

## Chapter Five

### More Mama, More Milk and More Mouse:

#### The structure and development of substance concepts

##### ' 5.1 Early Words for Substances

The bulk of a child's earliest words are concrete nouns, including names of individuals, names of concrete kinds, and some names for stuffs ("milk," "juice"). These are acquired in a rush by the dozens between about one and one half and two years old: "[T]his vocabulary spurt is often called the naming explosion to reflect the large preponderance of nouns that are learned" (Markman 1991, p. 81).<sup>1</sup> Adjectives come later and more slowly, and abstract nouns later still. This suggests that the ability to distinguish concrete individuals in thought and the ability to distinguish concrete kinds and stuffs may have something in common, and that concepts of properties and of other abstract objects may not be required for these tasks. There is much independent evidence that children come to appreciate separable dimensions, such as color, shape, and size, only after a considerable period in which "holistic similarities" dominate their attention (see Keil 1989, for discussion). Thus concepts of properties again appear as less fundamental than those expressed with simple concrete nouns.

We can interpret this data as suggesting that concepts of substances are the easiest for a child to obtain, and more surprising, that the ontological distinction among individuals, real kinds, and stuffs does not produce a difference in ease of early learning. I have proposed that despite their obvious ontological differences, individuals, real kinds, and stuffs have something important in common that bears directly on what it is to have concepts of them. I will now propose that this similarity makes them all knowable in a very similar way, and prior to properties. Though concepts of individuals, real kinds, and stuffs are traditionally considered to be quite different in structure, I believe that their root structure is in fact identical. Only as they become more fully developed do defining differences appear among them. This is because their corresponding substances have an identical ontological structure when considered at a suitably abstract level, and because it is possible to have unsophisticated substance concepts that rest only on this abstract structure.

##### ' 5.2 Initial Irrelevance of Some Fundamental Ontological Differences

I have argued that different domains of substances are differentiated according to the kinds of ontological grounds that hold them together, supporting successful inductions over encounters with them. One can learn on one encounter with Xavier what to expect on other encounters with Xavier for a different reason than one can learn from one encounter with the element silver or with the species dog what to expect on other encounters. And I have argued that we do not always have a correct understanding of the grounds of induction that underlie our successful substance concepts. For example, it is only recently that we have come to the understanding we now have, as opposed to

---

<sup>1</sup> See Gentner 1982 and Ingram 1989 for reviews, Dromi 1987 for some reservations. There is evidence that Korean children may usually have a "verb spurt" a month or two before their "noun spurt" begins. Still the number of nouns soon overtakes the number of verbs (Choi and Gopnik 1993).

the understanding Aristotle had (' 2.2), of what holds the various biological species together, and we still don't have many details in the case, for example, of asexual animals and easily hybridized plants. Although, ontologically speaking, individuals are space-time worms while real kinds are, instead, collections of similar space-time worms, to have the capacity to understand this ontological distinction would require a grasp of space-time structure and temporal relations of a sort not acquired by children until years after they are proficient in the use of both proper and common names (Nelson 1991). It seems it cannot be necessary to having the concept of a substance that one understand its ontological ground. This suggests that it may be possible in general, even though it may not be ideal, for the concept of a substance to rest merely on its most abstract structure as a substance, hence for primitive concepts of substances within the various domains to have a common structure. Small children might have concepts of individuals, real kinds, and stuffs prior to any understanding at all of the differences among the ontological grounds that in fact organize these domains, and these various concepts might all be formed in much the same way.

What would seem to be primary in the early experience of a child is merely that milk and mouse retain many of their properties and potentials for use or interaction over various encounters with them exactly as Mama does. Given this, we might expect the child, indeed we might expect any animal, in the first instance, to learn how to relate to, and what to expect from, each of these various items in much the same way. Putting it Quine's way, the child's first recognitions (and those of the dog) are merely of more Mama, more milk, and more mouse (Quine 1960 P. 92). To grasp this possibility, however, it is crucial to keep in mind the differences between classifying and identifying explored above in Chapter Three. If a child's primary concepts of, for example, milk and mouse were classifying concepts, then of course they could not have the same structure as her concept of Mama.

