Chapter 9

Scientific Theories That Unconceal Being: Intentions and Conceptions in Their Genesis

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You must inquire into all, both the untrembling heart of well-rounded unconcealment and the opinions of mortals, in which there is no unconcealing assurance. Yet nonetheless these too you shall learn, as the seeming things one must intend to prove to be (though, through it all, all of them transgress all assurances), because all are pervading everything.

The Goddess of Day to Parmenides

When John Macnamara agreed to be my doctoral supervisor, I had no idea what a joyful graduate experience awaited me, for I had never met him. But I had two good reasons for wanting him to supervise my graduate work. First, out of all the psychological theories on language and cognition, his were the only ones that really made good sense to me. His theories mirrored my own experience of my own mind—something few other theories did. Second, when I asked around to find out what his former graduate students thought of him, I was told, "They adore him." I was intrigued.

When I began my studies at McGill, I quickly learned why John's students adored him. I discovered that he had a brilliant mind that

This work was inspired to an immeasurable degree by Robert H. Schmidt, who always seems to point me in the right direction. Many of the insights are taken wholly from him, including some of the insights regarding the original senses of scientific concepts, which he earned through years of contemplation and research. I acknowledge also his help in pointing me to certain important passages, in various old works, relevant to changes in these concepts. Further, his comments and insights regarding the ideas in this chapter proved invaluable. I am extremely grateful to him. This chapter benefited also from useful comments from David Alexandre Nicolas, Ray Jackendoff, and Keith Niall. And I thank my dear departed friend and mentor John Macnamara for creating such beautiful theories that I could not help but ask myself how he did it.

instinctively aimed at only the most fundamental questions and penetrated straight into the core of them. He had a profound understanding of critical philosophical and psychological problems, and he shared his knowledge and insights with his students generously. To listen to him speak was as entertaining as reading his wonderfully elegant prose. But besides all this, he was sweet, loving, kind, wise, charming, playful, and funny—a delightful gentleman. I quickly came to count myself among the students who adored him.

It took me considerably longer to discover why his ideas and theories make so much sense. I believe I can now explain why. This chapter is devoted to this effort. I hope to show why the approach John took to theorizing results in superior theories, and why the usual approaches do not. Though I focus on theories of natural language semantics early in the discussion, the insights should apply to theory in any domain of inquiry.[1]

9.1 Theory

The word *theory* derives from the Greek *theōria*, 'a viewing' or 'a beholding'. Ideally, a theory should result from a theorist's viewing or beholding (or noetic perception) of being,[2] and it should permit others to behold that being. At a minimum, this implies that any concept guiding a theorist's thinking and transmitted to others along with a theory must originate in an authentic and relatively complete conception of being of some sort, and that the theory must be compatible with each such concept. What a theorist must do (and avoid doing) to ensure these outcomes will become clear.

9.2 Intentions in Theories

In the context of theories or, more generally, declarative statements in some language, an "intention" (from the Latin *intentio*, 'tension' or 'aim') is a noetic tensing or aiming of the mind toward being of some sort, an aiming concomitant with speaking or writing, and brought about by hearing or reading, a string of signs for which one knows the conventional (or theorist-defined) interpretations.[3] I take this to be the original sense of *intention* in the context of signification; be warned that it bears little resemblance to modern senses of the term (e.g., Bertrand Russell's "propositional attitude" understood as a relation of a person to a proposition, such as the "relation" of belief, where no relation of the person to being is

necessarily implied; for instance, those who advocate "methodological solipsism," such as Fodor (1980), conclude, from the fact that false beliefs can affect a person's actions, that a propositional attitude enters into the explanation of behavior under an opaque construal, which is considered to be the only construal relevant to psychological theories because the explanation of behavior is now typically said to be *the* goal of psychology—a naturalistic pretense of the behaviorist and postbehaviorist eras). The original sense of *intention* is more similar, in some respects, to the modern sense of *attention*.

In describing the object of an intention as "being," I do not mean to imply that its object must be "objective reality," or being as it is carved up by a god or nature, independently of our characterization of it (e.g., a "natural kind"); I am not presupposing the correctness of what Putnam (1981) calls the "externalist" perspective, according to which being and beings are necessarily defined or individuated objectively, and reference to anything extrapsychic is necessarily a connection of some sort to objectively defined being or beings. Theories—especially in psychology, the social sciences, mathematics, and semantics—often require that being be carved up or defined in other ways (e.g., the firms, consumption, and income of economic theory). Being that is carved out mentally by us is not imaginary or unreal just because its definition has no "objective" (i.e., nonsocial and nonpersonal) source; as Field (1982) argues, "what we have carved out existed independent of our carving it out, despite its nonsalience from the God's-eye perspective" (p. 561).[4]

9.3 A Defense of Intentions

The theses of this chapter presuppose the existence of intentions qua intentions. But the supposition of their existence is surprisingly controversial these days. So, with the aim of reducing the appeal of modern skepticism about them, and to show why scientific theorizing would be impossible without them, I will examine some claims that have been made about their nonexistence as well as some of the attempts to reduce them to something else.

The physicalist philosopher Daniel C. Dennett and his many followers would have us regard the intentions we ascribe to ourselves and others as "idealized fictions in an action-predicting, action-explaining calculus" (Dennett 1978, 30), and our ascription of them as a "stance" we take in relation to an organism or a machine when that stance seems useful in

explaining or predicting actions or behavior, but one irrelevant to scientific theorizing; talk of reference, thoughts, beliefs, perceptions, desires, fears, aims, and so on, is "a sham and ... mere word play" (Haugeland 1982, 616; Dennett claims that "intentional theory is vacuous as psychology" (p. 15)). But Dennett owes us an answer to this question: how can one adopt the intentional stance, or any explanatory stance, toward something's actions without coming into any (genuine) intentional states such as *perceiving* actions, *desiring* or *trying* to explain them, and *believing* or *asserting* that their explanation lies in, say, beliefs and desires? (See also Slors 1996.) As Putnam (1989) observes, "*Explanation* is a flagrantly intentional notion" (p. 217).

Some physicalists (e.g., Churchland (1981)) would have us embrace the goal of eliminating all talk of intentions—deemed unreal—from a science of the mind. But it seems to me foolish to deny the reality of that which one experiences directly in every waking moment just because averting one's eyes eases ontological queasiness. As Silvers (1991) remarks, "Eliminativism with respect to intentional phenomena is a way out but it is much like the way of the ostrich" (p. 68). If that which manifests itself to us does not accord with what we know about nature, then our knowledge of nature must be less than complete! The fact that intentional notions such as reference resist naturalistic explanation merely shows, as Putnam (1992b) explains, "the limitations of a certain notion of 'nature' and a certain notion of 'explanation'" (p. 384). Instead of denying the manifest, one might fruitfully aspire to what James Clerk Maxwell (1877) called "that state of thoroughly conscious ignorance which is the prelude to every real advance in knowledge" (p. 245).

It is easy to show that eliminativism is untenable. The eliminativist cannot even state his or her thesis without making covert use of intentions. When Churchland (1984) claims that the commonsense (or "folk psychology") conception of the mind as intentional "is a *false* and radically misleading *conception* of the causes of human behavior and the nature of cognitive activity" (p. 43; emphasis added), he uses the essentially intentional notions of falsity and a conception. When he says of folk psychology, considered as "an empirical theory," that "its *ontology* is an *illusion*" (1981, 72; emphasis added), he implies that theories are *about* (illusory or real) being and therefore intentional; and since an illusion is a type of intentional state (i.e., *perceiving something* as other than what it is), one cannot sensibly dismiss the intentional states in the ontology of the folk theory as illusions. Eliminativists cannot even maintain, without

inconsistency, that their goal is to eliminate all mention of intentions from scientific discourse because they are fictions, for goals are intentional. Garfield (1988) sums up the problem:

> The eliminativist enterprise is, in a straightforward sense, self-refuting. It commits, as Baker [(1987)] has put it, "cognitive suicide" by denying what is necessary in order to give it sense, viz., that those who assert it believe its truth (or, for that matter, anything at all) or mean anything by asserting it. (p. 123)

The whole of the scientific enterprise involves goals (e.g., the goal of generating hypotheses from a theory, and the goal of obtaining evidence in support of those hypotheses) and intentions of other kinds (e.g., desires for procedural rigor in experiments, perception and a belief in the veracity of one's senses during observation, and assertions about experimental results); as Baker (1987) argues, "Without intentionality science would be impossible" (p. 173; see also Garfield 1988, 112–116). Moreover, I cannot see how a scientific theory could be meaningful—something other than a word game or a kind of dream—unless it permitted the mind to intend being.

To make sense of what follows, the reader would do well to resist another (even stronger) modernistic temptation, namely, to try to understand signification, not in terms of intentionality, but in terms of the popular modern concept of a "mental representation." Having changed radically from the "representation" of German philosophers such as Kant and Brentano (i.e., their *Vorstellung*, the act of presentation to or placement in front of the conscious mind), a representation is now understood as a mental being (e.g., a mental symbol) to be operated upon, one unavailable to consciousness, in the context of the computational (or "information-processing") view of the mind. As Searle (1980) has demonstrated with his "Chinese room" argument, operating upon symbols in conformity with formal rules (i.e., rules that depend upon the shapes of the symbols) does not lead to any *understanding* of the symbols. Fodor (1986) puts it this way: "You can't get semantical properties out of symbols just by piling up their syntactical ones" (p. 13). More to the point, no existing theories of mental representations succeed in reducing intentionality to something else, I will argue, or allow for the mind to make the kind of contact with being necessary for scientific theorizing to proceed.

Sometimes mental representations of linguistic meaning are imagined to be symbols or symbolic formulae (in a mental dictionary, lexicon, or encyclopedia, or in some representational "space") in some partially

or entirely unlearned language (e.g., "Mentalese" or "the language of thought"). This view leads to a problem that Harnad (1990) calls the "symbol-grounding problem" and that Johnson-Laird (1988) calls the "symbolic fallacy": the interpretations of symbols cannot be just more symbols.

Some theorists seem to be blissfully unaware of the problem or unwilling to recognize it (e.g., Eco (1988); Schank and Kass (1988); Wilks (1988)), or seem to think it can be solved by some sort of "encoding" of semantic content by symbols in a formal system, but leave in shadow the mysteries of the encoding and decoding (e.g., Pylyshyn (1984, 258)).

Among those who recognize the problem and make a serious attempt to find a solution to it, some grasp at the slender hope that the interpretation of a sign or symbol is a causal connection of some sort (e.g., Dretske (1981); Stampe (1979)). Fodor (e.g., 1987), for instance, tries to explain semantic content in terms of the reliable causation of tokenings of a certain symbol by percepts of a certain kind, which are in turn caused by observable properties of beings of a certain kind; the covariation of tokens of a symbol and the referents that cause them is supposed to determine the interpretation or content of the symbol—presumably even when a referent is not present to cause its tokening. This seems to be not so much an explanation of interpretation as a change of topic; it seems plausible only as a partial account of why we tend to think "There's something red there" when a red surface fills the visual field (but a full account of that would require more, including accounts of how the English word *red* came to be associated with red things, how one takes one's perception of redness as evidence for something red—cf. Silvers 1991—and how one then interprets "something red" into it; all of these accounts would surely involve intentions). Moreover, the causes of tokenings of a sign (and of beliefs about its referents) need not be referents of the sign (or of any phrase headed by it), as when one learns about electrons from textbooks; and though *some* causal chain may link electrons to tokenings of *electron* immediately "caused" by textbooks, that causal chain could not be specified unless one already knew the referents of *electrons* and could refer to them by some other means (Putnam 1981). Contrary to the assumptions of those who espouse causal theories of semantic content, causes and causal chains are not purely objective and unique things. A cause or a causal chain leading to some event is not determined independently of observers; an observer must decide, out of the entirety of being—all of which somehow influences the event—which

things are the most important to mention in giving an explanation in line with his or her current purposes (Putnam 1984). Causal accounts of meaning also leave mysterious the way in which the expression *causal chain* comes to have *its* content (Putnam 1984). And attempting to explain the content of individual words in terms of causal connections does nothing to explain the content of complex referring expressions such as *the first baby born after the year 2500* that have referents with which one cannot possibly now interact causally (Putnam 1992a, 163). But perhaps the most serious problem with causal theories like Fodor's is that, *even when the referent is present*, the being that causes the sensory stimulation that is supposed to lead to the tokening of a symbol is rarely being that the symbol can be used to signify. The being that stimulates the retina so as to lead to a tokening of *person*, namely, parts of the exposed surfaces of a person's clothing and of the body of matter currently coincident with the person, is not equivalent to the referent of any noun phrase headed by the noun *person*. Causal accounts of reference will only seem plausible to those who unwittingly presuppose the intentionality such accounts are supposed to explain (cf. Searle 1980, 454).

Others hope that symbols can be grounded by nonsymbolic representations—icons or images (e.g., Harnad (1990); McGinn (1989)) or mental models (e.g., Johnson-Laird (1988)) that are supposed to represent by means of similarities, (natural, not assigned) correspondences, or isomorphisms with the being represented, and to intrinsically preserve information about it.

Sometimes such representations—or even symbolic representations—are imagined to give signs meaning in and of themselves. But this would imply that all statements, including theoretical statements in science, are about mental representations rather than being—which would make psychology the basic science (as in Tlön, the imaginary world invented by Jorge Luis Borges, one populated entirely by idealists); as Macnamara once remarked, "Flattering to a psychologist, but dubious!" (Macnamara 1989, 350). Moreover, the idea simply makes no sense. The fact that we can discuss whether or not statements put the mind in contact with something outside the mind presupposes our ability to refer to the extrapsychic. Macnamara (1989) made the point this way:

> One might ask: Does the expression 'extramental reality' put us in contact with something outside the mental models? If it does, why do other words not? If not, what might the expression mean? And how could any of us conceive the existence of an extramental reality, let alone wallow in its exuberant presence? (p. 352)

An inability to refer to the external would also make obscure the meaning of an indexical or demonstrative such as *this*, *that*, *here*, or *there* (especially in discourse contexts in which it had no antecedent) and would leave us with no way to account for its obvious kinship with (and frequent concomitance with) an indexical gesture such as pointing, nodding, or gazing toward something so as to indicate to another person an object of thought; one does not (and cannot) point, nod, or gaze in the direction of one's own mental representations. It is apparent that, as Putnam (1973) says, "'meanings' just ain't in the *head*" (p. 704).[5]

Sometimes some relation of a nonsymbolic representation to being is imagined to ground or give meaning to a symbol or formula. But theorists fail to characterize this relation in any way that could explain reference or interpretation, or that would permit scientists to theorize about the being represented.

This relation to being is most popularly described as a map or function from the representations to states of affairs in the extrapsychic world (e.g., Millikan 1984). But no such function could *explain* reference because it *presupposes* reference. Unless the mind already had the capacity to refer, such a function could not be computed in the mind because, though the arguments of the function (representations) could be in the mind, its values (extrapsychic states of affairs) could not.

