Two Theories of Meaning:
The Two Factor Dispositional/Relational And The Single Factor Relational[1]

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1. The Two Factor Dispositional/Relational Theory of Meaning

Theories of meaning are of two kinds, two-factor *dispositional/relational* theories and single factor *relational* theories. A two-factor dispositional/relational theory of meaning holds that the word 'meaning' has two senses: a primary and fundamental sense in which meaning is a *disposition* and a secondary and derivative sense in which meaning is a *relation*.

(a) In the primary or *dispositional* sense, the meaning of a linguistic expression, such as a phrase or sentence, is a *disposition*, shared by relevantly competent speakers and interpreters of a particular natural language or technical code, to apply certain *criteria* (which they need not be able to state) in deciding whether or not a particular they encounter is either an *instance* to which, in the case of a *general term* or universally quantified sentence, the expression *applies* or, in the case of a *singular term* or singularly quantified sentence, the individual to which it *refers*.

(b) In the secondary or *relational* sense, the meaning of a linguistic expression is the actual individuals assigned, by the application of those criteria, to the *extension* of a general term or universally quantified sentence or the actual individual *referred to* by a singular term or singularly quantified sentence when uttered on a particular occasion, as determined by the criteria.

In contrasting the dispositional and relational senses of the term 'meaning', I am assuming the thesis of a recently published paper entitled 'Intentionality as the mark of the dispositional' (Place 1996) in which I argue that intentionality, in the sense that Brentano (1874/1995) uses that term, is the mark, not as Brentano himself thought, the mark of the mental; it is the mark of the dispositional. I am also relying on Brentano's (1995, pp. 271-2) observation that intentionality (and hence, if I am right, dispositionality) is not a relation, because the intentional object (the range of possible future manifestations of the disposition) does not yet exist and may never do so.

The distinction between meaning in the dispositional and meaning in the relational sense is the same as the distinction drawn by the logicians of the Port Royal (Arnauld and Nicole 1662) between the "comprehension" and "extension" of a general term, by John Stuart Mill (1843) between what a term "connotes" and what it "denotes", by Sir William Hamilton (1860) between the "intension" and "extension" of a general term, and by Frege (1892/1960) between the sense ("*Sinn*") and reference ("*Bedeutung*") of a singular term. In all these cases it is assumed that there can be no extension without comprehension, no denotation without connotation, no extension without intension and no reference (*Bedeutung*) without sense (*Sinn*).

Subscribing to the two-factor theory of meaning entails endorsing the reality of the distinction between analytic and synthetic propositions and, what amounts to the same thing, endorsing the analysis of necessary and contingent truth in terms of what it is and is not self-contradictory to deny. On this view an analytic or necessarily true proposition is one in which the criteria for assigning particulars to one of the proposition's constituent terms are such that they are included in, embrace or coincide with those for assigning particulars to the other term or terms. Since it takes meaning in the dispositional sense as primary, the two-factor theory is incompatible both with the view that a purely extensional logic, such as standard predicate logic, is the foundation of natural language and with the view that it must or, indeed, could be the

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foundation for the language of science. However, if, as I have suggested, meaning in the dispositional sense is interpreted as a matter of the conventions observed by speakers of a particular natural language, it follows that what is analytically and necessarily true is not something set in concrete for all time. It is a matter of current convention which may well change as language evolves. To use Quine's (1951/1980) example, the statement 'All bachelors are unmarried males of marriageable age' is an analytic truth only when uttered in particular social contexts, such as reading the banns of marriage in an Anglican parish church.

2. The Single Factor Relational Theory of Meaning and its Motivation in Logic

A single factor or relational theory of meaning (Barwise and Perry 1983) recognises only one sense of the term meaning, one in which the meaning of a general term is the class of actually existing entities that fall under it, while the meaning of a singular term is the actual individual to which or to whom it refers. Dispositional notions such as 'comprehension', 'connotation', 'intension' and 'sense' drop out. The extension and reference of sentences as distinct from that of their terms is not usually discussed.