The child observes things about Mama when she encounters her, not things about samples or instances of Mama. The child identifies Mama; she does not classify Mama. The psychological structure of classification is the structure of subject-predicate judgment. To classify an item requires differentiating the item to be classified in thought and applying a predicate to it. To do the latter, the child would need to have prior concepts of instances of Mama—concepts of time slices of Mama, I suppose. But concepts of time slices of Mama clearly are analytical concepts, resting on prior concepts of Mama and of times, and thus we go around in a circle. (' 3.4)

In a similar way, to learn things about milk, the child need not think of or keep track of instances or portions of milk. And the very point of having the concept mouse would seem to be that under it, one does not distinguish Amos from Amos's brother, but thinks of them as the same. Classifying animals as mice versus cats versus dogs would involve thoughts of Fidos and Spots, Felixes and Macaffees, Amoses and brothers of Amoses, each individual to be judged a member of its proper kind. But there is no more reason to suppose that this is the way the child first conceives of mouse than that this is how she conceives of Mama. She need not have concepts of individual mice in order to recognize mouse again. Early substance concepts, even when what they are of,

ontologically, is kinds, need not be predicate concepts applied to prior subject concepts. They need not be understood as descriptions of anything.

In Chapter Four, I discussed how abilities typically rest on alternative means. My ability to get from home to school rests on many alternative means, as do my abilities to swim and to tie my shoes. Similarly, the capacity to identify a substance typically rests on a variety of alternative conceptual means. The number of ways I can identify each of my daughters is nearly innumerable through appearance of body or body parts from a hundred angles, by voice through many mediating conditions, by posture, clothing, sounds of feet, handwriting, characteristic habits and activities, various nicknames, and hundreds of identifying descriptions. On the other hand, as with my other abilities, none of these ways is infallible. Having an ability does not require one unfailingly to recognize when the required conditions for its means obtain, or even that one understand what these conditions are. Surely none of these methods of recognizing my daughters, either taken collectively or taken singly, constitutes a definition or criterion of any of my daughters. Concepts of one's friends are not analytical concepts but synthetical, nor are they "recognition" concepts (' 3.4). Exactly the same is undoubtedly true for the infant's concept of milk and of mouse. Indeed, the same is true of any adult's concepts of these things in so far as they operate as substance concepts. There are lots of ways to recognize milk quite reliably: by look, by taste, by context, by the sorts of stains it makes, by chemical analysis, and so forth. Similarly, there are lots of ways of recognizing mice. None of these ways plays any role in defining milk or mice. (These are defined in nature.) And none, of course, is infallible. (Failure to understand these points is called "verificationism".)

Concepts of Aristotle's secondary substances, such as mouse and dog, show themselves in English grammar as simple subjects of judgment by vacillating among singular, plural, definite and indefinite forms to express the same secondary-substance thoughts. Thus "The lion is tawny," "Lions are tawny" and "A lion is tawny" have, in most contexts, exactly the same meaning. The apparent determiners and the indication of number are doing no semantic work in these sentences. The grammar of English mandates use of some determiner with every count noun, but the name of a secondary substance does not, as such, express a counting thought. Nor is there a quantifier implicit in these sentences. They are not equivalent to "All lions are tawny," "Some lions are tawny," or "Most lions are tawny," despite the efforts of elementary logic texts to force them into one or another of these molds. Many languages, for example Bengali, Finnish, and Japanese, are more semantically transparent in this respect, using secondary substance names bare to express this kind of thought.

#### ' 5.3 the Structure Common to All Substance Concepts

What the infant identifies is more Mama, more milk and more mouse. Better, since the idea is not that the infant mistakes Mama and mouse for stuffs (that would require grasping the ontology of stuffs), what the infant understands is "here's Mama again," "here's milk again" and "here's mouse again."<sup>2</sup> But various substances and various

---

2 Some commentators on "More Mama, more milk and more mouse" (Millikan 1998a) did

domains of substances differ, of course, in the types of knowledge they afford. The child's individual highchair retains its overall shape hence its sitting-on capacity over encounters, but Mama does not (you cannot sit on Mama when she is standing). Milk and Mama retain their color while cat does not. Cat retains its overall shape and rough dimensions, but milk and wood do not. These various subjects of knowledge must be grasped as grouped into rough ontological categories according to the kinds of inductions likely to apply to them.