Some (e.g., Palmer (1978)) seem to think that the mere (objective) existence of a similarity, correspondence, or isomorphism will, by itself, do the trick—that such a correspondence with being is what we really mean by *reference* or *intention* (or at least *representation*). But that is not enough. Mental images or models could not, just by means of correspondences, determine what signs signify. For one thing, they would leave the signified indeterminate because a given one is similar to, corresponds to, or is isomorphic to many beings or states of affairs, and is similar to, corresponds to, or is isomorphic to a given being or state of affairs in many different ways, "representing" the truth-conditions of many different sentences and the referents of many different signs (see Cummins 1996; Fodor 1990; Putnam 1981). The correspondence to the signified being that is relevant to reference and truth-conditions would have to be singled out somehow. It could not be singled out by stipulation (cf. Morris 1991), since stipulating that the correspondence between *this* and *this* or stipulating that *this* correspondence between a representation and being of a given kind is the *relevant* correspondence *presupposes reference* (to the representation, the represented being, and, perhaps, the correspondence), which is the very thing that correspondence is supposed to explain (see Putnam 1981). Nor could any causal connection fix the relevant correspondence (see Fodor 1990; Putnam 1984). But even if one correspondence could somehow be singled out by some nonintentional means, still more would be needed to give rise to representation of, reference to, or an intention toward being. A given correspondence (or similarity, or isomorphism) does not a representation make (see, e.g., Pylyshyn 1984, 40–41). One thing can represent another only by virtue of an *intention* to represent (see Fodor 1990; Putnam 1981; and so it is foolhardy to try to reduce intentions to representations). The moon may happen to look like a man's face, but it would be odd indeed to say that it is a *representation* of a man's face; as far as we know, nobody shaped the surface of the moon so as to create the likeness of a man's face (or, for that matter, the likeness of a rabbit, which some people see in the moon). As Putnam (1981) points out, "Thought words and mental pictures do not *intrinsically* represent what they are about" (p. 5); "believing that some correspondence intrinsically just *is* reference (... as an *ultimate* metaphysical fact) amounts to a magical theory of reference" (p. 47)—that is, "a theory on which certain mental representations necessarily refer to certain external things and kinds of things" (p. 15).

A thinking subject must *do* something with, say, a mental icon if it is to bring the mind into contact with being. Three possibilities occur to me (but all of them presuppose intentionality). The subject could interpret the icon as (1) a linguistic sign of a special sort, one that happens to look like the being it signifies (comparable to early Sumerian cuneiform ideograms and early Egyptian hieroglyphs), in which case it is redundant; (2) an image of the being pictured; or (3) a representative, proxy, or counterpart for the being represented (see also Cummins 1996), something that stands in for it in mental activities, just as a map can stand in for a region in planning a route of travel. The latter possibility is pertinent to mental *activities* such as planning actions in the imagination, but it could not provide a plausible general account of interpreting signs or strings of signs in sentences. An icon (one available to consciousness) interpreted in the third way *may* play a role in signification when there is no particular or definite referent for a word or phrase embedded in a sentence so that the mind cannot fall upon extrapsychic being in interpreting it, as when one is interpreting an indefinite noun phrase in the predicate of a denial (e.g., *a ball* in *Rick did not hit a ball*, which obviously does not refer to any particular ball, since it makes no sense to ask, "Which ball?"; see Geach 1962; McPherson 1995, app. B) or in the predicate of a sentence such as

You will need an umbrella today (where the lack of a definite referent of *an umbrella* is evident, again, in the inappropriateness of the question "Which umbrella?"); in such cases, the mind may aim at an icon understood as a representative, proxy, or counterpart for any individual whatsoever of the kind. If a representation is interpreted in accordance with one of the first two possibilities, as an imagelike sign or an image, it may play a mnemonic role, helping the subject to remember the sort of being the associated linguistic sign conventionally signifies. But in any of these cases, we would not want to say that the icon *determines* what is signified so that the associated sign (or a referring expression headed by it) signifies just those aspects of being that are represented. That would determine the being signified too narrowly. Representation by means of an icon or model is always partial (see also Cummins 1996), and to think that only what is represented is signified would be, in the case of theoretical terms, to miss the whole point of scientific investigation: to discover or unconceal the *unknown* aspects of the nature of being. Moreover, the history of science demonstrates that a word can be used to refer to something even when it has been conceived *wrongly*. Science could not proceed if scientists could not use a scientific term such as *electron*, *gene*, or *gold* to refer to being of the same kind while they entertained different concepts of it and different theories about it (see also Putnam 1988). (Of course, the current concept cannot be *completely* mistaken. One could not use *electrons* to refer to electrons if one's concept of their nature were so far off that one did not even know that they are subatomic constituents of matter, for instance. And though one can *refer* to something not correctly conceived, its nature cannot yet be fully revealed to and beheld by one's mind; full unconcealment would lead to the conception of a new, correct concept.) The potential referents of a sign are fixed by a *convention* according to which the sign is used to refer to, or aim the mind at, being of a particular sort. The being toward which a linguistic sign can direct the mind is determined, not by a similarity, a natural correspondence, or an isomorphism between any associated mental representation and the being, but by a convention of a speech community (see also Aristotle, *On Interpretation* 2, 16^a19).

9.4 Intentional Objects and Semantic Theory: Macnamara's Contemplation of Being

The nature of thinking can be seen only by looking away from thinking.
Martin Heidegger, *Discourse on Thinking*

If we take the interpretation of signs or combinations of signs in sentences to be the objects of the intentions to which the signs give rise, then a theory of the interpretation of sentences—a theory of semantics—must characterize or define the objects of the intentions that arise upon hearing or reading sentences (where *object* is to be understood, here and elsewhere, as that toward which the mind is aimed, which is not necessarily an object in the sense of a sensible thing). A semanticist must characterize or define the being signified; to do so is to define what is meant. This is just what John Macnamara did. He did not merely *name* the objects of intentions (e.g., the word *John* is interpreted into John), for to do so is to leave their definition implicit; he characterized or defined the being toward which the mind aims. In his theory of the semantics of proper names, for instance, he identified the referent of a proper noun as an individual individuated or informed by a kind (or form or species), some psychologically (and perhaps ontologically) privileged kind such as PERSON—as opposed to an individual individuated by some other kind (e.g., WOMAN, FRIEND, DANCER, or PASSENGER), and as opposed to, say, a particular collection of molecules (which would not permit the application of a proper name both to a given woman and to the infant she once was), or a set of predicates or properties (for the properties of the bearer of a proper name change), or something that gives rise to a certain appearance (for that which bears a proper name—say, a person—can change radically in appearance—for example, from infancy to old age, through changes in hair color and hairstyle, and through changes in clothing, which alter the appearance radically but do not change a part of the person proper), or that appearance itself (for that which bears a proper name may well be largely hidden, as a person beneath his or her own skin, and usually under clothing as well; an appearance does not itself bear a proper name, but announces the presence of that which does). The identity of the named individual across factual and counterfactual situations is traced through the individuating kind (or form). (See La Palme Reyes, Macnamara, and Reyes 1994; La Palme Reyes et al. 1993; Macnamara and Reyes 1994.)

John arrived at definitions of intentional objects by "carefully sifting through" his own intuitions, as he put it. He would find meaningful utterances that seemed to reveal something about the interpretation of a sign or phrase and contemplate the nature of the being into which it is interpreted. He once described the process to me by comparing himself to a worm turning over the same piece of earth again and again. The analogy is apt. To turn over earth, a worm must make direct contact with the

earth. In his contemplation, John seems to have kept his mind in direct intentional contact with the objects of linguistic intentions. Those who knew John will know that the earth he turned over most frequently was the being intended in interpreting the sentence *Freddie is a dog*. The late Freddie was a large black poodle who shared his life with John and his family. The fact that the sign *Freddie* can still be used to pick out a certain dog, who is no longer with us, as well as a certain pup who was born in Montréal, that it can be used to pick out the same dog even in counterfactual situations (such as one in which Freddie was adopted by other humans), and other such facts led John to his theory about the nature of the being into which a proper name is interpreted. The theory accounts well for the facts of interpretation for proper nouns, and reveals or unconceals or brings to light the nature of the being implicitly and spontaneously understood to bear a proper name in every instance of the interpretation of a proper name.

John's choice of a declarative sentence (*Freddie is a dog*) as the focus of his contemplation may have facilitated his discovery of the nature of that being. A declarative sentence is the only type of utterance that can be judged true or false, and, when true, it unconceals being of some sort to the mind (which is why the Greeks used the word *alētheia*, 'unconcealment', for truth; see Aristotle, *On Interpretation* 1, $16^{a}9$–18; 4, $16^{b}33$–$17^{a}4$); and so a true declarative sentence can bring the mind into direct intentional or noetic contact with being. Contemplation of an isolated word may not permit such contact, for a word by itself may not actually signify; a word uttered or written in isolation, such as "person" or "green," does not seem to aim the mind at any definite or particular being or beings; it may only *potentially* signify (i.e., have the potential to signify) by virtue of one's having conceived a concept of, or formulated a definition of, the kind of being it would *actually* signify in a referring expression in accordance with a convention of a speech community. (And this may explain the Greeks' use of the word *dunamis*, 'power' or 'potentiality', for the force of an individual word.)[6] When a word is out of context, one cannot even determine on which side of the use/mention distinction it falls, that is, whether it is to be interpreted in its signifying function or as a string of sounds or letters (La Palme Reyes et al. 1993).

9.5 Inner Perception and Psychological Method

John came to understand his sifting of intuitions largely in terms of Franz Brentano's "inner perception" (*innere Wahrnehmung*; see, e.g., Macnamara

1994). Brentano (1838–1917) was, along with Wilhelm Wundt, one of the first empirically minded psychologists. Neither Wundt nor Brentano advocated the use of the methods of the natural sciences in psychology (see Macnamara 1992, 1993). Brentano advocated the use of inner perception as the proper empirical technique for a genuine science of psychology (see Brentano 1924).

Brentano maintained—and quite rightly, I believe—that all and only psychological phenomena are intentional; in any psychological phenomenon, the mind is turned toward—the attention is focused on—something as its object. Psychology, then, is the science of the intentional. Brentano argued that one can study intentions *directly* only by means of inner perception, which he described thus: 'Only while one's attention is turned toward another object, it happens that one also incidentally arrives at the perception of psychical events that are referred toward it [i.e., the other object]' (1924, 41).[7] In the context of semantics, this means that when a sign or combination of signs makes one's mind intend something as its object, one can perceive or notice or become aware of aspects of the intention such as the conditions under which it arises, its character, and the nature of its object.

Brentano took great pains to distinguish inner perception from introspection or inner *observation*, which he regarded as impossible (see Macnamara 1992, 1993). One cannot *observe* one's own intentions, for to do so would require a redirecting of one's attention—of one's mind's firm or taut aiming or tensing—away from the objects of intentions and toward the intentions themselves, which would abate or relax in one's so doing, ceasing to be; but one can notice characteristics of one's intentions incidentally as they occur (or, as Aristotle put it, *en parergōi*, 'in by-work', or 'in a deed done on the side'; *Metaphysics* Λ.9, $1074^{b}36$). One can in some sense observe one's intentions only when they have passed out of existence, through contemplating memories of them.

The science of psychology that Brentano envisioned, though founded on inner perception, was not fettered by the fact that one can perceive directly only one's own intentions. Brentano recognized that we can learn about the intentions of others through their reports about them or evidence of them in actions or in facial expressions or other involuntary behaviors. Such indirect means of learning about intentions can be the basis of psychological experimentation. But a theory that generates experimental hypotheses can only be a genuine theory of, or permit a genuine *beholding* of, intentions of some sort if the theorist uses inner perception to gain direct evidence of the nature of those intentions—for no other

direct means of discovering their nature exists. It is the discovery of their nature by this direct means that permits an interpretation of indirect evidence of intentions such as facial expressions and actions; no knowledge about intentions could be acquired on the basis of the indirect evidence by itself, for, as Brentano (1924) pointed out, 'what is a perception, what a judgment, what joy and sorrow, desire and aversion, hope and fear, courage and despair, what a decision and an aim of the will, we would never come to know if the inner perception of our own phenomena did not bring this knowledge to us' (p. 40). Psychologists cannot escape the need for inner perception.

I turn now to an examination of intentions and conceptions that will reveal some of the reasons a theory can fail to permit a beholding of being when the theoretical work behind it is done without the theorist's keeping his or her mind firmly aimed at the being of interest.

9.6 First Intentions and Second Intentions

Following the Scholastics, philosophers distinguish "first intentions" and "second intentions," or concepts conceived by direct intentional contact with being and concepts conceived by reflection upon concepts already conceived. But the distinction seems originally to have been between two types of intention rather than two types of concept. First intentions seem to have been understood originally as aimings of the mind toward 'real beings' (*entia realis*) directly, and second intentions as aimings of the mind first toward concepts (conceived either first-intentionally or through reflection upon concepts; concepts conceived in the latter way were called 'beings of reason',[8] *entia rationis*) before the mind may be redirected toward real beings. The distinction has consequences for theoretical work. Theories are usually about being of which our concepts are second-intentional (i.e., beings of reason—concepts originally conceived by reflection upon concepts), but theoretical reasoning that proceeds without the mind's aiming directly at any extrapsychic being can result in theories that fail to reveal the nature of any such being (partly because of the tendency of second-intentional concepts to change in sense and become depleted in sense—a problem addressed in the next section).

The original senses of *first intention* and *second intention* are evident in expositions of some of the Renaissance Scholastics.

Jacopo Zabarella (1533–1589) described the original, etymologically discovered sense of (*first*) *intention* as that action in which 'the soul aims [or stretches; *tendit*] toward an object with which it is to become acquainted [*in objectum cognoscendum*]' (1590–1605/1966, 870). The notion of an aiming (or stretching) of the soul toward something (some extrapsychic being) as its object was central to the understanding of a first intention even when the word *intentio* was being used by medieval Scholastics just for aims of the will. Aquinas, for instance, said that 'an intention, as the very name implies, means *to aim* [or *stretch*; *tendere*] *toward another*' (1266/1970, 111–112).

