the historic past, yet clearly modern times, the world being now actually much older, ought really to be regarded as the 'ancient.' In other words, there are two possible temporal directions along which thought can move. Looked at from the point of view of Adam and Eve, the present moment is hoary with years and therefore ancient; whereas the remote past looked back at from the present moment is similarly ancient, although the world was then 'young.' In such cases the direction towards which thought moves is purely arbitrary and depends upon that 'subjective reference' which is involved in all perception and meaning, and which we have discussed in Chapter III, Section 2.

The ambiguity of the words 'back' and 'front' is a similar case. The front pages of a book may be the pages that lie nearest the beginning, or the title page; and the back pages those which are towards the last page or end of the book. But when we are reading, the point of neutrality, the cut, is the page which we are now reading. The pages that we have already read are now behind us and are therefore the back pages; and the pages that we have still to read are in front of us and are therefore the front pages. Ogden writes that "*In front of* and *Behind*, which also give us the opposition of Before and After, Future and Past, are diagrammatized on

[7] E. T. Owen, The relations expressed by the passive voice, *Trans. Wisconsin Acad. Sci., Arts, and Letters*, 1910, 17.

[8] *Cf.* Chap. V, Sect. 4.

the horizontal line of right and left—in terms of the position of the body (facing either to the right or the left) and of a progress along the line; while Up and Down are primarily movements from one extreme of the vertical scale to the other." [9] A large number of verbal ambiguities are of this type.

Many words are the names of actions, and since action always has directionality, such words often acquire opposite meanings. Thus *to let* and *to rent* a house may *both* mean, either to come into the occupancy of the house by giving payment, or to give up the occupancy of a house and receive payment. The words *come* and *go* have become ambiguous through careless use, although they exist expressly to *define* the direction of motion as being towards or away from the speaker. In actual present usage this distinction is lost, and either word is used for motion in either direction.

The ambiguity of some adjectives is due to the same fundamental characteristic of directionality: *e.g.*, *invaluable*, *inestimable*, *incalculable*, (Fr.) *inappréciable*. In the sentence, 'I would not take any thing for it,' *any* may mean either *any the least* or *any the greatest*. The expression *nothing less than*, may mean either *as far as possible from* or *as near as possible to*. An historical instance of ambiguous use of *the least* is found in the following sentence from 'A Letter from the Right Hon. Edmund Burke to a Noble Lord' (1796):

> To have incurred the displeasure of the Duke of Orleans or the Duke of Bedford . . . I ought to consider as proofs, *not the least* satisfactory, that I have produced some part of the effect I proposed by my endeavors (italics ours).

We may point out that the expression *not the least* is almost always ambiguous, *e.g.*, 'I am not the least happy;' and it depends for its meaning on other factors which we have already discussed, namely, gestures, intonation, and the objective situation.

(*e*) The directionality of thought can also mislead a person

[9] C. K. Ogden, Opposition, a linguistic and psychological analysis, *Psyche Miniatures* (Gen. Ser.), 1932, no. 41, p. 90.

into a confused use of words which are themselves not ambiguous; as in the following sentence:

. . . because he worshipped Napoleon *this side* and even *beyond this side* of idolatry, he carefully preserved all the papers in his possession which bore in any degree on his master [10] (italics ours).

When this directionality of thought or behaviour is explicitly recognized, it gives rise to prepositions; *e.g.*, *to* and *fro*, *over* and *under*, *up* and *down*, *in* and *out*, and so forth. Also the grammatical comparative and superlative 'degrees' (expressed by the endings -er, -est) illustrate the same directionality of thought in ascending or descending series. The following passage from E. B. Tylor shows how in the Chinese and the Mandingo languages the formation of prepositions is based upon relations and positions which could be discovered, as it would seem, only by 'thought' moving along a dimension.