Even for the very young child, surely, a casual look at a new piece of furniture on the one hand and a new uncle on the other, must indicate which can be counted on to retain its current climbing-up-on affordance and which may grow tired of the sport. Similarly, preschoolers know that what is sleepy might also be hungry, but not made of metal or in need of fixing (Keil 1983). The conception one has of a substance is not merely the ways one knows to identify it, but also the dispositions one has to project certain kinds of invariances rather than others from one's experiences with it. One pole of a substance concept consists of more or less reliable means by which to recognize the substance, the other pole is a rough grasp of an applicable substance template or templates ('2.6). An essential part of grasping a new uncle's identity, of acquiring a concept of him, is grasping that he is, at least, a certain kind of physical object (in the broad sense) but better, that he is a human being. This must be grasped not as a set of properties Uncle has but as a sense for things possible to learn about Uncle.

In the same way that the child differentiates between (My) Highchair and (My) Uncle, both in her methods of keeping track and also in the invariants she projects, she differentiates among individuals, kinds and stuffs. She has, perhaps, a concept of Mama and also a concept of women. She uses different methods to keep track of these, and projects different invariants over encounters with them. Tracking Mama is one of the means of tracking women. If it's Mama again it's a woman again. But the concepts are entirely separate, not at all confused together. Similarly, knowing what to expect of a connected physical object and knowing to expect something different of a pile of sand (see Blum 1998 and references therein) shows that the child is capable of distinguishing between the domains of application of corresponding substance templates. And obviously the child's methods of conceptual tracking have to be entirely different for objects, kinds and stuffs. For example, her method of tracking cat will allow her to generalize from the cat on her left to the cat concurrently on her right, whereas her method of tracking individuals, hence Macaffee, will not. Methods of tracking for one ontological category will not necessarily work for another. In this way the child's

---

take me to be claiming infants think of Mama and mouse as masses or stuffs.

concepts of Mama, mouse, and milk do, of course, have to differ.

The child differentiates among individuals, stuffs, and real kinds, yet her concepts of things in these domains have a common structure. Each contains some means or other of tracking its appointed substance and a grasp of how to project some of the invariants defining this substance to new encounters. This is the most important fact about the structure of these concepts because it defines their function. It explains what we have them for. Substances need not be grasped by understanding the principles that structure them and hold them together, but merely by knowing how to exploit them for information gathering purposes. Just as one does not have to be able to describe or even to recognize the conditions required for exercise of one's other abilities, for example, just as a child can swim without understanding Archimedes principle and ride a bicycle without understanding the laws of dynamics, neither does one need to understand the ontological principles upon which one's successful projections of substance invariances depend. Analysis of the world structures that permit the possibility of human knowing is not the same thing as analysis of the inner psychological structure of the knowing.

Tradition, on the other hand, claims that there is nothing common to the structures of concepts of individuals, kinds, and stuffs, let alone of "here's Beethoven's 5th again" and "here's white again" (' 2.5). Throughout the history of philosophy and psychology, the tendency has always been to project the structure of the object grasped by thought into the mind itself. For example, it is thought that concepts of the sort we are calling substance concepts can be grasped only by understanding "criteria of identity" for their ontological kinds. But what would the relevance be, for example, of a "grasp of the criterion of identity for persons over time" to a practical ability to recognize the same person again over time? We can't always reidentify persons by following their space-time worms around. Besides, dogs are quite good at recognizing their masters, and babies at recognizing their mothers, even though it is quite certain that neither conceives of a criterion of identity for persons over time. Not that there are no situations in which an explicit grasp of persons, say, as space-time worms might prove helpful. Cross examination to determine where the accused was an hour before the crime illustrates that. But, for the most part, we employ quite different methods to keep track of one another as substances.