Eustachius a Sancto Paulo (1573–1640) pointed out that the name of a second intention reveals the original sense to be an aiming of the mind at real being secondarily rather than directly as in a first intention:

> A second intention, if you look at the force of the name, is that very operation of the mind by which it secondarily aims in the direction of a real thing already known previously, insofar as it is known. (*Summa Philosophiae Quadripartita* 4; see Gilson 1979, 107)

Francisco Suárez (1548–1617) gave a more detailed treatment of second intentions (in *De Entibus Rationis*, 'On Beings of Reason'):

> Second intentions [i.e., second-intentional *concepts*] ... [result] from a second intention or attention or consideration of the intellect, by which name is properly called a reflexive intellection [i.e., one turned back upon the intellect itself], because it supposes another [intellection] with which it is occupied [*circa quam versatur*].... Properly that operation is reflex, and (if I may put it this way) is in accordance with itself [*per se*] second, which falls upon another cognition, or upon an object according as it is denominated by a prior cognition, and is from that participating in some properties. Therefore because those logical relations are always based on reflex cognition of this kind, for that reason they in particular are called second intentions, or second objective notions, because they are objects for a second notion [i.e., acquaintance] or formal intention.... These relations of reason are usually called things of second intention ... because ... [they have their] being only objectively in [i.e., as the object of] a second or reflexive cognition of the intellect.
>
> From this moreover, it further arises that the intellect could be reflexed [i.e., bent back] again upon second intentions themselves, and consider agreements or differences among them, and define these, or reason discursively from these, and then after that base similar relations on these; as from genus and species it abstracts the relation of universal, and denominates that a genus, similarly also with regard to others; then those are relations of reason now not only by reason of the other deficiencies [e.g., not having any being except as objects of second intentions], but because they are not occupied [*non versantur*] proximately with real things, or existing [things], and for that reason when these relations are said to be in some way based on things, it must be understood to be because of the first relations of

this series.... These relations can be multiplied nearly to infinity by fictions [i.e., formations or inventions] or reflexions of the intellect. (1597/1965, 1041)

A first intention, then, in the original sense, is an aiming of the mind directly at real being. A second intention is reflex (*reflexus*, 'bent back', directed toward itself), with the mind turning toward or intending some of its own contents, namely, concepts; if it turns toward the real being of which they are concepts, it does so only secondarily. Second intentions toward or reflection upon concepts can give rise to a new concept, which was also called a second intention. As Suárez noted, the being of reason so conceived can then be taken up as the object of further reflexive intellection to conceive further concepts, as when one conceives a relation through reflecting upon the concept of a ratio and concepts of comparative being such as being greater than and being less than, where some of these concepts have themselves been conceived by second intentions (e.g., the concept of a ratio is conceived through reflection upon the concepts of double, triple, etc.).

How is this distinction between first and second intentions relevant to theorizing? If a being of reason can be the object of an intention in the reflection that permits new conceptions, then surely it can be the same in theoretical reflection. Now when a theorist makes use of a second-intentional concept such as that of a relation, the theorist's mind aims at this being of reason. If the theorist's mind is to fall upon any real being, it must then aim toward one of the concepts that gave rise to the second-intentional concept, a concept such as that of being greater than, and it can only then aim at any being that is an instance of a relation (just as the mind, when thinking of the genus ANIMAL, can only fall upon a particular animal after aiming toward a concept of some particular species of animal). But the theorist's mind need never be redirected toward any real being; the theorist may think about a relation without ever thinking about specific instances of it in being, such as the ratio of the magnitude of one of the long sides of a certain rectangle to the magnitude of one of its short sides. Suppose, though, that in some instances at least the theorist's mind does continue to be redirected until it comes into intentional contact with real being. A concept is, by necessity, the result of a partial conception (or a partial taking into the mind) of the real being that gave rise to it, and especially so when the concept is conceived by second intentions. When some real being is viewed "through" a being of reason or concept (i.e., as an instance of the being of which it is a concept), the concept serves as a kind of filter, focusing the attention so as to limit the experience of the

being to a reexperiencing of that which is already known about it—that which has already been conceived. Second intentions thereby hamper any new revelations about being; they deny being any real opportunity to unconceal or reveal itself. And any such opportunity is most certainly denied whenever the theorist's mind fails to aim toward any real being at all, standing firm in an intention toward a concept or being of reason. This purely reflexive aiming is most likely to occur when the concept that is its object is second-intentional, since such a concept is further removed from being than a first-intentional concept.

If a theorist has only second intentions while theorizing, and especially if second-intentional concepts are the sole objects of the theorist's intentions (which is not unlikely, because the being a theory is supposed to describe or explain is often conceived second-intentionally), any real intentional contact with being is wanting, and so any real opportunity for genuine discovery is passed over. If being is to unconceal itself and thereby guide the formation of theories about it, a theorist's mind must aim at it directly. This is not to say that second-intentional concepts should be avoided (for many theories require the introduction of signs tied to such concepts in order to achieve the appropriate level of generality), but just that they should be grounded in first intentions. Such concepts may even facilitate a revelation of being if they are compared to the first-intentional concepts upon which they are based, and to the being that gave rise to those concepts, to see if they "fit" the being of which they are supposed to be (secondary) concepts; whether or not they fit, the exercise of comparing them to being may lead the theorist to look at the being in a new way such that something about it is revealed.

Theorizing solely by means of second intentions toward second-intentional concepts is especially dangerous because such concepts can change so that, in addition to impeding the unconcealment of aspects of being not previously conceived, they actually come to *conceal* the nature of being. This kind of change is addressed next.

9.7 Conceptual Sedimentation and Sense Depletion

["The disciplines," said I,] "which we said did lay hold of being to some extent, geometry and also those [disciplines] attending it, are, as we see, dreaming about being, but a waking vision of it is impossible for them to behold so long as they leave unstirred the suppositions being used, not being able to offer an account of them. For when the origin is not examined, and the conclusion as well as the intervening steps are interwoven out of that which is not examined, what means

can ever transform taken-for-grantedness such as this into understanding?" "None," said he.

Plato, *The Republic*

A scientific or philosophical concept, when originally conceived, may well reflect the being of which it is a concept—to the degree to which it is true to intuitions arising from first-intentional contemplation of the being conceived. But over the course of its use in theoretical and philosophical reasoning, and especially through its transmission to new generations of thinkers, a concept can diverge from and come to conceal its original sense.

Edmund Husserl (1859–1938) described such conceptual change as "sedimentation." If we regard a concept as it was originally conceived (ideally in a contemplation or noetic beholding of being) as the original "deposit," sedimentation can be understood as a process by which layers of sense are imposed upon the concept, usually with the effect of bringing it into line with contemporary philosophical views and contemporary methods, techniques, and tools (e.g., symbolic logic). It occurs when a concept is used without the being that originally gave rise to it ever getting contemplated anew. The additional layers of sense alter the way we regard that being, the perception of which is filtered through the concept; the mind falls upon the changed concept before it falls upon the being (if it falls upon it at all). As Husserl (1925/1977) put it, "Our opinions which stem from our theoretical or practical activities clothe our experience over, or clothe its sense with new layers of sense" (p. 41). The superimposed layers of sense conceal the original sense, the sense most likely to reflect the nature of the being that originally gave rise to the concept.

To uncover the original sense of a concept (which implies uncovering its ontic or first-intentional root or source, if it was conceived through first intentions), and to distinguish this sense from the acquired senses that cover it up, one must engage in what Husserl called "genetic analysis." Harvey (1989) describes it as follows:

> Genetic analysis is the investigation backwards (*Zurückuntersuchung*) from the given, into the layers of accumulated sense that constitute the given. Or, more colorfully stated, it is the archaeological dig into the sense-chains of understanding. By uncovering these sense-chains, genetic phenomenology can restore meaning to knowledge domains that have become severed from their intuitive, intentional, and semantic roots. (pp. 52–53)

For a theory to be truly meaningful, the theorist must conduct such a dig through the layers of sense in any concept that guides the interpretation of a sign used in stating the theory and, having uncovered the original sense, examine that sense to make sure it is true to carefully sifted intuitions arising from first intentions—for even the original sense may carry conceptual baggage inherited from earlier thought. And so Husserl (1954/1970) said,

> A theoretical task and achievement ... can only be and remain meaningful in a true and original sense *if* the scientist has developed in himself the ability to *inquire back* into the *original meaning* of all his meaning-structures and methods, i.e., into the *historical meaning of their primal establishment*, and especially into the meaning of all the *inherited meanings* taken over unnoticed in this primal establishment, as well as those taken over later on. (p. 56)

Few theorists currently see the need to inquire back into the original sense and the acquired senses of any given concept. A concept's contemporary sense is typically regarded as evident and not in need of examination, and it is imagined to have been immutable across generations. The concept gives the impression of what Husserl called *Selbstverständlichkeit*, literally 'self-understandability' or 'self-intelligibility'. Harvey (1989) describes this "obviousness" as the "taken-for-grantedness" of inherited ideas. Husserl argued that taking a concept for granted leads to 'sense depletion' (*Sinnentleerung*); the concept comes to reflect less and less the being from which it originated.

To the degree to which a concept is sedimented and depleted of sense, theories that make use of a sign interpreted in keeping with that concept fail to reveal the nature of being, and the science that permits itself to be guided by those theories is not sound, for it is not anchored to being. For this reason, Husserl cautioned scientists against adopting and using scientific concepts and terms in a thoughtless way:

> It is easy to see that even in [ordinary] human life, and first of all in every individual life from childhood up to maturity, the originally intuitive life which creates its originally self-evident structures through activities on the basis of sense-experience very quickly and in increasing measure falls victim to the *seduction of language*. Greater and greater segments of this life lapse into a kind of talking and reading that is dominated purely by association; and often enough, in respect to the validities arrived at in this way, it is disappointed by subsequent experience.
>
> Now one will say that in the sphere that interests us here—that of science, of thinking directed toward the attainment of truths and the avoidance of falsehood—one is obviously greatly concerned from the start to put a stop to the free play of associative constructions. In view of the unavoidable sedimentation of mental products in the form of persisting linguistic acquisitions, which can be taken up again at first merely passively and be taken over by anyone else, such constructions remain a constant danger. (1954/1970, app. 6, 362)

Husserl pointed out that the incorporation of a concept into mathematized theories, or into mathematics itself, and the facile manipulation, in formal operations, logical or otherwise, of a symbol for the being of which it is a concept increases the likelihood that it will become sedimented and sense-depleted. There is a tension between mathematics as a *technē* (i.e., a practical art) and mathematics as a science; proficiency at calculation and innovations that facilitate calculation may obstruct the unconcealment of being.

When the original sense of a concept that was conceived through first-intentional contemplation of being is discovered (e.g., through a careful and unprejudiced examination of ancient texts in the original languages, or through an etymological study of the roots of the word for the being of which it is a concept), it should seem natural and authentic, and, in my experience, it is readily intelligible—perhaps because it arises naturally from a contemplation of being that is entered into at will, or perhaps because, as Jacob Klein (1940) claimed, it somehow exists within the current sense and is understood semiconsciously or latently:

> No science, in its actual progress, can escape the "seduction" emanating from the spoken and written word. For the signifying function of a word has, by its very nature, the tendency to lose its revealing character. The more we become accustomed to words, the less we perceive their original and precise "significance": a kind of superficial and "passive" understanding is the necessary result of the increasing familiarity with spoken and written words. The original mental activity, and production of significance, embodied in sounds and signs, is not reproduced in the course of actual communication. Yet it is there, in every word, somehow "forgotten" but still at the bottom of our speaking and our understanding, however vague the meaning conveyed by our speech might be. The original "evidence" has faded away but has not disappeared completely. It need not be "awakened" even, it actually underlies our mutual understanding in a "sedimented" form. "Sedimentation is always somehow forgetfulness" [(Husserl 1939, 212)]. And this kind of forgetfulness accompanies, of necessity, the development and growth of a science.

He added,

> The "sedimentation of significance" can reach such a degree that a particular science, and science in general, appear almost devoid of "significance." (pp. 155–156)

These critical problems of sedimentation and sense depletion can be truly understood only through an examination of instances of them. And so I devote most of the remainder of this chapter to genetic analyses of three concepts: that of a number, that of a relation, and that of a predicate. An "archaeological dig" into the layers of sense in these concepts will, moreover, be of benefit to theorists because of their wide use in scientific theories. These three concepts are examined together because sedimentation in the number concept was accompanied by sedimentation in the concept of a relation, and the latter contributed to sedimentation in the concept of a predicate.

I will not attempt to give a complete or fully documented history of changes in each concept. (See McPherson 1995, apps. A and B, for somewhat fuller treatments.) I aim only to give the reader a feel for the ways in which scientific concepts can change and what sorts of forces can drive the changes. I begin, in each case, with a description of the concept as it was understood in classical Greece, for I have concluded (on the basis of my studies of relevant Greek texts) that when these concepts were conceived by Greek scholars (some of the first thinkers to treat of them thoughtfully), they arose from these thinkers' own reflections upon concepts arising from first intentions. In each case, the original sense of the concept will be seen to come from conceptions of things present in or somehow depending upon real being, whereas the current sense of the concept is such as to lead to the conclusion that its conception did not involve any real being; it is, rather, an *ens rationis* in the most literal sense, something that can reside only in the mind.

9.7.1 Numbers

> Natural numbers were made by God; the rest is the work of man.
> Leopold Kronecker

In ancient Greek thought, numbers were distinct from the continuous magnitudes of geometry; what we would call positive whole numbers were the whole of number. Moreover, numbers were always tied to collections of individuals of some kind (see Klein 1934–1936/1968). As Aristotle revealed, a number, in the Greek way of thinking, is always a number *of* particular things (*Metaphysics* N.5, $1092^{b}19–20$), whether apples or fingers or coins; it is the number of individuals of one species or genus in a definite collection (*Metaphysics* N.1, $1088^{a}8–14$).

In the Greek science of numbers (i.e., arithmetic), the concept of a monad figured prominently. Some modern scholars claim that monads were understood as abstract units to be counted, which may be taken to imply that numbers were not always tied to real individuals. But there is evidence that a monad was understood as a boundary or partition

between items being counted, where the items are individual beings of one species; a monad may have been understood to separate or partition off one individual as it was added to a collection of individuals already separated out in counting (as Robert H. Schmidt has argued, in conversation; alternatively, a monad may have been understood as a resting-place or stopping-place, *monē*, for the movements (say, of a finger or hand) making up the act of separating out an individual as items are counted in succession—as the *telos* or end of one cycle of movements during counting). This thesis is compatible with Aristotle's description of counting as 'by parts' or 'by portions' (*kata meridas*), which implies separating something out and setting it apart or allotting it, and as 'takings in [or additions]' (*proslambanontes*; *Metaphysics* M.7, 1082^{b}34–36), as well as his description of a count (i.e., a number;[9] *arithmos*) as 'a delimited multitude' (*plēthos peperasmenon*; *Metaphysics* Δ.13, 1020^{a}13) and Eudoxus's definition of a count as 'a multitude marked [or separated] out by boundaries' (*plēthos hōrismenon*; see Klein 1934–1936/1968, 51). It is also compatible with Aristotle's characterization of monads as being one after another or in succession (*ephexēs*; *Physics* E.3, 227^{a}29–30), his description of a monad (along with a point, a line, and a plane) as something by which a body gets marked (or separated) out by boundaries (or bounded, defined, or delimited; *[toutōi] hōristai to sōma*; *Metaphysics* B.5, 1002^{a}4–6), and his description of a count or counting (*arithmos*) as that which marks (or separates) out by boundaries (or bounds, defines, or delimits) all things (*horizein panta*; *Metaphysics* Δ.8, 1017^{b}20–21). The thesis accords as well with a statement of Nicomachus: 'By means of the monad, all the counts having begun from the dyad, being separated out together one after another, generate the orderly species of that which is multiple in the proper sequence' (see Klein 1934–1936/1968, 52, for the Greek).