The very formation of new parts of speech may be seen going on, as where Chinese shows how prepositions may be made out of nouns or verbs. Thus 'kuo *chung*,' that is 'kingdom *middle*,' is used to mean 'in the kingdom,' and 'sha jin *i* thing,' that is, 'kill man *use* stick,' expresses 'to kill a man *with* a stick.' So an African language, the Mandingo, may be caught in the act of making prepositions out of the nouns *kang*, 'neck,' and *kono*, 'belly,' when they say 'put table *neck*,' for '*on* the table,' and 'house *belly*' for '*in* the house.' [11]

Section 2. Syntax

It is only when we consider language as a part of the behaviour of man or woman responding in and to an environment, that most of the peculiarities of language can be understood. "Language in its structure," says Malinowski, "mirrors the real categories derived from practical attitudes of the child and of the primitive or natural man to the surrounding world." [12] And Jespersen remarks "that language is not exactly what a one-sided occupation with dictionaries and

[10] F. Schevill, *The New Republic*, Feb. 24, 1926, p. 26.

[11] E. B. Tylor, Anthropology, 1881, Chap. V.

[12] B. Malinowski, Appendix to The meaning of meaning, by C. K. Ogden and I A. Richards, 1923, p. 497.

the usual grammars might lead us to think, but a set of habits, of habitual actions, and that each word and each sentence spoken is a complex action on the part of the speaker. The greater part of these actions are determined by what he has done previously in similar situations." [13] All this is pre-ëminently true in the case of syntax. For the order of ideas in a sentence is manifestly very much determined by the order of objects spoken of, in space, or of the events spoken of, in time. In the light of this fact a sentence may be regarded primarily as a report of a journey of exploration in space, or of observed sequence of events in time. This is specially obvious in the grammatically crude word-sequences of children and of savages. It is a familiar fact to any one who has observed the speech and behaviour of children in a definite objective situation, that a child speaks of objects in the order in which he comes to them in thought or in actual perception; as was shown in the sentence previously quoted from Jespersen's record of a child "who saw his father give corn to the hens out of his cap": "Papa hen corn cap." [14] Clara and William Stern observe that "A transcription on paper [of a child's first word-sentences] fails to render adequately one regular characteristic: that is, his intermittent blurting out of the single words, with intervening pauses." [15]

More graphically is this fact about thought exhibited in those ancient pictographic or hieroglyphic representations in which the march of thought has been preserved for us in the form of a pictorial record. Thus the drawing, *A*, on the following page, represents the picture-writing used by the hunting tribes of North America. "It records an expedition across Lake Superior, led by a chief who is shown on horseback with his magical drumstick in his hand. There were in all fifty-one men in five canoes, the first of them being led by the chief's ally, whose name, Kishkemunazee, that is, Kingfisher, is shown by the drawing of this bird. Their reaching the other side seems to be shown by the land-tortoise, the well-known emblem of land, while by the picture of three suns under the

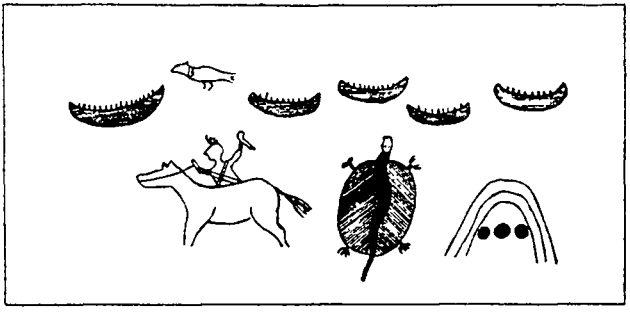
[13] O. Jespersen, The philosophy of grammar, 1924, p. 29.

[14] O. Jespersen, Language, its nature, development and origin, 1921, p. 135.

[15] C. and W. Stern, Die Kindersprache, 1907, p. 182.