Another venerable tradition argues that it is possible for us to individuate other individuals in our thought only because each such individual is uniquely located relative to us in the same space-time. This is surely a valid point, but not, as this tradition has it, because conceiving of other individuals requires us to think of their relations to us, anchoring our thoughts of them beginning with thoughts of ourselves. The valid point is that having a concept of any substance at all involves the capacity to keep track of it, which in turn means interacting with it, actively collecting together various manifestations of it that impinge on our senses or appear in our thought over time. And obviously one cannot collect together manifestations of something not in one's own space-time system.

What is true and important is that the activity of collecting and employing knowledge of any individual can be accomplished only in so far as our world has a certain space-time

and causal structure in which we too are ingredient and to which we are attuned. That is, for the most part we can find our way about in it. This should not be confused with the idea that knowledge of or thoughts about this structure are required for success in this activity. The capacity to reidentify Mama and learn things about her is a high level skill exercised in the world. Thinking of Mama is not done just in one's head.

#### ' 5.4 Conceptual Development Begins with Perceptual Tracking

The sketch of the structure of substance concepts presented so far has been argued for almost entirely a priori. I have attempted a task analysis for substance concepts and tried to show what follows if they are to perform these tasks. Earlier I compared this project to Marr's first level of analysis in his theory of vision, where he gives a task analysis for visual perception. To fill in higher levels of analysis, explaining exactly how these abilities are implemented, how the various kinds of substances are reidentified across encounters, how skills in reidentification are acquired, how substance templates are acquired and how they operate, is a job, as I understand it, primarily for experimental psychology and for research in child development. But I can try to help make the questions clearer and offer some tentative suggestions about where one might look for answers.

According to various estimates, children acquire from five to nine words daily between the ages of two and six (Waxman 1991, Clark 1991, Byrnes and Gelman 1991) Chomsky says, "about a word an hour from ages two to eight with lexical items typically acquired on a single exposure..." (Chomsky 1995, p. 15). How is this possible? One obvious hypothesis here is that many concepts are developed prior to language, and indeed, at least some must be, for the infant recognizes her mother and the dog recognizes its master. Each has the capacity to reidentify the relevant individual under diverse conditions, thus making it possible to learn how to behave appropriately in their presence.

Some of the skills that are surely essential to reidentifying ordinary substances have traditionally been classified as "motor" and "perceptual" rather than "cognitive." Perhaps the most basic of these is the ability to track objects with the eyes, head, feet, hands, ears, and nose, and so forth. Objects tracked in this way are not merely conceived to be the same but are perceived as the same under certain conditions, the perception of sameness bridging, for example, over motions of perceived and perceiver, over changes in properties of the object, and over temporary disappearances of the object behind other objects. The mechanisms responsible for the ability to track and for perceptual "identity-" or "existence-constancy" may well be largely endogenous (Nelson and Horowitz 1987, Dodwell, Humphrey, and Muir 1987, Spelke 1993) and also "cognitively impenetrable" (Shepard 1976, 1983). That is, no matter what you know really happened, under appropriate sensory stimulation, certain illusions of constant identity persist. Even if the perceived object apparently flies right through a brick wall, you still can't help perceiving it as the same object going in one side and coming out of the other. These basic abilities seem to be the bottom layer upon which conceptions of substances are built.

The mechanisms by which infants reidentify individuals perceptually apparently do

not rely upon properties of the tracked object remaining the same but upon movement, spatial location and trajectory (Gopnik&Meltzoff 1996). Xu and Carey (1996) have recently produced experimental evidence that 10 month infants, unlike 12 month infants, are not surprised if an object of one kind apparently turns into an object of another kind, say, a yellow rubber duck into a white styrofoam ball, though they are surprised if an object they are tracking apparently turns into two objects. Tracking in this property-blind way would make it possible to observe, for various broad kinds of objects, what sorts of things tend to remain the same and what sorts may change within a short period, yielding clues for keeping conceptual track of substances. While perceptually tracking a substance you can learn how it looks, how it sounds, how it feels, smells, tastes, the manner in which it moves and changes, and so forth.