If monads were, in addition or instead, understood by some mathematicians to be the items of counting themselves, they nonetheless seem not to have been regarded as separate from real beings, but rather as *present in* real beings.[10] A monad (*monas*, 'aloneness', derived from *monos*, 'alone' or 'solitary') seems sometimes to have been understood as the *oneness* in an atomic being as isolated by abstraction in the Greek sense, that is, what is left over in an atom (e.g., a cat) when all its particular properties other than its oneness—a oneness concomitant with its indivisibility as something informed by its *eidos* or species (or "basic-level kind"; see Aristotle, *Metaphysics* B.3, 999^{a}1–6; Δ.6, 1016^{b}3–6; M.3, 1078^{a}23–25)—are mentally stripped away from it. (See *Metaphysics* K.3, 1061^{a}29–35,

and *Categories* 7, 7^{a}31–7^{b}9, for examples of abstraction as the Greeks understood it—*aphairesis*, 'taking away from', 'carrying off', or 'removal', or *periairesis*, 'taking away that which surrounds' or 'stripping off'.) This thesis (and the partition thesis as well) is in line with Euclid's definition of a monad: 'A monad is that because of which [or in accordance with which] each of the beings gets called one' (*Elements*, bk. 7, def. 1; see Heath 1956). Also compatible with the abstraction thesis are Aristotle's arguments that mathematical entities (presumably including the monad) do not exist separately from beings (*Metaphysics* M.2), even though they are sometimes considered separately by arithmeticians and geometricians (*Metaphysics* M.2; M.3, 1078^{a}21–23; *On the Soul* Γ.7, 431^{b}15–17), and that *arithmoi* in particular, which are counts of monads, do not exist separately (*Metaphysics* M.8).[11] The understanding of a monad as the oneness in an atom that is concomitant with the indivisibility deriving from its species is complemented by the understanding as a partition, for to delimit or define the items of counting by means of a partition is to reveal which species is the source of oneness for each of them. Counting individuals delimited in this way may even, in some sense, effect the abstraction that leaves only the oneness in a being, for to separate out an individual and count it as one is to ignore everything about the individual except its being an atom or monad; in being counted (and in having been counted), an individual is understood as one—as a monad.

It seems, then, that a number (or count) was normally understood to exist only by virtue of a collection of beings of the same kind, as the count of individuals in that collection. For the ancients, numbers could not exist independently of collections of beings.

This view was preserved by Roman mathematicians, but they created a numeric notation that allowed them to use collections of strokes on papyrus as the objects of their calculations (much as the Babylonians had used collections of slim wedge-shaped impressions in clay in their calculations). These exemplars of collections could take the place of other collections to facilitate reckoning. In the Roman numeral system (as in the Babylonian numeral system), the symbols for the numbers one through three are *I*, *II*, and *III*. A manipulation of these symbols is a manipulation of collections—collections of strokes. These collections can stand for, or stand in for, collections of individuals of any kind whatsoever (Schmidt 1986). Schmidt calls them "counterparts," and I will use this term here. A counterpart is not a *sign* for a collection, but an *example* of one that can stand in for another so that operations on it stand in for operations on the

collection for which it is a counterpart. Schmidt gives as another example of a counterpart a nautical chart. A course is planned on the chart, whereupon the planned movements are executed in the place that the chart represents. In a comparable way, manipulations of numeric counterparts lead to results that can be transferred to any other collections having the same numbers of individuals: if two strokes counted together with three strokes gives a collection of five strokes, then two coins counted together with three coins will give a collection of five coins. The Roman numeral for the number five, *V*, is not itself a collection of strokes, but it was understood to be a sign for, or rather shorthand for or a proxy for, five strokes; it meant IIIII. And so some Roman numerals (e.g., *V*, *X*, *L*) were not themselves counterparts, but stood in the place of counterparts and were operated upon just as if they were the counterparts they stood for.

When the Hindu-Arabic numeric notation became popular in the West, late in the twelfth century, the symbols seem initially to have been understood in just the same way as the Roman numeral *V*, namely, as shorthand marks or proxies for collections of strokes on paper that were counterparts for collections of individuals of any kind whatsoever. (Leonardo of Pisa—now known as Leonardo Fibonacci—called his book of 1202 on Hindu-Arabic numeric symbols and algebra *Liber Abbaci*, 'Book of the Abacus'. The new numeric symbols would have brought to mind an abacus because both the counters on an abacus and the digits of a Hindu-Arabic numeral were understood as counterparts in a place-value system.) Alternatively, the symbols may have been understood as proxies for Roman numerals, which were either counterparts for collections of individuals or shorthand or proxies for such counterparts (Schmidt 1986).

Over time, this understanding of the symbols was lost; mathematicians began to forget that their symbols were originally intended to be proxies for counterparts. As a result, the symbols began to lose their conceptual tie with collections of individuals, and the number concept began to change correspondingly, losing its basis in multitude.

With collections of individuals no longer consciously guiding the conception of number, the concept became more inclusive. Proper fractions were reinterpreted as numbers; ratios (newly interpreted as quotients) of whole numbers and of commensurable magnitudes were reinterpreted as (rational) numbers; and ratios of incommensurable magnitudes were reinterpreted as (irrational) numbers (or at least this seems to be the way

in which irrational numbers were originally understood; in modern times, irrationals are understood as "real" numbers invented so as to fill in gaps in the "real number line," where the filling of gaps is accomplished by means of Dedekind cuts or Cauchy sequences). For the number concept to include fractions of units, quotients of any two numbers, and quotients of any two magnitudes, whether commensurable or not, a number had to have been newly conceived as something similar in nature to a continuous magnitude; and so it had, as John Dee (1527–1608) explained:

> Practice has led *Numbers* farther, and has framed them, to take upon them, the show of *Magnitudes'* property: Which is *Incommensurability* and *Irrationality*. (For in pure *Arithmetic*, a *Unit*, is the common Measure of all Numbers.) And, here, Numbers are become, as Lines, Planes and Solids: sometimes *Rational*, sometimes *Irrational*. (1570/1975, 5)

The change in the concept likely came about because mathematicians thoughtlessly began to perform operations that the syntaxes of their mathematical languages permitted (such as multiplying and dividing, not just numbers, but also ratios) but that were not meaningful until the concept of number changed. This may be what Dee meant by "practice" framing numbers to take on a property of magnitudes.

Though the new concept of number as continuous like magnitude seems implicit in mathematical writings of the late Middle Ages and the early Renaissance, the first mathematician to whom an explicit espousal of it is attributed is Simon Stevin (1548–1620). He viewed number as a property of magnitude comparable to the wetness of water:

> Number is something in magnitude comparable to wetness in water, for as this extends everywhere and in each part of the water, so number tied to some magnitude extends everywhere and in each part of its magnitude: Just as to a water continuum there corresponds a wetness continuum, so to a magnitude continuum there corresponds a number continuum. Just as the wetness continuum of the entirety of the water undergoes the same division and separation as its water, so the number continuum undergoes the same division and separation as its magnitude, so that these two quantities cannot be distinguished by continuity and discontinuity. (1585/1958a, 502)

Stevin may have been influenced by his own adoption of decimal notation for fractions (see Stevin 1585/1958b). He was one of the first mathematicians in the West to use decimal fractions, and the first to successfully promote their use. Acceptance of this notation could lead one to believe that there is a number for every possible decimal expansion, so that the numbers can fill up a continuum.

Stevin even went so far as to argue that the notion of discontinuous (or whole) numbers is merely a product of the imagination:

> All that is just a quantity is not at all a disjunct quantity. Sixty, according as it is number, is a quantity (that is to say a number). Sixty, then, according as it is number, is not at all a disjunct quantity. As for that which you divide by your imagination, this proposed unique and whole quantity, into sixty *unities* [or *units*] (which you could divide, by equal reason, into thirty dualities, or twenty trinities, etc.), and which then you next define [to be] the divided up, that is not definition of the proposed of which there is some question: you could similarly divide the proposed magnitude, by the imagination, into sixty *parts*, and then by equal reason define it to be discontinuous quantity, which is absurd. (1585/1958a, 501–502; emphasis added)

So for Stevin, at least, numbers had become completely divorced from collections of beings and multitude. But this means that numbers had (ironically) moved completely into the realm of imagination, as *entia rationis* alone (despite the reality Stevin attributed to the "number" he imagined to be inhering in magnitudes).

Stevin's view of number as continuous found easy acceptance, perhaps because of its practical utility, or the utility of the associated decimal fractions, and perhaps also because it had been implicit in mathematical reasoning for some time (despite explicit rejections of the irrational numbers it permitted; e.g., Frater Fredericus said, c. 1460, 'An irrational number is not a number. For a number is that which a unit measures'; in 1544, Michael Stifel said that 'an irrational number is not a true number'; see Klein 1934–1936/1968, 251, n. 176; in 1560, Jacques Peletier argued that irrational numbers are not numbers in the absolute sense, but that they are nonetheless necessary in practice, even though unintelligible; he said that what they truly represent 'conceals itself in perpetual darkness'; see Klein 1934–1936/1968, 290, n. 302). The new number concept may also have been welcomed because it facilitated contemporaneous attempts to submit both numbers and magnitudes to algebraic treatment; doing so presupposed either interpreting geometric objects as special cases of numbers (as John Wallis seems to have done[12]) or interpreting arithmetic objects (i.e., numbers) as special cases of geometric magnitudes (as Descartes may have done[13]). But not all mathematicians understood the new, continuous number in the same way as Stevin. John Wallis (1616–1703) assimilated his concept of number to the concept of a ratio of continuous magnitudes. In Greek geometry, continuous magnitudes acquired something comparable to values only through comparison with other (commensurable) continuous magnitudes; for instance, the magnitude of one

side of a triangle was understood quantitatively in terms of its magnitude *relative to* the magnitude of another side of the triangle—that is, the ratio that magnitude had to the magnitude chosen as a standard. (For the Greeks, this ratio was always understood in relational, not numeric, terms; as will be seen in the next section, it was only much later understood to be a number.) For Wallis, any number was a ratio of some quantity to a unit quantity, or rather the quotient of the antecedent and consequent of that ratio (which he called an 'index' or 'exponent'):

> The whole of arithmetic itself, if looked at more closely, seems scarcely other than a doctrine of ratios. And numbers themselves [are] indices of just so many ratios whose common consequent is 1, unity [i.e., the unit]. For when 1, or unity, is regarded as [the] quantity set forth [as the reference unit], all the rest of the numbers (whether whole, or broken, or even irrational) are indices or exponents of just so many ratios of other [quantities] to [the] quantity set forth [i.e., to unity]. (*Mathesis Universalis*; for the Latin, see Wallis 1657/1695, *Opera*, vol. 1, as cited in Klein 1934–1936/1968, 220–221)

In this interpretation of numbers, Wallis attempts to understand the strange new continuous numbers in terms of the more familiar geometric concept of a ratio of magnitudes.

When even quotients of incommensurable magnitudes came to be understood as numbers, mathematicians could imagine that to every point along a continuous magnitude there corresponds a number.[14] To facilitate calculation, they even came to include negative numbers among the so-called real numbers. With no possible tie to multitude or even geometric magnitude, numbers were now fully divorced from any *entia realis* (making ironic the appellation "real numbers"). In the modern view, numbers correspond to points on the "number line," an imaginary entity that allows number to be understood to be continuous and extending to infinity in two directions from an origin.

With numbers divorced from *entia realis*, mathematicians got into great muddles trying to describe the interpretation of a numeral. Gottlob Frege (1813–1890), for instance, took a numeral to be a proper name for a number, which is, according to him, an invisible and locationless but self-subsistent individual of some mysterious sort defined in terms of one-to-one correspondence (see Frege 1884/1980). This odd view may again reveal an effect of notation. The interpretation of a numeral as a proper name for an individual of some sort follows naturally from the notation that mathematicians had come to use. In natural language, numerals enter mostly as quantifiers with count nouns for individuals (e.g., *three*

cats), in keeping with the Greek (and presumably our first-intentional) understanding of numbers; but in modern mathematical notation, numerals appear in isolation, just as proper names do in noun phrases. (The Greeks always placed a count noun next to a numeral, because a number was always a number *of something*; in arithmetic, the noun was *monas*—'monad'. The disappearance from mathematics of count nouns is a consequence of number moving into the realm of the purely imaginary, where numbers are no longer counts of beings; instead, they are points on the number line.)

Some mathematicians steered clear of the muddles by abandoning attempts to interpret a numeral. Mathematicians in the formalist camp came to view the written or typed marks on paper that are instances of numerals as the objects of mathematics, and operating on symbols, or syntactic manipulation, as the whole of number science. The symbols are not interpreted at all, in this way of thinking.

The concept of number seems to have become one of what Husserl (1954/1970) called "ideas emptied [of sense] which have been obscured and have become mere word-concepts; ideas burdened, through attempts at exposition, with false interpretations" (p. 74). The concept has become so weirdly distant from anything involving real being that numeric symbols have become little more than tokens—in the sense of vestiges of the numeric proxies for counterparts that mathematicians used into the Renaissance (for a numeral is no longer understood as shorthand for or a proxy for a counterpart for a collection of beings), as well as in the sense of formal marks that signal the permissibility of certain operations upon them. The original sense of the concept survives in only the vaguest forms, namely, in the fact that definitions of number begin with the definition of the natural numbers (though these include zero and one; the former is not a count, and the latter was originally the *measure* for counting) and in the fact that these numbers are defined in terms of succession, which is understood (if not initially defined) in terms of successive additions of one (but not of one *thing*) as an imperfect reflection of counting in the Greek mode. But as soon as the integers (which include negative numbers), the rationals, and the reals enter the picture, the original sense is tossed aside. This is not to deny the utility of the modern number concept in practical applications, but that utility depends upon interpreting a positive number that is the result of calculations as the measure of the multitude of the beings in a collection, or as a multiple of unit magnitudes (such as inches or centimeters).

Changes in the concept of number appear to be attributable, in a great measure, to changes in notation that set up conditions for forgetfulness about the original sense (see also Schmidt 1986). The Hindu-Arabic numeric notation made the counterpart function of numerals invisible, opening the door to the imposition of a new layer of sense upon the number concept (with the new sense apparently seeping into mathematics through initially meaningless extensions of mathematical operations that were permitted by the syntaxes of mathematical languages). The modern sense of the number concept, with number regarded as continuous like magnitude, fully covered over the original sense after the introduction into widespread use of decimal fractions.

9.7.2 Relations

A new interpretation of the ratio accompanied the new interpretation of number as continuous. The ratio was the prototypical relation for mathematicians, and so the new understanding of it may be responsible for observable change in the concept of a relation in general.