The motivation for preferring a single factor relational theory of meaning comes from *logic* and in particular from the fact that, in order to yield interesting proofs, predicate logic has to be extensional in the sense that the only singular quantifier recognised within it is existential. Predicate logic leaves no room, not only for the intension/extension and sense/reference distinctions, but, more conspicuously, for Kant's distinction between propositions that are *analytic* and those that are *synthetic* (Quine 1951/1980) or for the Leibnizian analysis of what is *necessarily* and *contingently* true in terms of what it is and is not self-contradictory to deny (Kripke 1972; 1980).

In the latter case there is an additional reason for rejecting the distinction which derives from Kripke's observation that interesting proofs in modal logic cannot be generated without the axiom

'The proposition "*p* is necessary" is itself necessary'

or formally

'$\Box p \rightarrow \Box\Box p$'

This axiom is inconsistent with the Leibnizian account of the necessity/contingency distinction, since on that view the proposition '*p* is necessary' becomes a contingent metalinguistic proposition about the effect of the semantic and syntactic conventions governing sentences that express *p*. Consequently, in order to obtain the axiom which makes '*p* is necessary' itself necessary, Kripke has to give an alternative account of the necessity/contingency distinction which he does in terms of what is and is not true in all possible worlds.

3. Psychology and the Motivation for the Two Factor Theory

The motivation for retaining the two-factor theory in which extension and reference depend on the classificatory dispositions of the speakers and interpreters of a particular natural language comes from *psychology*. For it falls to psychology to explain how it comes about that human beings are able to identify both the referents of singular terms, to an extent, regardless of the circumstances under which those individuals are encountered, as well as instances to which a given general term applies, regardless of what other descriptions may apply to them. Not only is it evident that without that ability language would be impossible. It is also clear that having it is an essential ingredient in what is meant by saying of someone that they *know the meanings of* the words and expressions in question.

Knowing the meaning of a word in this sense is not just a matter of being able to associate a singular term with a particular referent on a particular occasion in the past or a general term with one or more particular instances of it. It is a matter of being able to identify the referent of a singular term or an instance to which a general term applies, *if at any time in the future* such an object is encountered. In other words, knowing the meaning of a word or expression is a matter of knowing the meaning, not just in the relational sense in which it is restricted to actual past and present encounters with such objects, but in the dispositional sense in which it is open to what may or may not happen in the future. It is a matter of knowing the *sense* of a singular term and the *intension* of a general term, where sense determines reference and intension determines extension, and where reference cannot be identified without sense or extension without intension. Someone who combines the relational theory of meaning with a belief in abstract universals would no doubt argue that we must distinguish between the real universal that a word or expression designates and

the individual speaker's often inaccurate concept of that universal, and that it is the relation between the word and the abstract universal which it designates, not the individual's concept, that is its *real* meaning, when viewed *sub specie aeternitatis*.

But how, you may ask, does an individual tell whether her concept corresponds to the relevant universal? Since, as everyone agrees, all we ever perceive of a universal is its instances, it would seem that the only things that tell us when we are right and when we are wrong are the response of others to what we say and to our response to what they say. If that is right, why not concede that there is nothing more to a linguistic universal beyond the error-correcting practices of a linguistic community and the uniformities they generate in the way words are used within them. Even if you believe, as Kripke appears to do, that the way words are used within a linguistic community are the product of an inborn faculty of intuition which guides us infallibly to the objects our rigid designators designate, we are still dealing with a dispositional property of the language user which has application, not only to the actual past and present, but also to a range of possible futures none of which need actually come about. To describe these possible futures as a set of possible worlds, as Kripke's analysis suggests we should, looks somewhat implausible once we realise that for *any* disposition the number of possible future and counterfactual past manifestations is indefinitely, if not infinitely large. But where logic and metaphysics are the order of the day, such considerations of scientific plausibility are given short shrift.