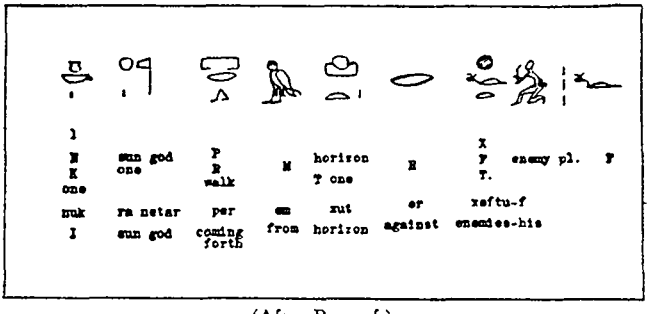
sky it is recorded that the crossing took three days." [16] The order of this picture-sentence is essentially determined by the order in which various objects confronted the writer as he recalled the details of the expedition.

A



Picture-writing, rock near Lake Superior (after Schoolcraft).

B



(After Renouf)

Two examples of picture-writing. From Sir E. B. Tylor, Anthropology.

Drawing *B* is a specimen of a short hieroglyphic sentence. It illustrates the same fundamental principle at a higher level of pictorial abstraction. It means, 'I (am) the Sun-god coming forth from the horizon against his enemies.' Concerning this record Sir E. B. Tylor writes:

Here part of the pictures of animals and things are letters to be read into Egyptian words, as shown underneath. But others are still real pictures, intended to stand for what they represent. The sun is shown by his picture, with a one-mark below, and followed by

[16] E. B. Tylor, Anthropology, 1881, Chap. VII.

the battle-axe which is the symbol of divinity, while further on comes a picture of the horizon with the sun on it. Beside these, some of the figures are determinative pictures to explain the words, the verb to walk being followed by an explanatory pair of legs, and the word enemy having the picture of an enemy after it, and then three strokes, the sign of plurality.[17]

That is, the order in which the thought of the writer moves is the order in which things and objects are encountered in space or time.

Nevertheless, a thinker jumps and pauses; he may move to and fro; he is apt to return most often to some favoured object, and there pause longer. The priority of important items becomes noticeable in the syntactic structure; a point to which reference was made in the preceding Section, in connection with the passive voice. The important item is the station at which thought in its journey pauses the longest. Those who recall the context of the Biblical sentence, 'Great is Diana of the Ephesians,' will agree that the statement, 'Diana of the Ephesians is great,' would not be an adequate substitute. For it was the 'greatness' of Diana which was challenged, and it was her 'greatness' that was foremost in the mind of the speaker. It must therefore occupy first place in the syntactic order.

What we have said in this Section about the movement of thought has been more fully expounded and illustrated by Ernst Mach, specially in his discussions of the 'Gedanken-experiment.'[18] Not merely the order of words in a sentence but, as Mach has so well shown, the sequence of ideas in any process of *reasoning* represents a sort of journey which the reasoner makes as he explores (by re-creative responses) the field of his discourse.

Section 3. Synecdoche, Metonymy, Metaphor

Synecdoche, according to the French lexicographer Darmesteter,[19] is a change in the meaning of a word (a trope)

[17] *Ibid.*

[18] E. Mach, Erkenntnis und Irrtum (4th edition), 1920, pp. 41–42, 171–173, 183–200.

[19] A. Darmesteter, La vie des mots, 1925, pp 46–48.

whereby the extension of that meaning is increased or diminished. The name of a whole may be used for the part; the *State* has decided, for *Mussolini* has decided: of a part may be used for the whole; fifty *head(s)*, for fifty *cows*: of a genus for the species; the succulent *bivalve*, for *oyster*: of a species for the genus; *cutthroats*, for *murderers* of any description: etc.

Metonymy is a trope, very imperfectly distinguished from the foregoing, whereby the name of a cause is used as a name for the effect; a *work* of art: of an effect for the cause; *stronghold*, for *fort*: of container or covering for the contained; the *cloth*, for the *clergy*: etc.