Greek mathematicians understood a ratio to be an aspect of the being of one magnitude or number as considered relative to another. So a magnitude—say, one side of a given triangle (understood as a magnitude, i.e., as a length)—having a ratio of 2:1 to another magnitude—say, one of the other sides of the triangle (understood as a magnitude)—was seen to have as a part of its being doubleness in relation to the other; the greater magnitude was understood to be the subject or substrate for the doubleness, which was determined or defined by reference to the lesser magnitude, the object of the relation. A relation of any sort was understood in this way, as an aspect of the being of one individual, its subject, defined with reference to another individual, its object.

Oddly enough, ratios came to be interpreted as *numbers*. The ratio 6:3 is now interpreted as the common fraction 6/3, which is equal to the number 2, the result of dividing the numerator by the denominator (i.e., the quotient). We call the numbers that are identified with the new "ratios" *rational numbers*.

The reinterpretation of ratios as numbers seems to have been tied to the new concept of number as something along a continuum. When numbers were no longer understood as measured multitudes, but as exponents or indices of ratios of magnitudes (for Wallis), properties of magnitudes (Stevin), or multiples of unit magnitudes (Descartes), the result of the division of the antecedent of a ratio by the consequent could be interpreted

as a number whether or not the result was a whole number. Even before numbers were *explicitly* interpreted as continuous, the potential reinterpretation of ratios as numbers may have been at least partially actualized through forgetfulness concerning the use of what were called "denominations." In use from the late Middle Ages, denominations are names given to ratios, taken from their "base" ratios. A ratio—say, 6:3—is denominated by the ratio of the smallest numbers for which the antecedent is in the same relation to the consequent—or 2:1 in this case. But how did denominations contribute to a reinterpretation of ratios as numbers? It seems that denominations themselves came to be understood as numbers. Probably the first to be so understood were denominations of the prototypical ratios, "multiples" such as double (2:1) and triple (3:1), which are ratios to the unit; such denominations were especially likely to come to be understood as numbers because they were given as the antecedent alone (e.g., 2 for 2:1, 3 for 3:1). But it seems that the denomination for any ratio of commensurables came to be understood as a number; Thomas of Bradwardine (1290–1349) said that any ratio of commensurables 'is immediately denominated by some *number*, just as in the case of the ratio double, and triple, even so in the cases of the others' (1328/1955, 66; emphasis added). Moreover, from the thirteenth century onward, denominations were used in mathematical computations just as if they were numbers.

When ratios came to be interpreted as numbers, mathematicians' understanding of relations seems to have changed concomitantly. The number to which a ratio is reduced—say, the quotient 2 as the reduction of the ratio 6:3—is not an aspect of the being of the antecedent defined by reference to the consequent; it is, rather, *a separate individual number*. (The 2 is a measure of parts of the antecedent, where each part is equal to the consequent; but unlike the *ratio* of that measure to unity, or 2:1, it is not *relational*.) A relation in general likewise came to be viewed as separate from the two individuals involved, not present in either individual—a third "thing" of some sort. For this reason, scholars ceased speaking of the relation *of* one thing *to* another (where the *of* implies that the relation *belongs to* the first thing, and the *to* implies that the relation is defined with reference *to* the second thing). They began to speak instead of the relation *between* two things. This way of talking seems to imply that a relation came to be viewed as something that exists in neither individual, but that exists between them somehow, connecting them with one another. With a relation newly conceived as a connection of some sort, it can

involve more than two individuals, in which case it is sometimes spoken of as a relation *among* individuals.

Gottfried Wilhelm Leibniz (1646–1716) wrote what is perhaps the first and maybe even the only explicit description of the modern "relation." He characterized it as a type of relation distinct from the usual and described it as an 'ideal thing', which meant, for him, an idea in the mind of God (e.g., 1714/1902, 262). His description of the new "relation" appears in a letter written to Isaac Newton's disciple Samuel Clarke:

> The ratio or proportion *between* two lines L and M can be conceived in three ways: as a ratio *of* the greater L *to* the lesser M, as a ratio *of* the lesser M *to* the greater L, and finally as *something abstracted from the two*, that is to say as the ratio *between* L and M, without considering which is the antecedent or the consequent, the subject or the object.... In the first consideration, L the greater is the subject; in the second, M the lesser is the subject of that accident, that the philosophers call relation or rapport. But which of them will be the subject in the third sense? One could not say that both of them, L and M together, are the subject of such an accident, for that way we would have one accident in two subjects, which would have one leg in the one, and the other [leg] in the other, which is contrary to the notion of accidents. Therefore one must say, that this rapport [or relation] in this third sense is really *outside of the subjects*; but that being neither substance nor accident, it must be *a purely ideal thing*, the consideration of which is nonetheless useful. (1717/1965b, 401; emphasis added)

By the "ideal" relation "abstracted" from the two lines, Leibniz likely meant the *order* of the magnitudes of the two lines, for elsewhere he described time and space as orders that he called "relations" (see Leibniz 1717/1965b), and, in the following passage, he again describes orders, as well as various other arrangements of interrelated entities, as individual relations:

> There are ... examples of a relation among several things at once, as that of order or that of a genealogical tree, which expresses the rank and the connection of all the terms or members; and even a figure like that of a polygon contains the relation of all the sides. (1765/1965a, 211)

A "relation" in the new sense (which was, for Leibniz, an idea in the mind of God) cannot be present in any *ens realis*, and so it can be nothing more than an *ens rationis* in the minds of modern thinkers.

In mathematics, a relation (or what is called a "binary relation") has come to be defined and understood as a *set of ordered pairs*. The order is such that the first coordinate in a pair is always in the relation to the second coordinate in the pair. The set of all the first coordinates and the set of all the second coordinates are called the "domain" and the "range" of

the relation, respectively. A relation defined as a set of ordered pairs of individuals resembles Leibniz's favorite "ideal" relation, namely, an *order* of individuals; but it is not the order itself; it is, rather, ordered *individuals*. It is a poor reflection of a relation in the original sense, for both coordinates are *individuals*—say, the numbers 6 and 3 (or delimited multitudes of 6 and 3 individuals, if numbers are interpreted more traditionally)—whereas a relation—say, *double*—is just one aspect of the being of an individual (or of a delimited multitude of individuals), which is defined with reference to another individual (or to another delimited multitude of individuals)—say, of 6 (defined with reference to 3); the doubleness of 6 as compared to 3 is not equivalent to 6 or to 3, or to 6 and 3 considered together, or to their order. The order of two individuals in an ordered pair is a conventional way of signaling which individual bears the relation and which individual it is related to, which reveals the stamp of the original sense of the concept. But since the *inverse* of a relation, or the set of ordered pairs with the order reversed, is usually *identified* with the relation, and since sets of ordered triples, ordered quadruples, and so on, are also considered to be relations, the modern sense of a relation as something separate from and somehow connecting the individuals involved has evidently been laid over the original sense. And since a relation is *defined* as a set of ordered pairs, as opposed to an aspect of the being of the first coordinate as considered relative to the second coordinate, the original sense is covered over with yet another layer of sense. The original sense nonetheless peeks through the formalization in the ordering of the individuals in a pair (with the bearer of the relation first in the order). The original sense of *relation* somehow lies at the bottom of the mathematical concept, but the Leibnizian notion and another idea, that of individuals in a certain order, are laid over the original sense.

The concept of a relation had its original sense covered over, it seems, primarily because of a new conception of the prototypical relation, the ratio—a new conception tied to change in the concept of number. An additional layer of sense that conceals further the original sense came to be laid upon the concept as a result of its being incorporated into set-theoretical mathematics, which deals only with individuals—individuals qua individuals—so that relational being can be accommodated only through placing individuals possessing it and the individuals to which they are referred into sets. Set theory provides no means for dealing with relational being in a way true to its nature as an aspect of the being of some substrate, dependent for its existence upon that individual and some other individual to which the former is referred so as to define the relation.

9.7.3 Predicates and Predication

Aristotle's teachings on *logos* in the *Organon* reveal a highly developed understanding of predicates and predication. Though his view was probably unique to him, his concepts of predicates and predication appear to be based on first intentions, so they are worthy of careful consideration—especially because they are so well hidden in modern translations and treatments of his works.

The words Aristotle used for a predicate and predication are clues to his concepts of them. The noun he used for a predicate is *katēgoria*, which is derived from the verb he used for predication, *katēgoreō*. This verb means 'accuse', or literally 'speak out against publicly'; it is formed from the prepositional prefix *kata*, 'against', and the verb *agoreuō*, 'speak in the agora (i.e., the assembly of the people)'. In common language, the noun *katēgoria* was used for the speech for the prosecutor in front of a tribunal (and it was opposed to *apologia*, the speech for the defendant). Aristotle sometimes used another expression for predication, one synonymous with *katēgoreō*: *legō kata tinos*, 'speak against someone/something'. Aristotle's choice of expressions for a predicate and predication[15] suggests that he regarded predication as an attribution of responsibility to the subject for whatever the predicate signifies (cf. Heidegger 1927/1962). In accusing someone of some deed, we hold that person responsible for it; we claim that the person gave rise to it. (In Athenian law, an accusation could be made against an animal or something inanimate if, say, it had played a part in a death by unnatural causes (see McPherson 1995). So the use of accusation as a metaphor for predication would not carry the implication that predication is restricted to predications about persons.)

Aristotle seems to have based his ascription of responsibility to the subject on its being the origin or *archē* of that which the predicate signifies. He used the verb *huparchō* to describe what a predicate does in relation to a subject. This word contains, as a prefix, the preposition *hupo*, 'under', and the verb *archō*, 'originate'. It means to originate *under* in the sense of being dependent upon or under the power of.[16] So Aristotle seems to have understood the being a predicate signifies to originate in dependency upon a subject. (In *On Interpretation* 5, 17ª23–24, he said that 'the simple declarative sentence [*apophansis*] is significant spoken sound about whether something [in the case of an affirmation] originates

in dependency [*huparchei*] or [in the case of a denial] does not originate in dependency'. In *Prior Analytics* Á.37, 49ª6–8, he explained that this dependent origination is to be apprehended differently for each of the 10 schemata of predication, or *katēgoriai*.) Much the same idea is implied by the word chosen for a subject: *hupokeimenon*, the present (middle) participle of the verb *hupokeimai*, 'underlie', here used as a nominal, means 'that which is underlying'. The subject is the being that supports the being signified by the predicate; it is its substrate and its source.

Laying an accusation against someone also brings something about that person to light; it reveals something brought into being by that person (say, an unlawful deed), something that was hidden. Aristotle seems also to have understood predication to reveal, or make noetically manifest, something about the subject.[17] This view is revealed, again, in his terminology. His word for a declarative sentence, which combines a predicate with a subject and a copula, is *apophansis*; the preposition *apo* that appears as a prefix means 'away from' or 'forth', and *phansis* is equivalent to *phasis*, a noun derived from the verb *phainō*, this verb meaning 'bring to light', 'cause to appear', 'show', 'uncover', or 'reveal', but also 'denounce' or 'inform against'. The primary meaning of the word *apophansis* seems to have been 'showing forth'. In contrasting the effect of an apophantic utterance with the effect of an isolated word, Aristotle said, 'Now the noun as well as the *rhēma* [i.e., verb or adjective], let it be [called] only an utterance, for one is not, in speaking in this way, making something [noetically] manifest with that spoken sound so as [for it] to show itself forth [*apophainesthai*]' (*On Interpretation* 5, 17ª17–19). His use of the middle-voice form of the infinitive of the verb *apophainō* reveals that the subject is showing *itself* forth, from itself (see Heidegger 1927/1962); for much the same reason, Aristotle described the sorts of being signified in the different schemata of predication—the *katēgoriai*—as *kath' hauta*, or 'because of (or in accordance with) themselves' (*Metaphysics* Δ.7, 1017ª22–23).[18] The nature of the showing can be discerned through a consideration of the word *phasis* that is a part of the word *apophansis*, and that is also a part of the words for an affirmation and a denial, that is, a positive and a negative declarative statement, namely, *kataphasis* and *apophasis*.[19] *Phasis* (as derived from *phainō*; *phasis* was derived from *phēmi* as well) had one meaning that seems to be particularly enlightening in this context: it was used for the appearance of a (fixed or wandering) star as it rose above the horizon, and especially for its first such appearance after a period of concealment under the sun's beams

(i.e., for its heliacal rising). So the word strongly suggests something that was hidden coming to light or becoming manifest. The same suggestion comes from another source. As Aristotle pointed out, *apophansis* is the only kind of utterance that can be judged true or false; neither an individual word or phrase nor a sentence of any other type (e.g., a question, a prayer, a request, or a command) can be said to be true or false (see *On Interpretation* 1, 16ª9–18; 4, 16ᵇ33–17ª4). But the Greek word translated as 'true' is *alēthēs* (*a-lēth-ēs*), 'taking out of hiding' or 'unconcealing' (or 'unconcealed'). The privative or negative prefix *a-* expresses want or absence, loss, or forcible removal, and the verbal stem contained in this adjective is that of the verb *lēthō* or *lanthanō*, which means 'escape notice', 'be unseen', 'be unnoticed', or 'be unknown'; in the middle and passive voices, this verb means 'forget'. So the word usually translated as 'true' suggests something failing or ceasing to escape one's notice or remain unseen; it suggests something that was hidden or forgotten—or something unknown—being brought to light or revealed. (The Greek word for *false* is *pseudēs*, 'deceitful' or 'lying'; it means giving the impression of unconcealing something without doing so.)

That which predication brings to light is *being*. This is evident in the fact that the copula, in any language that has it, is the verb meaning 'be'. In declarative statements, the copula (whether or not it is explicit)—which is conjugated to agree with the subject (in person and number)—indicates that being is unconcealed from the subject.[20] (When a predicate and the copula combine with a subject, the being that is shown forth or unconcealed from the subject—the being that the predicate signifies—is being that depends for its existence upon the subject, its support and its origin. When the copula combines with a subject alone, as in *Socrates was*, the being unconcealed is that of the subject as a whole.) And so Aristotle said that the 'is' in an affirmation signifies that it is true or unconcealing (*Metaphysics* Δ.7, 1017ª31–34), that being is the true or the unconcealed, and that a true affirmation is unconcealing because the being signified by the predicate is lying together with the being signified by the subject (*Metaphysics* Θ.10, 1051ª34–1051ᵇ13).