4. Case Study 1: Water is H_2O

A well known example of the application of the single factor relational theory of meaning which can be used to bring out the differences between the two theories is Putnam's (1975) Twin Earth fantasy in which everything on Twin-Earth is as it is on earth except for the fact that what is called 'water' on Twin-Earth has the chemical composition XYZ instead of the chemical composition H_2O which it has on Earth. On a single factor theory, because the term 'water' has a different set of referents on Twin-Earth from those it has on Earth, it has a different meaning in the two cases. The fact that the criteria that are used by the man or woman in the street for distinguishing cases of water from other things are the same on Twin Earth as they are on Earth is irrelevant. On a two-factor theory, by contrast, the criteria that are used to distinguish water from other things are the very essence of the meaning of the word 'water'. On this view it is only in so far as the chemical composition of a putative sample of water is used as a criterion for deciding whether or not it really *is* water that the chemical composition becomes part of the dispositional meaning of the word. On this view it is only for Twin-Earth scientists that 'water' means something different on Twin Earth than it does on Earth.

A very different account is given of the history of a concept such as 'water' on the two theories. On the single factor theory the meaning of the word 'water' has remained the same ever since the stuff in question was "baptized" something like **woda* by speakers of an ancestral form of the Indo-European group of languages in the dim and distant past. All that has happened since is that scientists have now identified the "real essence" of the stuff that bears that name in the shape of its chemical composition, H_2O.

On the two factor theory a very different story is told. Here the intension or dispositional meaning of the term 'water' is subject to constant change, not only as the criteria for distinguishing water from non-water change with advances in scientific knowledge, but as the context of utterance changes. In scientific contexts, ice and steam are included within the concept of water. In other contexts only the liquid form is included. Where water is something you drink solutions such as sea water or wine are excluded, and so on.

In the case of the changes of dispositional meaning that occur as a consequence of advances in scientific knowledge, a remarkable transformation occurs in the status of type-identity statements such as 'Water is H_2O'. When first formulated, statements of this type are contingent and synthetic. They are scientific hypotheses which are open to confirmation or disconfirmation by the way the empirical evidence pans out. But, once it becomes accepted that tests of the hypothesis invariably confirm it, the status of the proposition changes. It becomes analytic and, in the Leibnizian sense, a necessary truth. This happens at the point where the scientific description begins to be used as a criterion for the application of the common sense expression. Consider what happens when it is discovered that something that by other criteria would be classified as water does not have the chemical composition H_2O. When 'Water = H_2O' was still a matter of hypothesis, such a case would have been evidence suggesting that the hypothesis is false; but once the

type-identity becomes a matter of established fact, it is treated as evidence that the sample in question is not water, 'Water is H_2O' has become an analytic and necessary truth.

5. Case Study 2: Ohm's Law

Another example is Ohm's Law.

Those of my friends who know much more physics than I do tell me that Ohm's Law in its classical form is only approximately true. If they are right, Ohm's Law in this form cannot be, as I think, an analytic truth. To appreciate the case for the view that Ohm's Law is analytic, we need to look behind the mathematical formula and recognise that what the formula describes is a causal relation between, on the one hand, the magnitude of two dispositional properties of a conductor, the potential difference (E) between its two ends and its resistance (R), and, on the other, their combined effect or joint manifestation, the magnitude of the electrical current that flows along it. In other words, the form of the law which most accurately depicts the causal relation involved is

$$I \quad \frac{E}{R}$$

The case for thinking that this formulation of Ohm's Law is an analytic truth can be traced back to Wittgenstein's fantasy in the Brown Book (Wittgenstein 1958 pp. 100-1) of a people in whose language the dispositional adjectives 'hard' and 'soft' are replaced by descriptions of what *can* happen based on the results of tests e.g. of the ease with which a stick can be bent. The implication of this "language game" is that to ascribe a dispositional property to something is to say something about how the property-bearer *could* or *would* behave, if at any time so long as the disposition persists certain conditions were to be fulfilled, the conditions which *are* fulfilled when a test or measurement of the disposition is arranged. Moreover, in so far as there is nothing that the speakers of such a language cannot say that speakers of disposition-property-ascribing language can, it follows that there is nothing that is said by such dispositional property ascriptions that is not said by a *subjunctive conditional* describing how the property-bearer would or could behave, if the relevant conditions were to be fulfilled, and how it actually *has* behaved when, as they are when an appropriate test is carried out, those conditions actually *are* fulfilled.