It is clear that all the phenomena of synecdoche and metonymy depend merely on the association of ideas; and it was shown long since in psychology that all association of ideas is reducible to association by contiguity. "The various changes in meaning," says P. Giles, "which are classed together as synecdoche, have their origin in contiguity." [20] The physiological basis of this association has now been found to be the conditioned reflex of Pavlov. And thus the linguistic phenomena of synecdoche and of metonymy are precisely what, from our physiological point of view, we should expect to find.

For illustration let us consider the trope whereby 'the clergy' come to be called 'the cloth.' It is to be noted that any individual clergyman is much more than that name indicates; he may be also a father, a scholar, etc. So that the very name 'clergyman' designates the man by only one of his aspects. The name is suitable because it *connotes* membership in a certain profession, and in social use can (as could any other word) be conditioned to denote the actual members of that profession. In social contact with clerics their black garb (cloth) is a conspicuous accompanying stimulus, so that it as stimulus will suffice to call up (cause one to re-create) whatever one knows about clerics. And vice versa, any other of their qualities with which one has become acquainted, as stimulus, will call up a re-creation of the black cloth. Inevitably 'cloth' will function satisfactorily as a name for

[20] P. Giles, Philology, *Encyclopaedia Britannica* (10th edition), 1902, 31, p. 678.

members of the profession; and inevitably it will occur to persons to use that name. Such names as Black Friar, Gray Friar, White Friar, White Cap, Capuchin, Red Coat, moss rose, bluebird, and thousands of others originated in the same way.

Metaphor, Darmesteter[21] says, is a figure of speech in which 'the mind' applies the name of one object to some other object, by reason of some character which the two objects have in common; as, *leaf* of a tree, *leaf* of paper, *leaf* of a door or table, etc. It is clear that metaphor, and for that matter analogy also, are psychologically in no respect different from synecdoche and metonymy. As were these, so are they explained by (Pavlovian) association.

"Every substantive," Darmesteter says, "at first designates an object by a particular quality which characterizes it."[22] "The name has not the function of *defining* the object, but only of evoking an image of it."[23] "In short, every substantive commences with designating an object by one of its qualities; it is then adjectival; later, it arouses a *total* image of the object, and is then a substantive."[24] Thus in ancient Latium a river was something *quod fluit*, and so acquired the name *fluvius*. In the Italy of a later period a warrior was *soldato* (paid), and so we today call him a *soldier*.

So far as substantives are formed in the way described by Darmesteter, from descriptive words or phrases, the process differs in no essential way from the phenomena of association which we have discussed above. Onomatopoetic nouns (bow-wow, etc.), on the other hand, are formed by an even more direct action of the conditioned reflex principle; as we have explained in Chap. IV, Sect. 2. Darmesteter further states that the three tropes, synecdoche, metonymy, and metaphor, "include, in their multiplicity, nearly all of the changes which take place in the meanings [of words]."[25] This is by no means surprising in view of the prominent part which

[21] A. Darmesteter, *op. cit.*, p. 51.
[22] *Ibid.*, p. 40.
[23] *Ibid.*, p. 43.
[24] *Ibid.*, p. 45.
[25] A. Darmesteter, *op. cit.*, p. 46.

metaphor plays in all human thinking; as has been shown by Mauthner and others.[26]

It seems certain that the physiological principle of the conditioned reflex plays the important part in the whole process of establishing and developing the meanings of words.

Section 4. Motor Re-Creation in the Case of 'Abstract Ideas'

Words are symbols which represent specific motor responses of an agent (speaker or writer) in a definite objective situation; and which, in so far as they convey right meaning, arouse in another agent (listener or reader) similar motor responses. Those who attempt to study them as an isolated phenomenon, divorced from the other motor responses of the agent and from the objective situation which evokes them, have ignored this fact. According to these latter, words are static and mysterious entities, having an independent and quasi-metaphysical existence. This superstition is widespread. Thus Walt Whitman said that "All words are spiritual, nothing is more spiritual than words. Whence are they? Along how many thousands and tens of thousands of years have they come?"[27] The remark is nothing more than a confession of ignorance. From the physiological point of view which we have presented, there is nothing mysterious about the origin of words.