The nature of the experience of an unconcealment of being is revealed in the use of the word *epistēmē* for the understanding that comes from hearing a true apophantic utterance or a syllogism or dialectical argument in which such utterances are properly combined. This noun is derived from the verb *epistamai*, which is believed to be an old middle-voice form of *ephistēmi*; the latter is composed of the prepositional prefix *epi*, mean-

ing 'upon', and the verb *histēmi*, which has among its intransitive meanings 'stand', 'stand still', and 'stand firm'. And so the most literal meaning of the nominal *epistēmē* (formed with the suffix *-mē*) would seem to be 'standing upon', 'standing still upon', or 'standing firm upon'; what we call *understanding* (or standing under) was called *overstanding* (or standing over or upon). The standing would seem to be the mind's standing upon unconcealed being. Aristotle regarded this standing as a stillness or resting of the mind—resting not in the sense of being slack, but in the sense of being arrested by a tension in one direction: 'Mental perception [*noēsis*] is more like a sort of rest [or stillness] and stopping than motion' (*On the Soul* A.3, 407^{a}32–33); 'When the discursive thought [*dianoia*] has come to rest and has come to a standstill, we are said to stand upon [or understand; *epistasthai*] and to intend [or attend; *phronein*]' (*Physics* H.3, 247^{b}11–12). The experience Aristotle described is likely the aiming of the mind that is concomitant with an unconcealment of being; in intending or aiming toward being, the mind is necessarily standing firm for so long as the being is unconcealed—for when it ceases to stand still, it will turn in other directions, and the being toward which it was aimed will slip out of awareness, entering into or returning to a state of escaping one's notice or being hidden or forgotten.

The Aristotelian account of predication and of the *apophansis* or showing forth that results from it implies that hearing or reading or saying to oneself "Cats are furry" makes the being of cats' furriness—being that originates in and depends upon cats—appear noetically to the mind as it aims toward that being, which was escaping one's notice, hidden from consciousness or forgotten, and which now comes to light (and remains in the light until the mind ceases to stand firm, aimed toward it, and turns elsewhere).

After the Aristotelian theory of predication was forgotten, concepts of predication were swept every which way with the currents of philosophical movements, like shifting sediment. For a partial history of the various views that arose, see McPherson 1995. Briefly, here are a few of those views: According to nominalists such as William of Ockham, the subject and the predicate are names for the same thing (and Geach (1962) has thoroughly trounced this view). In the opinion of Thomas Hobbes, they are marks that bring to mind thoughts of the same thing. James Mill, influenced by Hume's and Hartley's associationism, asserted that they are names for ideas experienced in succession or concurrently. The theories of Hobbes and Mill are examples of one general trend. Under the influence

of materialism—a tenet that precludes any serious consideration of first intentions—many thinkers came to deny that linguistic signs can bring the mind into any relation to being. The force of the copula 'be' was forgotten, and predication came to be seen as a relation of one mental entity (e.g., a concept or an idea) to another. As such, it could not involve any attribution of responsibility for the origination of being, or any unconcealment of being.

A view revealing another trend had become the "established opinion" by the mid-nineteenth century (Mill 1851, 103) and still prevails: the idea that the subject is included in a class of things that the predicate is supposed to signify; *Cats are furry* is supposed to mean that cats are included in the class of furry things. John Stuart Mill (1851) described this theory as "a signal example of a logical error very often committed in logic, that of ... explaining a thing by something which presupposes it" (p. 104); predication in the original sense is presupposed in the class-inclusion approach because the class of furry things cannot be defined unless one can determine which things are furry—that is, of which things the predicate *furry* can be truly predicated. This class-inclusion approach is in keeping with a trend toward extensional versus intensional thinking. As modern times approached, the extensional (e.g., spatial dimensions of bodies) came to be deemed more and more real as compared to the intensional (i.e., that which intensifies and remits, such as a form or a quality; more and more qualities came to be considered "secondary," or primarily subjective). This trend is evident in Descartes's assertions that only extension and its concomitants (e.g., figure and motion) can be deemed real with any certainty, the reality of qualities being questionable (e.g., *Meditations on First Philosophy* 3), and that extension is the essence of bodily substance (e.g., *Principles of Philosophy* 3). (Robert H. Schmidt has argued, in conversation, that this extensional bias arose because of a desire to follow Galileo in seeking a mathematical reality behind the appearances combined with a continuing failure to adequately measure intensive magnitudes so that intensions could be mathematized—a failure that led to the abandonment of this measurement problem.) With the reality of intensional being (such as a quality) qua intensional widely denied, such being came to be reinterpreted as a collection, a class or a set, so that it could be imagined to be extensional rather than intensional.

As modern symbolic logic developed, the class-inclusion interpretation of predication underwent a change so as to include classes or sets of ordered couples, triples, and so on. In symbolic logic, a "predicate" is

understood to signify, in the case of a monadic or one-place predicate, a *property*, or, in the case of a polyadic or many-place predicate, a *relation* in the modern sense (i.e., an order or other "connection" of any number of interrelated individuals), and the usual interpretation is extensional rather than intensional, with a property identified with the class or set of individuals possessing that property, and with a relation identified with the class or set of ordered pairs (or ordered triples, etc.—ordered *n*-tuples) for which the relation holds. The idea has its origin in Frege's many-place function (even though Frege did not understand predication in terms of class inclusion). In a Fregean function, variables symbolized by letters are substituted for some or all of the noun phrases that are the arguments of a verb heading the predicate of a declarative sentence. This historical source alone suggests that the concept of a predicate in symbolic logic is irrelevant to a theory of predication, for Frege did not design his symbolic language to take account of the distinction between a subject and a predicate, and so predicates did not find their way into his language:

> A distinction of *subject* and *predicate* finds *no place* in my way of representing a judgment.... [Take] the two propositions 'the Greeks defeated the Persians at Plataea' and 'the Persians were defeated by the Greeks at Plataea'.... Even if a slight difference of sense is discernible, the agreement in sense is preponderant. Now I call the part of the content that is the same in both the *conceptual content. Only this* has significance for our symbolic language; we need therefore make no distinction between propositions that have the same conceptual content. (1879/1952a, 2–3)

Frege found that retaining the distinction between a subject and a predicate in a formalized language was "obstructive of [his] special purpose" (p. 4), namely, to model a language of thought on the formalized language of mathematics (in which, he said, "subject and predicate can be distinguished only by doing violence to the thought" (p. 3))—a language to be used for drawing valid inferences. He therefore dismissed as "slight" the difference in the sense of an active and a passive statement—a difference he seems not to have understood, for he thought that the subject is merely that which occupies the place in the word order that the speaker wants the hearer "to attend to specially" (p. 3). Frege failed to see the real difference in sense: an active predicate signifies action, and a passive one signifies an undergoing of action. Aristotle characterized these as distinct types of *katēgoria*, and distinct types of being—and so they are, for to hit and to be hit, or to defeat and to be defeated, are surely different things. Unfortunately, Frege's view that active and passive utterances have (more

or less, for his purposes) the same conceptual (or semantic) content came to be shared by many later thinkers (who saw no difference at all in sense, irrespective of any purpose). This erroneous way of thinking likely came to prevail when the modern concept of a relation was incorporated into the concept of a predicate. Since a relation, in the modern sense (which includes transitive actions), is not an aspect of the being of any particular one of the individuals involved (but something outside all of them and somehow connecting them), any given relation is often assumed to be unchanging in nature regardless of which individual involved in it is chosen as the subject of a sentence (though the unchanging nature attributed to it always comes from choosing—sometimes unconsciously or tacitly—one individual as the subject; with verbs for actions, that individual is the one acting, so that the nature attributed to the "relation" or "predicate" is active, even when the associated verb is in its passive form). And so the sense of *defeated* can be imagined to be the same in the two sentences *The Greeks defeated the Persians* and *The Persians were defeated by the Greeks*; the second sentence, like the first, can be taken to be about an action rather than an undergoing of action. The following consideration may help highlight the distinct sense of the passive. The passive voice developed out of the middle voice in ancient languages; the distinct meaning of a passive utterance can thus be seen more clearly through considering an utterance with a meaning comparable to that of an utterance in the middle voice: *The Persians let themselves be (or got themselves) defeated by the Greeks* clearly has a different meaning than *The Greeks defeated the Persians*.

The concept of a predicate came to subsume the modern concept of a relation through David Hilbert (1862–1943) and his collaborators, who were the first mathematicians to use the term *predicate* (*Prädikat*) for polyadic relations and Fregean polyadic functions (see Hilbert and Bernays 1934; Frege (1891/1952b) called grammatical predicates "functions," but he did not call polyadic functions "predicates"). Hilbert and Ackermann (1938/1950) described such "relations" as "predicates having several subjects" (p. 45), revealing a confusion of subjects with arguments and a failure to see that the predicate must change with the subject (e.g., from *defeated the Persians* to *defeated by the Greeks*). They attempted to justify the new concept of a predicate as follows:

> The Aristotelian formalism [based on the structure of a declarative sentence, i.e., a predicate attributed to a subject] turns out to be inadequate even in quite simple logical situations. It is basically insufficient for dealing with the logical

foundations of mathematics. It fails, specifically, whenever a *relation among several objects* is to be represented symbolically.

This may be clarified by a simple example. Consider the statement: "If B lies between A and C, then B also lies between C and A." ... In the ... [monadic predicate calculus, the statement] may in fact be formulated thus: "If an ordered triple of points has the property that the second point lies between the first and third, then it also has the property that the second point lies between the third and first." This formulation, however, fails to express the logical essence of the statement, namely, the symmetry with respect to A and C of the relation "between." Therefore, it cannot be employed to derive the mathematical consequences of the statement under consideration. ...

... Since the foregoing calculus has turned out to be inadequate, we are forced to seek a new kind of logical symbolism. For this purpose we return to that point in our discussion at which we first went beyond the sentential calculus. The decisive step there was the division of sentences into subject and predicate. ... [We now] separate in the rendering of a sentence the *objects* (*individuals*) from the *properties* (*predicates*) attributed to them and ... symbolize both explicitly.

This is done by employing *functional symbols with argument places* (n-adic functional symbols where n is the number of argument places) for the symbolic rendering of predicates, in which symbols representing objects are to be substituted in the argument places. ... If the relation of the smaller to the greater is expressed by the two-place functional symbol $<(\ ,\ )$, then $<(2, 3)$ is the symbolic rendering of the sentence "2 is less than 3." Likewise, the sentence "B lies between A and C" may be rendered by $Z(A, B, C)$.

All mathematical formulas represent such relations among two or more quantities. For example, to the formula $x + y = z$ there corresponds a triadic predicate $S(x, y, z)$. The truth of $S(x, y, z)$ means that x, y, and z are connected by the relation $x + y = z$. (1938/1950, 55–57)

They pointed out the novelty in their use of the word *predicate* for the modern "relation" in a footnote and without explanation:

Hitherto it has been customary in logic to call only functions with one argument place predicates, while functions with more than one place were called relations. Here we use the word "predicate" in a quite general sense. (1938/1950, 57, fn. 1)

Hilbert and Bernays first introduced the new usage of the term as follows:

We understand "predicate," here and in what follows as well, always in a wider sense [than the usual], so that even predicates with two or several subjects are included. Depending on the number of subjects, we speak of "one-place," "two-place" ... predicates. (1934, 7)

This extension of the term *predicate*, so casually introduced, was unfortunately accepted by later mathematical logicians, apparently without question, and it has even influenced views on predicates and predication outside of mathematics (e.g., in philosophy of language, linguistics, and

psychology). As a result, many modern scholars think a predicate is predicated of all the arguments of a verb heading an actual (i.e., a grammatical) predicate. And so we find Rispoli (1995) saying that in the sentence *I took a spoon from the drawer*, "*took from* is a predicate predicated of three arguments: I, spoon, and drawer" (p. 333). In reality, a different predicate is predicable of each of the three noun phrases, for the type of being that can be shown forth from each of the individuals involved in the event is different in each case; the predicate *took a spoon from the drawer* is predicable of *I*, *taken from the drawer by me* is predicable of *a spoon*, and *the place from which I took a spoon* is predicable of *the drawer*.

Modern linguists have a number of different opinions about the nature of predication. Some describe it simply as "saying something" about the subject, and others claim that "the speaker announces a topic and then says something about it" (Hockett 1958, 201), a view sometimes understood in terms of the subject's or topic's expression of *given* information (i.e., information already given in the discourse context) and the predicate's introduction of *new* information. The idea that a predicate "says something about" a subject is far too vague to qualify as a theory. The reduction of the subject and the predicate to a topic and a comment upon it seems misguided, for in the sentence *That idiot wrecked my car*, the subject noun phrase seems to comment on the character of the subject, not just to point to an individual about whom something will be said. But perhaps the most serious problem with this view, as well as with the view that a subject provides information given in the discourse context and a predicate provides new information, is that it does not account for the facts of predication, such as the fact that subjects tend to be *ousiai*, that is, 'beingnesses' or substances, that primary beingnesses or individuals cannot be predicated of anything other than themselves, that genera are predicated of species but species are not predicated of genera, and that being that is dependent upon a substrate for its existence, such as a quality, a relation, or an action, can be predicated of beingnesses but beingnesses cannot be predicated of any such dependent being.

The modern concepts of a predicate and predication are so sense-depleted that modern linguists rarely find any place for them in their theories, and when predicates *do* find a place in linguistic theories, they are typically treated as purely syntactic entities.

In postclassical times, new conceptions of predicates and predication seem to have been shaped largely by philosophical trends rather than the

nature of the being a predicate signifies or its relation to the being a subject signifies. The concept acquired a new layer of sediment when it was incorporated into symbolic logic. The aim of modeling a logical language after a mathematical language, such as the language of arithmetic or algebra (Boole and Frege) or the calculus of sets (Peano), and the aim of creating a language for the deduction of mathematical consequences (e.g., Whitehead and Russell, Hilbert) blurred the distinction between a declarative sentence and a mathematical formula; and a rash, ill-considered decision to use the term *predicate* for a Fregean function followed by the almost universal, unquestioning adoption of this use of the term led to widespread forgetting of the distinction between a predicate and both a Fregean function and a relation in the modern, sedimented sense and of the distinction between a subject and an argument. Contemplation of predicates has been conspicuously absent in the creation and adoption of new concepts of a predicate. Geach (1962), regarding a class-inclusion interpretation of predicates in statements of a certain kind, commented that "writers hurry over the topic, as over a thin patch of ice" (p. 15); the same can be said about discussions of predication in general.

9.8 Some Consequences of Sedimentation for Scientific Theories

It is one thing for people who do no scientific work to let sedimented concepts guide their thinking; it is another thing for a theoretical scientist to use words or signs tied to sedimented concepts in the construction of theoretical statements. When a concept becomes sedimented so that it no longer reflects the nature of the being that originally gave rise to it, any theory shaped by that concept will fail to permit a beholding or unconcealment of that being and will actively conceal it. The theory may reflect well the thinking of the theorist, but it will be of little value if the being it reveals is only that of *entia rationis* in the minds of the theorist and his or her followers.

A consideration of some specific consequences of using the sedimented concepts analyzed above will help to show how sedimented concepts can impede the formation of true theories—that is, theories that unconceal being.

Psychologists and philosophers of mind often aim to distinguish unlearned from learned concepts (or mental representations). But discussions about whether a concept is unlearned or learned can only be meaningful if the original sense of the concept is known—for this is the only sense that

could be unlearned. Consider, for instance, the concept of number. The modern concept of number as continuous emerged in human thought only within the last few centuries. It is highly unlikely that it is unlearned, or that we have some special unlearned capacity just for understanding or using this sedimented concept. For this reason, arguments in favor of unlearned mental representations of numbers that are continuous, with any whole number represented as an extent or magnitude that is a multiple of a unit magnitude (e.g., Meck and Church 1983), would seem to require careful examination.