In contrast to simple dispositions such as the brittleness of a glass vessel, the flexibility of a rubber cushion or the magnetic properties of an iron bar, where the test results are a direct measure of the disposition in question, the case expressed by Ohm's law involves the simultaneous manifestation of two opposed and interacting dispositions. One of these (the potential difference - E) is a disposition for the effect (the flow of current - I) to occur, while the other (resistance - R) is a disposition to impede its occurrence. Since all that is measured directly in such a case is the combined effect of the two opposing dispositions (current flow - I) the only way to determine the respective contributions of the two is to assume that they are equal and opposite, in other words that the magnitude of the current flow (I) is a function of the potential difference (E) divided by the resistance (R) which gives us Ohm's Law in its classical form. Moreover, since it is incorporated into the definitions of the units used to measure the dispositional properties that determine current flow (as measured in *amperes*), the *volts* that measure the potential difference and the *ohms* that measure resistance, Ohm's Law so stated is an analytic proposition made true by the stipulative definitions of those units of measurement. That this is so will be apparent from the following definitions of the "ELECTROMAGNETIC UNITS. E.M.U." taken from *A Dictionary of Science* (Uvarov and Chapman 1943/1951):

> System of electrical units, within the G.G.S. [centimetre-gram-second] system based on the unit magnetic pole, which repels a similar pole, placed 1 cm. away, with a force of 1 dyne [the force which acting upon a mass of 1 gm., will impart to it an acceleration of 1 cm. per second per second].
> The E.M.U. of current is that current which, flowing in an arc of a circle of unit length and radius (i.e. 1 cm.), exerts a force of 1 dyne on a unit magnetic pole placed at the centre.
> The E.M.U. of resistance is that resistance in which energy is dissipated at the rate of 1 erg [the work done by a force of 1 dyne acting through a distance of 1 cm.] per second by the flow of 1 E.M.U. of current.

> The E.M.U. of electromotive force or potential is that potential which, applied across the ends of a conductor of 1 E.M.U. resistance, causes 1 E.M.U. of current to flow.

It will be apparent from these definitions that, whereas the E.M.U. of current is defined independently of those of resistance and electromotive force, the latter are defined in terms of the E.M.U. of current plus, in the case of resistance, a measure of the rate at which electromotive potential is thereby dissipated and, in the case of electromotive potential, the magnitude in E.M.U. of the resistance of the conductor between the two ends of which the potential exists. Such definitions are obviously circular; but in view of their practical utility, the circularity is virtuous rather than vicious.

The belief that Ohm's Law is only approximately true derives, I suspect, from what I regard as the mistaken belief that a dispositional property, in this case the resistance of a conductor, is the *same thing as* the features of the microstructure of the property-bearer, the conductor, on which it depends. It is, of course, obvious to anyone with the most elementary understanding of the principles of electrical conduction that the resistance of a conductor depends on three factors (a) its length (b) its cross-sectional magnitude and (c) its physical structure. Metals in general are good conductors. Fibrous, ceramic and plastic materials are poor conductors and, provided they are not permeated with water, can be used to *insulate* one conductor from another. It follows from this that once we understand physical structure of a material on which its resistance depends, it becomes possible to estimate the resistance of a conductor from a knowledge of its physical structure when combined with its length and cross-sectional magnitude. If you believe, as many scientists as well as philosophers appear to do, that dispositional properties and the physical structures on which they undoubtedly depend are one and the same thing, you will think that in discovering the physical structure on which the disposition depends you have discovered the "real essence" of the property itself. In the case of electrical resistance the effect of this belief is that estimates based on measurements of its structural basis are taken as more accurate than those based on measurements of current and calculations based on assuming Ohm's Law in its classical form. Consequently any discrepancies between the two estimates will be attributed to the inaccuracy of the latter.