In his 'Essay concerning Human Understanding' (1690) Locke showed that even abstract and general ideas are derived from concrete objects. "And he that thinks *general natures* or *notions* are anything else but such abstract and partial ideas of more complex ones, taken at first from particular existences, will I fear, be at a loss where to find them. For let any one reflect, and then tell me, wherein does his idea of *man* differ from that of *Peter* and *Paul*, or his idea of *horse* from that of *Bucephalus*, but in the leaving out of something that is peculiar to each individual, and retaining so much of those particular complex ideas of several particular existences as they are found to agree in? . . . To conclude: this whole

[26] F. Mauthner, Beiträge zu einer Kritik der Sprache.

[27] Quoted from C. K. Ogden, and I. A. Richards, The meaning of meaning, 1923, p. 32.

mystery of genera and species, which make such a noise in the schools, and are with justice so little regarded out of them, is nothing else but *abstract ideas*, more or less comprehensive, with names annexed to them. In all which this is constant and unvariable, That every more general term stands for such an idea, and is but a part of any of those contained under it." [28] Thus any abstract or general idea is an actually *simpler* motor re-creation than is any one of the particular ideas (objects) included under it.

We should, then, expect that the *name* or *word* for any abstract or general idea, would also be derived from a concrete and particular source. And this we find to be the case. As Locke remarks, "*Spirit*, in its primary signification, is breath; *angel*, a messenger: and I doubt not but, if we could trace them to their sources, we should find, in all languages, the names which stand for things that fall not under our senses to have had their first rise from sensible ideas." [29] This doctrine was illustrated in the most copious way by the learned French philologist, de Brosses [30]; and by the latter half of the nineteenth century it had become an accepted commonplace of linguists that all 'immaterial' words are metaphors from the names of concrete objects or actions.[31]

That verbs, the names for 'mental' actions and abstract processes, derive from concrete and very generally behaviouristic sources suggests even more forcibly than does the parallel derivation of nouns, that 'mental' activity is indeed muscular activity. Locke himself had remarked that those words "which are made use of to stand for actions and notions quite removed from sense, have their rise from thence, and from obvious sensible ideas are transferred to more abstruse significations, and made to stand for ideas that come not under the cognizance of our senses; e.g. to *imagine*, *apprehend*,

[28] J. Locke, Essay concerning human understanding, 1690, Book III, Chap III, § 9.

[29] *Ibid.*, Book III, Chap. I, § 5.

[30] C. de Brosses, *Traité de la formation méchanique des langues* (Paris), 1765, Vol. II, Chapters X, XII.

[31] F. Max Müller, New lessons on the science of language, 1867–8, Vol. II, Lesson 8.

comprehend, *adhere*, *conceive*, *instil*, *disgust*, *disturbance*, *tranquillity*, etc. are all words taken from the operations of sensible things, and applied to certain modes of thinking.[32] de Brosses showed, among his many examples, that to *admire*, *contemplate*, *consider*, *desire*, and *admonish*, are all attenuated forms or partial aspects of ('metaphors' for) what our remote ancestors *did* when they gazed at the sun, the moon, the stars, or the open sky.[33]

In a recent paper R. C. Givler writes:

> Our word *pugnacity* is derived from the Latin *pugna*, a fist, that is, a tightly closed fist, a fully functioned grasping reflex. . . . There are other kinds of violent behaviour which are strictly dependent upon the integrity and development of this same simple response. Our language points to them by such terms as *grabbing* and *snatching*, *wringing from* and *tearing away*, *scrambling for* and *pouncing upon*, and *snatching from* one's grasp; while *wresting from*, *laying violent hands upon*, and other forms of *rapacity* are equally served by this flexion mechanism. Since, also, the grasping reflex is the preliminary step in the making of twisting or torsional arm movements, the *extortioner* and the *grasping miser*, the beggar with the *itching palm*, and the *close*, *hard*, or *tight-fisted miser* may be mentioned in this same catalogue of derivatives.[34]