Because sedimentation hides the original sense of a concept, or the sense most likely to have been conceived through first intentions and to reflect the nature of being, doors that would be open to a theorist familiar with the original sense are closed. But removing sedimented layers from one's concept to reveal the original sense can open those doors. For example: if numbers are understood first-intentionally as counts of individuals of the same kind, then unlearned representations of numbers (if there are any) may be counterparts for collections of individuals (much like Roman numerals), with collections of like symbols representing collections of individuals of any kind whatsoever with the same cardinalities. (Wynn (1992) presents evidence consistent with the existence of unlearned representations of numbers that are counterparts of this sort.)[21]

Sedimented concepts can lead theorists down blind alleys. Take, for instance, the sedimented concept of a predicate adopted by modern mathematicians and those influenced by them, which subsumes the sedimented concept of a relation. This concept led some linguists down a path that is now fairly widely recognized as a dead end. The mathematician's (polyadic) "predicate" is a relation in the modern sense, so that it is imagined to apply equally and simultaneously to all the arguments of a verb that heads a grammatical predicate (i.e., to be something that connects them together somehow, with a nature that remains the same regardless of which argument is chosen as the subject of a sentence). Linguists who adopted this sedimented concept were blinded to the difference in sense of an active and a passive sentence containing the same verb and the same noun phrases but with a different noun phrase in subject position and possibly a different verb form. They thought that *any* sentence with a predicate headed by the verb *defeat* (even when it is in its passive participial form) must be about the action of defeating (and so they made a distinction between the "grammatical" or actual subject of a sentence and the "logical" subject, which is the noun phrase for the indi-

vidual carrying out an action—but this reveals an inconsistent vestige of the Aristotelian view according to which a predicate signifies being that originates in the subject). They failed to see that a passive utterance is about the undergoing or suffering of an action, which is being of a distinct type. For this reason, they regarded a passive sentence as an active sentence that has undergone a "transformation" in which the words were rearranged, the verb may have changed form, and a few elements were added (e.g., *is* or *was* and *by* in English) without any accompanying change in meaning. This way of thinking is tied to the invention of two notions: (1) transformations in language processing (and so Chomsky (1965) said that sentences containing passive participles, or sentences in which the "logical" subject and object differ, in this way of thinking, from the "grammatical" subject and object, "provide the primary motivation and empirical justification for the theory of transformational grammar" (p. 70)), and (2) a "deep structure" (later "D-structure"), which contains the untransformed version of a sentence—a notion supplemented by the "Katz-Postal principle," or the idea that the meaning of the sentence in deep structure is unaffected by the transformation that produces the "surface-structure" sentence. Though the notion of deep structure was rejected by some linguists not long after its emergence in Chomsky's (1965) theories (e.g., in some papers first circulated in 1967: Lakoff and Ross 1976; McCawley 1968), and though the accompanying Katz-Postal principle was soon rejected by Chomsky and his followers (e.g., Jackendoff 1972), deep structure (as D-structure) remained a part of Chomsky's popular theories for many years (e.g., Chomsky 1991), albeit with progressively less prominence (see, e.g., Lakoff 1980) and a progressively more restricted role with regard to meaning; Chomsky (e.g., 1995b) only recently eliminated it from his theories. The notion of a transformation, though also questioned early on (e.g., in 1967 by Postal; see Postal 1976), still survives in Chomsky's theories (e.g., Chomsky 1995b), even though it has a greatly diminished role in the grammar (and has largely fallen out of favor with other linguists as proposed alternatives to a transformational grammar have come into favor). Much ink will have been spilled in vain over this notion and the notion of deep structure before they are both finally abandoned.

9.9 Generating Theories That Unconceal Being

Let us not fool ourselves. All of us, including those who think professionally, as it were, are often enough thought-poor; we all are far too easily thought-less.

Thoughtlessness is an uncanny visitor who comes and goes everywhere in today's world. For nowadays we take in everything in the quickest and cheapest way, only to forget it just as quickly, instantly....

... Man today is in *flight from thinking*. This flight-from-thought is the ground of thoughtlessness.

Martin Heidegger, *Discourse on Thinking*

If theoretical statements are to be genuinely apophantic, unconcealing being and permitting a noetic beholding (*theōria*) of being, theorists must adopt and use scientific concepts and terms much more consciously and deliberately than is usual nowadays. They must not allow themselves to fall an easy prey to the pervasive forgetfulness of sense depletion and sedimentation—to that which only *seems* to be—but must pursue its opposite, the unforgetting of well-rounded unconcealment or full understanding.

Concepts should not be adopted passively. Rather than trusting other scholars to have properly conceived a second-intentional concept through reflection upon first-intentional concepts, and rather than having faith that the concept remains unsedimented, a theorist should compare any second-intentional concept used with the first-intentional concepts that originally gave rise to it to see whether the former adequately reflects the latter, and should compare the first-intentional concepts with the being that gave rise to them. If a theorist is using the second-intentional concept of a relation, for instance, concepts of individual types of relation (e.g., the ratio *double*, the relation *taller than*) can be examined to see if the theorist's concept of a relation reflects something in the nature of a relation of each type as it is conceived—and, more importantly, as it resides in being.

In addition to this sort of reflection, a theorist can attempt to unearth, through historical or etymological investigation, the original sense of any concept guiding the thought behind a theory, and to dig up whatever layers of sense have been deposited over it to conceal it. But the theorist should also determine whether the original sense reflects authentic conceptions of being originating in first intentions, and this determination can be made only through a contemplation of being.

Contemplation of being serves a purpose other than restoring meaning to sedimented and sense-depleted concepts: it can also lead to new conceptions so that theories are freed from the limitations of concepts that happen to be ready to hand.

Because apophantic (or declarative) sentences can unconceal being, a theorist attempting to conceive being anew through first-intentional con-

templation might benefit from embedding a word for the being of interest in true declarative sentences. And since apophantic sentences are the *only* linguistic entities that can unconceal being, semanticists trying to discover the meaning of a word or the schema of meaning for a class of words (e.g., a class of words belonging to one part of speech) should always embed the word (or an exemplar of the part of speech) in declarative sentences that they judge to be meaningful (such as *Freddie is a dog*) and try to become aware of the nature of the being signified.

Because statements in standard modern mathematical notation (whether algebraic or logical or of another sort) are not (or are not properly) modeled after apophantic utterances, theoretical work should begin with nonmathematical statements and reasoning. When the being under investigation has been conceived, properly speaking, and a theory developed, mathematical formulations can then be introduced—but they should be introduced only with great caution, with the theorist making sure that in formalizing a theory, he or she is not importing sedimented concepts into the theory by virtue of the formalization. Further, if contemplations of being reveal inadequacies in existing mathematical concepts and notation, mathematical languages can be revised or constructed so as to provide adequate formal tools for theorists (as Macnamara (1994) argued).

All of these recommendations point in the same direction. Because the mind is only in direct (noetic) contact with being in first intentions, these must be the foundation of theoretical work. If theories are not anchored to being by first intentions, they will drift in whatever directions the imagination and philosophical currents take them. The result is usually a series of theoretical fads (especially in psychology and the social sciences—in the *Geisteswissenschaften*—where the being under investigation—intentions, as well as the actions that follow from them—is not, strictly speaking, sensible, and so it does not force one's mind to turn toward it; it even resists its own unconcealment because intentions are directed away from themselves, and, being the very stuff of consciousness, their constant presence in one's waking psyche leads one to take them for granted so that they typically escape one's notice).[22] Faddish theoretical frameworks often stimulate fruitless debates about issues irrelevant to actual phenomena, which retreat into concealment to the degree to which the positions taken in the debates are accepted as guides to one's thinking. A genuine resolution of such debates is rarely found (even though one position may come into favor by virtue of the strength of the personalities supporting it); far more frequently, the debated issues are forgotten as it becomes fashionable to follow new currents.

If theories are to be about anything other than human imaginings, theorists must develop their capacity for first intentions and make a habit of them. Having done so, they will be far more likely to adopt theoretical terms, and concepts of the being they signify, that permit being to be unconcealed; moreover, they will be far more likely to combine those terms in structures that reflect the constitution of the unconcealed being.

Notes

1. Edmund Husserl and Jacob Klein made use of many of these insights, either explicitly or implicitly, in evaluating theories in modern physics and mathematics (see Husserl 1954/1970; Klein 1934–1936/1968, 1932/1985).

2. I use *being* as a general term for that which is, including existent and substantial beings (where *beings* is comparable to the Greeks' *ta onta*; it does not necessarily refer to living things) as well as matter and the being that inheres in, originates in, or otherwise depends upon beings or matter, such as qualities, quantities, relations, actions and passions, locations in space and time, and so on (and *being* is here understood as a mass noun, comparable to the Greeks' *to on*). What I refer to as *being* is not identical with the "Being" of Heidegger and the Greek philosophers who inspired him. *That* Being is the proper subject of philosophy (see Aristotle, *Metaphysics* Γ.1, 1003ª21–22; Heidegger 1927/1962); theories in the special sciences deal only with parts of Being (*Metaphysics* Γ.1, 1003ª22–26). Wherever I use *being* as a count noun, it implies an individual informed or individuated atomically by some form (or species), and where I use *being* as a mass noun, the context should make clear whether I mean matter or dependent being alone or whether I mean beings, matter, and dependent being together.

3. For other mental phenomena, an intention arises under different conditions, and it is a qualitatively different kind of aiming at something as an object, originating not through activation of the noetic faculty, but of some other faculty of the psyche. In a state of desire, for instance, a person intends something or aims his or her mind at something by longing for it. In an instance of the perception of sensible things, he or she intends something by perceiving it sensibly.

The notion of an intention entered into Scholasticism through the Islamic philosophy of Al-Farabi and Avicenna. Like *intentio*, the word these philosophers used for it, *ma'na* (or sometimes *ma'qul*; see Engelhardt 1976), means concretely the drawing or stretching back of a bow (which brings it into a state of tension) in aiming an arrow at a target. This word brings together in one concept the ideas of aiming and tensing. The tensing that accompanies the aiming might best be understood as the mind's standing firm in its aiming—its tensing in that sense. But the characterization of an intention as a tensing also brings out the fact that it can vary in intensity, intensifying and remitting; the standing firm in the aiming can be more or less firm. Desires, fears, loves, angers, and so on, can be more or less intense, and thoughts too can in some sense intensify and remit, being entertained more or less intently, or, one might say, involving more or less attention.

4. Some theorists (e.g., Chomsky (1992, 1995a)) seem to think that a carving up that involves a human mind necessarily implies that what is carved up cannot be *outside* the mind. But the involvement of the mind in the carving no more implies that the stuff being carved is internal to the mind than the involvement of arms, hands, and an axe in chopping up the wood of a tree (an act that violates the tree's natural boundaries) implies that the stuff being chopped up does not exist in the world outside the instruments used in chopping—the arms, the hands, and the axe. If the members of a speech community collectively delimit, bound, or define certain beings—say, the beings called DANCERS (defined as people who dance)—this does not imply that those beings exist in our minds rather than in the extrapsychic world; dancers, like the dancing that makes them dancers, and like the people who underlie them, exist outside our minds (and, unlike mental beings, may be found performing on a stage). The fact that dancers (as well as firms, consumption, and income) are not beings with metaphysical primacy (in the sense of Aristotle's *prōtē ousia*, 'primary beingness' or primary substance)—that is, beings that underlie all other being—does not mean that they are not extrapsychic beings. The example of dancers serves to highlight another point. In comparing the carving up of being to chopping wood, I do not mean to imply that the being to be carved up is necessarily *matter*. A dancer is carved from a person, coming into being when the person takes up dancing, and passing away when the person ceases to dance. A person is not a portion of matter (though a portion of matter coincides with a person at any given moment); the matter in a given person's body changes throughout the lifespan. Nor is a person the mereological sum of time-slices of all the matter that is, was, or will be in his or her four-dimensional (space-time) body (a view that Putnam (1994) attributes to David Lewis), for the summation of the portions of matter that happen to coincide with a given person at different times presupposes the person, the identity of whom guides the summation.

Being can also be defined relative to other being without implying that it is unreal or imaginary. If Patricia is taller than Katherine, the fact that reference to Katherine is necessary to determine Patricia's being taller than her does not mean that Patricia's relative tallness is not really an aspect of her being. And being can be defined with respect to individual observers and yet reside outside their heads. That beauty is imaginary is not implied by the fact that beauty is relative to observers ("in the eye of the beholder"). If some people judge a painting to be beautiful, then the aspects of its being that give rise to that judgment are the components of the beauty they perceive. (This idea is reminiscent of Locke's (1694) view that to say an object is red is to say it has the power, by virtue of the nature of its surface, to give rise to a certain sensation in us. But unlike Locke, I would not deem redness unreal and the physical property that makes something look red real; I would identify the two instead. As Berkeley (1710/1982) pointed out, *all* qualities—not just those that Boyle and Locke called "secondary"—are experienced the way they are because of properties of the observer. But I do not conclude, as Berkeley did, that all qualities are secondary and there is no reality outside our experiences; I conclude, rather, that most qualities are "primary" and the peculiar and mutable nature of our experiences of them is irrelevant to their reality. The fact that the appearances we experience may not *resemble* or be *similar* to the qualities that give rise to them does not means that those qualities are not bona fide qualities of being (cf. Putnam 1981).)

5. Most of the semanticists who adopt the "It's all in your head" view (or what Jerry Fodor calls "psychosemantics")—the view that all linguistic meaning arises somehow from mental representations—seem, like eliminativists, to be guided primarily by skepticism about the mind's manifest ability to intend being or beings, skepticism motivated by faith in a physicalistic ontology, which, as it is currently conceived, excludes this ability (see also Baker 1987; Morris 1991). It is skepticism of this sort that led Fodor (1987) to say, "If the semantic and the intentional are real properties of things, it must be in virtue of their identity with (or maybe of their supervenience on?) properties that are themselves *neither* intentional *nor* semantic. If aboutness is real, it must be really something else" (p. 97)—which I would answer with Joseph Butler's observation that "everything is what it is and not another thing" (see Kripke 1972, 94).

Fodor attests to the fact that many cognitive scientists and philosophers "are repulsed by the idea that intentionality is a *fundamental* property of mental states (or, indeed, of anything else—talk about your ontological dangers!)" (1990, 313). He points out that "the deepest motivation for intentional irrealism derives ... from a certain ontological intuition: that there is no place for intentional categories in a physicalistic view of the world; that the intentional can't be *naturalized*" (1987, 97).

Such ontological dogmatism seems inappropriate in science, where being comes to be understood by means of observation and evidence. Evidence from inner perception and observation of people's use and interpretation of language clearly reveals the capacity of the mind to intend being outside the mind in its thoughts, perceptions, desires, and so on. If, for instance, a girl asks a salesclerk for an ice-cream cone, both the girl and the salesclerk understand perfectly well that the girl desires an ice-cream cone, not a mental representation of one.