However, a careful examination of specific examples where dispositional properties are accounted for in terms of the underlying structure of the property-bearer shows in every case that the relation between the structure and the dispositional property it underpins is a causal relation in which the structure stands as cause to the dispositional property as effect. I first drew attention to this fact in relation to the horsepower of an engine and its basis in such structural features as the cubic capacity of its cylinders (Place 1967). More recently (Armstrong, Martin and Place 1996, pp. 113-5, 123-4) I have discussed it in relation to the example of the sharpness of a knife or needle where the disposition to cut or pierce depends causally on three factors, (a) the fineness of the edge or point (b) the hardness and (c) the rigidity (two dispositional properties be it noted) of the object as a whole. We now have the example of the resistance of a conductor which, as we have seen, depends causally, not just on the physical structure of the material of which the conductor is composed, but also on its cross section and length.

In all these cases the multiplicity of factors on the structural side, the fact they include both an element of spatio-temporal arrangement and one or more dispositional properties of the features or components so arranged, and the fact that any one of these factors may vary or be absent independently of the others with a corresponding variation in or disappearance of the resulting dispositional property convinces me that this is a causal relation and not a relation of identity. If that is so, three things follow. In the first place estimates of the resistance of a conductor based [on] an examination of its physical structure are estimates based, not on an examination of the resistance itself, but of one of its causal determinants. Secondly, estimates of resistance based on measurements of electric current using Ohm's Law as an analytic principle in order to calculate the respective contribution of resistance and potential difference, though they are also indirect, are indirect in a way that all measurements of dispositional properties are necessarily indirect, namely that what is measured is a particular manifestation of the disposition rather than the disposition itself. Thirdly and finally, though both estimates of resistance are indirect, the estimate of resistance based on a measurement of its manifestation in the form of a flow of electric current comes closer to a direct measure of the property itself than does an estimate derived from measuring only one of its causal determinants, the physical structure of the conductor. But given that estimates based on observing the manifestations of a disposition have greater epistemic authority than those based on its causes, any

discrepancy between the two estimates must be attributed to "noise" in the causal relation between the underlying physical structure and the disposition rather than to "noise" in the causal relation between the disposition and its manifestation. If that is correct, there are no grounds here to question the use of Ohm's Law as an analytic principle used to convert measurements of the manifestation (electric current flow - I) into measurements of its two dispositional determinants, potential difference (E) and resistance (R). Ohm's Law is not approximately true. It is an analytic principle made true by the stipulative definitions of the units used to measure the three variables E, R and I involved in the flow of electric current.

By way of conclusion I want to emphasise once again that, in arguing for a rehabilitation of the analytic/synthetic distinction, I am not arguing for the immutability of analytic truths. Indeed it is an essential ingredient in the story I have told that, as semantic conventions change, so some of the sentences which previously expressed an analytic truth cease to do so and sentences which were previously synthetic become analytic. Moreover, I do not wish to deny that, in the case of the concepts and theories of science, these changes come about as a result of cumulative empirical discoveries which render the old ways of talking no longer convenient and appropriate. But I still want to insist that, given the previous semantic conventions, the old sentences are still true, analytically, necessarily and *a priori*. It is just that the conventions that make them true have been rendered obsolete by subsequent empirical discovery, just as the conventions which make many of our present scientific principles analytically true will no doubt be rendered obsolete by empirical discoveries in the future. But this process, whereby analytic principles which comprise the conceptual framework or "paradigm", to use Kuhn's (1962/1970) term, within which scientific research is conducted are rendered obsolete by subsequent scientific discovery, should not be confused with the process whereby low level hypotheses are falsified without disturbing the conceptual framework within which those hypotheses are formulated and without disturbing the analytic principles in terms of which the conceptual framework is itself formulated.

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