Still more recently David Katz has shown that words which originally designated motions of the hands and arms have become, in a similar way in the German language, the names for many of the most abstract intellectual processes; as in the case of *begreifen* and other derivatives of *Griff* (= grasp).[35]

Perhaps no linguistic symbols are more abstract, no 'ideas' more abstract and elusive, than those which belong to the field of mathematics. Yet precisely here our work of physiological interpretation has already been done for us. The Neo-Kantian philosopher, Paul Natorp,[36] has shown that the

[32] J. Locke, *op. cit.*, Book III, Chap. I, § 5.

[33] C. de Brosses, *op. cit.*, Vol. II, pp. 241–251.

[34] R. C. Givler, The intellectual significance of the grasping reflex, *J. Phil.*, 1921, 18, p. 624.

[35] D. Katz, Der Aufbau der Tastwelt, *Zch. f. Psychol.*, 1925, *Erg.* 11, pp. 251–254.

[36] P. Natorp, Die logischen Grundlagen der exakten Wissenschaften, 1910, pp. 98–265.

number system is a series of definite 'Denktätigkeiten' (thought activities). According to him, the number 3 means 'three pulsations of thought,' and to count means to think one step or 'pulsation' for each object counted. In such terms Natorp has interpreted and explained all numbers (including the imaginary and the unreal), all arithmetical operations, and many more advanced numerical operations. Natorp stands by no means alone, for serious students of the philosophy of mathematics generally accept the view that every mathematical operation is a movement of 'thought,' and that all mathematical symbols, including the numerals, are 'rules of procedure,' that is, directions to do something.

These philosophers are not psychologists, and are content to rest with 'thought' and 'pulsations of thought.' Being almost without exception idealists, if not Kantians, they are not interested in discovering that a 'pulsation of thought' is a pulsation of muscle; although they can hardly escape this conclusion if they will read any anthropologist's account of the origin of number and of arithmetical operations. In the light of this evidence from anthropology, Holt writes that anyone who counts

> . . . has by his movement reproduced one aspect, a meagre and yet a true one, of the configuration of his environment. And we know this to be, in the case of counting, extremely simple. Under the conditions of sensory stimulation and response, the hand or eye easily and naturally comes to rest on an object, then moves on to another and pauses, then alights on another, and so on. And this is the counting process as we see it in children and in untutored persons. A sophisticated adult can count less overtly, more economically; the process can be telescoped and abridged in several ways; overt movements of the arm or finger or eye can be replaced by unseen movements of the tongue or throat or even by successive throbs or mere play of tonus in some muscle or muscle group. But there is no reason to believe that the act of counting, which in the learning is a succession of sensori-motor responses to objects in the environment, ever so utterly changes its nature as to cease to be a sensori-motor process. In fact we know with almost complete certainty that it does not. And when counting is not the counting of outer objects, but the apprehension of the meaning of a written

or spoken number symbol, it is a chain reflex of a definite length, which is now released by the visible or audible number symbol as a stimulus.[37]

Philippe Chaslin says, quoting Ribot, that in the acquisition of ideas of number "both the child and the savage count by pronouncing the words [number-names] 'but above all with the assistance of the objects counted which are perceived at the same time—or else, with the assistance of the fingers; which latter case is a first effort at substitution' [*i.e.* fingers for the objects counted]." [38] And so we could go on to explain mathematical operations in physiological and behavioural terms. But Chaslin has done this, and we would here refer the reader to his very interesting work.