6. The dependence of an isolated word's potential to signify upon a concept or definition may be one source of the belief of many semanticists that utterances of all sorts get their meanings solely by virtue of mental representations (where *mental representation* seems to be understood as a general term for mental entities of various sorts, including concepts and definitions). Semanticists typically take a compositional view of sentence meaning, seeing the meanings of sentences as structured aggregations of the meanings of the words in the sentences. If words considered individually do not permit the mind to intend being, but have a "sense" or "meaning" only by virtue of a concept or definition, then a compositionalist could be led to believe that the meanings of sentences are combinations of mental representations.

But even if a theorist is only interested in the "senses" of individual words—the mental representations (or concepts or definitions) of the being they have the potential to signify—the theorist must nonetheless characterize the being the words would signify in declarative statements (or, more generally, in referring expressions), for the simple reason that mental representations are representations of being; one cannot characterize the representations until one has characterized the being or beings they represent.

7. This translation and the other translation of Brentano's German are my own, as are all the translations in this chapter from classical Greek (i.e., of Aristotle, Euclid, Eudoxus, Nicomachus, Parmenides, Plato, and Porphyry), Latin (i.e., of Aquinas, Bradwardine, Descartes, Eustachius a Sancto Paulo, Fredericus, Peletier, Stifel, Suárez, Wallis, and Zabarella), and French (i.e., of Leibniz and Stevin). Translations of German authors other than Brentano (i.e., Dedekind, Frege, Heidegger, Hilbert and Ackermann, Husserl, and Klein) are from the published English editions cited, except for the translation of the passage from Hilbert and Bernays, which is my own. Wherever a quotation that I have translated into English is incorporated into the text, I have enclosed it in single quotation marks to distinguish it from direct quotations from works published in English, which are enclosed in double quotation marks.

8. 'Being of reason' is the standard (and literal) translation of the Scholastic expression *ens rationis*. It refers to a being, such as the concept of a universal, that exists in the mind (and perhaps only in the mind).

9. The Greeks had no word meaning 'number' per se; their word *arithmos* is best translated as 'count' or 'counting' (depending on the context). The Greeks did not understand numbers to fall under a single idea corresponding to our number concept, for they did not believe that things that have an *order* can fall under a common idea, definition, or genus (see Aristotle, *Nicomachean Ethics* A.6, $1096^{a}17$–19; *On the Soul* B.3, $414^{b}22$–28; *Metaphysics* B.3, $999^{a}6$–10). And, indeed, if numbers are understood as counts, it does not make sense to think of them as belonging to a genus, since each one contains within it, or is a successor of, all smaller ones. To count 5 beings, one must first count 2 beings, then 3 beings, then 4 beings, successively adding 1 being to the collection of beings already counted. Two is not separate from 3, or from 5, but rather a part or antecessor of it. And so even though each number is a species (with, e.g., all counts of 3 belonging to one species), the different species of number are not independent species that can be included under a common genus.

10. For Plato, monads were separate, nonsensible, noetically perceived beings, real beings in the realm of the mathematicals; but, as Klein (1934–1936/1968) pointed out, "the emphasis with which the thesis of 'pure' monads is propounded is indicative of the fact that *arithmoi* were ordinarily, and as a matter of course, understood only as definite numbers of sensible objects" (p. 70).

11. The idea that a monad is that which remains in an atom when all but its oneness is abstracted away is also consistent with Aristotle's comment that a monad, like a point, is indivisible in any dimension, but whereas a point has position, a monad has none (*Metaphysics* Δ.6, $1016^{b}24$–31; and so he calls a monad a point without position, *stigmē athetos*; *Metaphysics* M.8, $1084^{b}26$–27); a point is what remains in a being when its species, its sensible qualities, its matter, and its extension in every direction are mentally stripped away (*Metaphysics* K.3, $1061^{a}29$–35; and so Aristotle describes the objects of geometry as physical, e.g., physical points or lines drawn on papyrus, but not qua physical; see *Physics* B.2, $194^{a}9$–11).

12. Wallis said, 'Geometry is more or less subordinated to arithmetic, and to that extent it applies universal assertions of arithmetic specially to its objects' (*Mathesis Universalis*; for the Latin, see Wallis 1657/1695, *Opera*, vol. 1, as cited in Klein 1934–1936/1968, 216).

13. Descartes (1596–1650) stated that the geometric figures used in his algebraic geometry as counterparts for magnitudes or quantities of any sort whatsoever (see Schmidt 1986) 'must exhibit at one time continuous magnitudes, at another time multitude or number also' (1701/1966, 452). By introducing a unit magnitude with which other magnitudes could be compared, he was able to interpret magnitudes as numbers: 'Thanks to the unit we have assumed, continuous magnitudes can in some instances be reduced in their entirety to multitude' (pp. 451–452); he also said, 'If number be the question, we imagine a particular subject [i.e., a figure] measurable by a multitude of units' (p. 445), and, 'That very division into a plurality of equal parts, whether it be real, or only intellectual, is properly a [mode of] measuring in accordance with which we count things' (pp. 447–448).

14. In a later era, Richard Dedekind (1831–1916), who regarded numbers as "free creations of the human mind" (1888/1963, 31), stated explicitly that the goal of introducing irrational numbers is to permit numbers, as points, to fill up a straight line. After comparing the fact of one rational number's being greater than another to a point's being to the right of another on a straight line, and of its being less than another to a point's being to the left of another, and similarly, he said,

> To every rational number a, i.e., to every individual in R [the domain of rational numbers], corresponds one and only one point p, i.e., an individual in L [the points in a line]. . . .
>
> Of the greatest importance, however, is the fact that in the straight line L there are infinitely many points which correspond to no rational number. . . . The straight line L is infinitely richer in point-individuals than the domain R of rational numbers in number-individuals.
>
> If now, as is our desire, we try to follow up arithmetically all phenomena in the straight line, the domain of rational numbers is insufficient and it becomes absolutely necessary that the instrument R constructed by the creation of the rational numbers be essentially improved by the creation of new numbers such that the domain of numbers shall gain the same completeness, or as we may say at once, the same *continuity*, as the straight line. (1888/1963, 8–9)

The use of the points on a line as a model for numbers was so customary by his time that Dedekind felt no need to justify the assumption that for every point on a straight line there must be a corresponding number.

15. Aristotle used these words as if they were standard terms, not commenting on his use of them, so he may have been borrowing from and developing an existing theory. But by the third century C.E. at the latest, the words for predicates and predication that Aristotle used were deemed to have been of his own choosing. Porphyry (232–309), in his commentary on the *Categories*, asked,

> Why, since *katēgorias* in customary language is said, in respect of the forensic speeches, of the [*katēgorias*] in accusation, to which is opposed the speech for the defendant, did Aristotle, not having undertaken to instruct us about how to speak against opponents in the courts of justice, but [about] something else, which very thing is not called by this name among the Hellenes, choose to make strange [use of language] by entitling the book *katēgorias*? (265/1887, 55)

16. Modern English editions of Aristotle's logical writings often give 'belong to' as the translation of *huparchō*. Alternative and even more unrevealing translations

are 'apply to' and 'hold of', which do not correspond to any meanings the word ever had for the Greeks.

17. As Plato pointed out (*Sophist* 262d–263a), a simple declarative sentence such as *Theaetetus sits* has two aspects, which he captured in the expressions *peri hou esti* and *hotou esti*, 'whom/what it is about' and 'whosever it is': (1) Viewed as a *rhēma* (a verb or an adjective) mingled (*kekramenon*) or intertwined (*sumplekes*) with a noun (or as a predicate intertwined with a noun phrase), the simple sentence reveals something *about* something (i.e., the subject, or Theaetetus in this case)—some determination (*logos*) of the subject. (Plato said that intertwining a *rhēma* with a noun *ti perainei*, 'brings something to an end', 'limits something', or 'determines something', and that for this reason we call this combination of intertwined word a *logos* (see 262d). Robert H. Schmidt has argued, in conversation, that the original meanings of *legō* as 'lay (to rest)' and 'gather (together)' suggest that a *logos* was understood as a gathering together that lays to rest. The gathering together of words in an intertwining of a verb with a noun (through conjugation for person and number) gives a sense of completion and thus brings the mind to a rest or standstill, whereas a word or a phrase by itself does not do so. A verb intertwined with a noun determines or brings to an end in that sense. The intertwining of a verb with a noun, or of a predicate with a noun phrase, also limits or defines the being of the subject that is shown forth from the subject.) (2) Viewed as that which has laid down together (*suntheis*) a noun (or a noun phrase) with a *rhēma* (or a predicate), a *logos* (or 'determination') is seen to belong to something, or be *of* something (i.e., the subject, Theaetetus). The two aspects correspond to two roles as answers to questions of two sorts, exemplified by "What is Theaetetus doing?" (or "What *is* it about Theaetetus?") and "Who sits?" (or "Who is *it* who sits?"). Both can be answered with "Theaetetus sits"; this utterance both reveals something about Theaetetus (namely, that he sits) and lets it be known that the particular determination of the subject (namely, the sitting) is the determination of Theaetetus (the possessor of the sitting). But since predication, or affirming or denying something about a subject, is the intertwining of a predicate with a (presupposed) noun phrase, it brings into being an utterance with the former role or aspect—one that reveals something about the subject.

18. This description reveals the error in the claim of scholars, at least since Boethius (480–524), that the categories other than *ousia*—literally 'beingness' but conventionally translated as 'substance'—are supposed to be categories of "accidental" being, for Aristotle explicitly contrasted the being of the categories, or being that is *kath' hauto*, with accidental being, or being that is *kata sumbebēkos*—'because of (or in accordance with) concomitance' (see *Metaphysics* Δ.7).

19. Here, *phasis* seems to mean primarily 'denunciation' or 'a charge laid'—a bringing to light in that sense; the prepositional prefix *kata* in *kataphasis* implies a charge being laid *against* someone (or something), and *apo*, which appears also in *apologia* and *apologeomai* ('speak in one's defense'), as well as in *apopsēphizomai* ('vote a charge away from' or 'acquit'), implies a charge being removed. (Alexander of Aphrodisias, in his commentary on Aristotle's *Topics*, said that *apophasis* is *anairesis*, which means 'taking up' or 'taking away'; in legal contexts, it means the quashing of an indictment.) Aristotle said that 'kataphasis is apophansis [i.e., showing forth] of something [laid] against something, and apophasis is apophansis of something [i.e., some charge] removed from something' (*On Interpretation* 5, 17ª25–26).

20. When sentences of other types contain the verb meaning 'be' (explicitly or implicitly), it plays some other role regarding being. In a question, it indicates that being can be unconcealed in the response the question is intended to elicit. In a command (e.g., "Be kind"; "Don't be cruel"), a request (e.g., "Please be quiet"), or a prayer (e.g., "Be merciful to him"), where there is no subject, it indicates that being of the type desired (or desired to be free of) can get brought into existence (or taken or kept out of existence) if the addressee complies, thereby becoming (or ceasing to be, or ensuring he or she is not) the subject or origin of the being (so that, in the case of desired being, the verb meaning 'be' can be conjugated to agree with that subject in an affirmative declarative statement unconcealing the being from that subject). Among clauses with the structure of a declarative sentence, in some (such as those that follow *because* after verbs such as *quit*) the copula indicates that being is unconcealed from the subject of the clause, but in others (such as those that follow *that*, *whether*, or *if* in the complements of verbs such as *hope*, *believe*, *wonder*, *say*, and *report*) the copula indicates that being would be unconcealed from the subject of the clause if it were true.

21. It is possible that we have no unlearned representations of numbers per se, but rather an unlearned ability to detect sameness and difference in the cardinalities of collections of beings, combined with an unlearned ability to understand something as a counterpart for something else (which is similar to but not identical with the ability to understand an image as an image, i.e., as transparent rather than opaque, and let one's mind fall upon that of which it is an image through assenting to the image's announcement of it, rather than being spellbound by the image so that one's mind stands firm in an intention toward the image itself; the Greeks called this ability *eikasia*). These abilities would permit us to use any image of a collection of individuals of any kind held in the imagination as a counterpart for other collections with the same cardinality, much as when we use our fingers, in counting, as counterparts for individuals in a collection of beings of some other kind.

The ability to understand something as a counterpart for something else (which permits us, for example, to use a map as a counterpart for a region) seems to be present from an early age, for young children learning common nouns (along with the adults teaching them) seem to understand pictures of, say, animals in books as counterparts for real animals, so that the children take the nouns applied to the pictures by the adults to be names for species of real animals.

As the examples of a map, pictures in books, and fingers used in counting show, representations used as counterparts need not be internal to the mind (see also Houghton 1997), as is usually supposed.

22. Perhaps some of the best examples of such fads are to be found in psychology, where the views of the mind that have dominated theories are, for the most part, metaphorical: the mind as chemical compounds (e.g., Locke's complex or compound ideas formed out of simple ideas, Wundt's and Titchener's structuralism),

the mind as a mechanical system (e.g., Hume's associationism, where "ideas" are governed by laws of "attraction" or association analogous to Newton's law of gravitation), the mind as "Poof!" (behaviorism, or the mind's retreat into complete concealment), the mind as a computer (the "information-processing" model of the mind, functionalism), and the mind as a brain ("neural-network" models). Psychology can only begin to be a genuine science when theoretical approaches based on such metaphors—crude attempts to naturalize psychology—are abandoned and we begin in earnest to study the mind *as a mind*—when the nature of the being in psychology's domain (namely, intentional being) is allowed to guide our choices in classifying phenomena, our choices of terminology, our choices of problems to address, and the ways we choose to go about solving them, including methods and theoretical approaches, as that being gradually unconceals its nature to us (as Husserl (1954/1970) urged).

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Chapter 10

The Nature of Human Concepts: Evidence from an Unusual Source

Steven Pinker and Alan Prince

10.1 Classical and Family Resemblance Categories

This chapter is about an extensive parallel we have discovered between a part of language and a part of cognition, and about the possibility that the parallel is not a coincidence. The parallel involves the difference between a *classical category* and a *prototype* or *family resemblance category*, a topic of controversy for many years in cognitive psychology, philosophy, linguistics, and artificial intelligence.

Classical categories are defined by necessary and sufficient criteria, and membership in them is all-or-none. Examples include squares, grandmothers, odd numbers, and the vertebrate class Aves. Family resemblance categories differ from classical categories in a number of ways:

- They *lack necessary and sufficient conditions* for membership. For example, the category "chair" includes objects that have legs and that lack them (e.g., beanbag chairs), and objects that can be sat upon and that cannot (e.g., delicate museum pieces).
- They have *graded degrees of membership*. A robin is a better example of the family resemblance category "bird" than an eagle is; and a penguin is a worse example.

John Macnamara was a man of extraordinary wit, wisdom, and warmth. His insights on the relations among cognition, logic, and the world greatly influenced the thinking that went into this chapter. It is an honor to contribute to a volume in his memory.

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