The concept of 'muscular throb or play of tonus' is not a fanciful hypothesis. It has been familiar to psychologists ever since Alexander Bain wrote his two great works. And it has been repeatedly demonstrated experimentally. Most recently of all, Edmund Jacobson, by means of a highly refined technique for studying action-currents, has demonstrated the presence of such currents in the muscles of speech whenever words or numbers are 'thought' of. He reports:

When the electrodes are connected in the speech musculature of the trained subject, the string shadow is practically quiet during relaxation. But promptly after the signal is sounded to engage in mental activity involving words or numbers, marked vibrations appear, indicating action-potentials. Soon after the subject hears the signal to relax any muscular tensions present, the vibrations cease, and the string returns to rest [39] (italics in original).

Section 5. Moods

Perhaps no feature of language reveals the part played by physiological processes more unmistakably than the phenomenon which grammarians call 'mood.' For, other than the

[37] E. B. Holt, On the conceptual affinity of opposites (Unpublished). Quoted by permission of the author.

[38] P. Chaslin, Essai sur le mécanisme psychologique des opérations de la mathématique pure, 1926, p. 11.

[39] E. Jacobson, Electrical measurements of neuromuscular states during mental activities, VII., *Amer. J. Physiol.*, 1931, 97, p. 205.

bodily attitude and action of the speaker, that which we have termed 'subjective content,' there *is* no 'mood.' Frank Lorimer writes:

> Mood is fundamentally a matter of the relation of a symbolic process to other phases of activity. The declarative sentence is typically a relatively consummatory, deliberate symbolic process—although, as the name implies, it has characteristically a social motive—and this is usually far more complex than a desire to impart information. The interrogatory and subjunctive moods are characterized by uncertainty and irresolution, in various degrees, to the end. This is frequently indicated by the sustained pitch of the voice. The imperative mood, whether addressed to another, or used in 'bracing oneself' for action or directing the course of one's movements, is incidentally characterized by omitting the subject (which is usually obvious to all concerned) because the focal tension is centered in the intentional pattern of the expected consequent behaviour; it is typically concerned with supplying cues for action, rather than in providing elaborate or unambiguous statements of situations. Thus a man playing golf may mutter to himself, 'Up a little, steady, shoot, damn! not so high next time.' [40]

In general, mood is but imperfectly expressed by the symbols of language. In English speech, for instance, the interrogative, exclamatory, hortative, imperative and other moods depend for their conveyance so much more on intonation and gesture than on inflection, syntax, or diction, that grammarians are left in doubt as to how many *de facto* 'moods' should be officially recognized in text-books. Has English, for instance, conditional, potential, and conjunctive moods in addition to the subjunctive? And it is probably not too much to say that in spoken English any grammatical sentence whatsoever can be put into any "mood" merely by suitable intonation and gesture.

Mood *is* behaviour, motor attitude. It is concerned not with what a man says in words, but with what he is doing, or preparing to do, in connection with what he says. Such accompanying attitudes are innumerable, and it is not surprising that only the most common of them are expressed by

[40] F. Lorimer, The growth of reason, 1929, p. 107.

systematic inflectional forms, that the number recognized is very different in different languages, or that the minor devices for indicating mood are so various. Some of these devices are: a prefix or suffix to the verb, a modification of the verb-form, an auxiliary verb (as Eng. *may*, *can*, *will*), a particle (as Eng. *if*), a particular word-order (as in the interrogative mood), a mere punctuation-mark (exclamation- and interrogation-points), etc. It has been said that the languages of the world, taken together, exhibit some fifty different 'moods.' Few persons will deny that the Greek optative, the *wish* mood, represents an attitude of the speaker. But even the indicative, that admirable mood which is so nearly purged of any personal element, is after all a chastened form of the vocative mood, and must forever remain the 'mood' of one who *indicates* or points out something.

It is with a view to demonstrating the general validity of the physiological (stimulus-response) method which we have adopted in treating the origin of sounds and meaning, that we have, in this concluding Chapter, sketched, very briefly, a few of the applications of this method to more advanced linguistic problems. It is our firm conviction that all the complicated problems of language, so elaborately and sometimes arbitrarily treated of by a great many philologists and grammarians, can be ultimately, and most adequately, solved on the basis of a thorough-going physiological explanation.

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