Perceptual tracking allows the accumulation of information about a substance over a period of time, information perceived as about the same substance. Nor is it only individual objects that are tracked in this way. If I am tracking Fido, I am also tracking the species dog, and also fur and bone. Which of these I am tracking with my mind depends upon which I am learning about or registering information about as I go. And that is determined by which of these substances I identify on other occasions as the one this learning concerns, that is, as being the same substance again. As I dissect my specimen frog in the zoology laboratory, whether I am conceptually tracking just the individual Kermit, or tracking frogs, depends on whether I attempt to apply what I have learned from my experience only to later meetings with Kermit or whether to frogs in general.

#### ' 5.5 Conceptual Tracking Using Perceptual Skills

For the usefulness of your knowledge of a substance to last, however, you must also know how to reidentify the substance after a break, even a lengthy break, in perceptual tracking. And unless the substance is an individual space-time worm, you must be able to reidentify it also over its objective discontinuities in space and time. The substance dog is not space-time continuous, nor is wood. This kind of keeping track of a substance I will call "conceptual tracking." To track a substance conceptually is to understand rather than directly to perceive its being the same one when you encounter it again. Perceptual tracking would seem to be the beginning of conceptual tracking, but conceptual tracking or keeping track must continue over long and wide interruptions in perceptual tracking. Out of what materials are our abilities to track substances conceptually built?

The mechanisms of perceptual constancy for properties are probably the most important. These mechanisms may be fashioned in part through experience and certainly they are tuned through experience, but much of their basic structure may be endogenous (Dodwell et al 1987; compare Gallistel, Brown, Carey, Gelman and Keil 1993, Marler 1993). They cause distal qualities to appear as the same through wide variation in proximal manifestations. For example, they allow the same shape and size to be registered as the same despite alterations in angle of observation and distance, colors to appear as the same under widely varying lighting conditions, and voices to sound as the same voice through distortions and extraneous noise. These mechanisms allow one to be sensitive to the objective variances versus invariances characterizing a perceptually

tracked object through changes in conditions of observation and in its changing relations to the tracker. And they allow substances to be reidentified via their stable properties under very diverse conditions of perception.

Because the mechanisms of perceptual constancy are involved, however, it should not be thought that concepts of properties are always involved in conceptual tracking of substances. Having concepts of properties, I am assuming, would be to represent properties, as such, in thought. The thought of a property is not just a reaction caused by a property; it must play an appropriate conceptual role ('7.4). Certainly a mere response to a presented property, such as a discriminating reflex response, requires no concepts. The moth turns toward light but has no concept of light. Similarly, responding, say, to a certain configuration of shape, color, texture, and motion with the thought squirrel again is not, merely as such, to have thoughts of these shapes, colors, textures and motions themselves. Indeed, adults don't seem to have concepts of the particular shapes and motions that are squirrel shapes and squirrel motions except the analytical concepts squirrel-shaped and moves-like-a-squirrel, these concepts presupposing rather than underlying the concept squirrel.

This accords, of course, with the finding that children appreciate holistic similarities before appreciating separate property dimensions such as color and shape, suggesting that concepts of properties and other abstract objects may not be required to have substance concepts. Apparently it also accords with findings in neuroscience:

...more detailed investigation reveals that most sensory neurons respond to complex combinations of stimulus features. For example, visual cells that respond to oriented edges may also respond to color, motion and color disparity (Pribram 1991, pp. 79-81). Moreover, it is not uncommon to find neurons in visual cortex that are attuned to acoustic frequencies (Pribram 1991, p. 81, citing Bridgeman 1982; Pribram, Speielli and Kamback 1967). Conversely, it has been reported recently (Calvert, Bullmore, Brammer, Campbell, Williams, McGuire, Woodruff, Iverson and Davis 1997) that our understanding of face-to-face communication is aided by the response of auditory neurons to visual stimuli. Finally...top-down signals in sensory systems can alter the receptive fields of sensory neurons, that is, their response is context-sensitive (Pribram 1991 pp. 257-258.)

Much of the persistence of talk about feature detectors in neuroscience can be attributed to the same descriptivist assumptions that pervade philosophy and cognitive science. If...that is what we...look for in the brain...to a large extent that is what we will find. (MacLennan 1998, pp. 78)

MacLennan goes on to claim that cases in which "a stimulus is projected into a very low-dimensional space," are "comparatively rare and secondary to the processing of concrete micro correlations, upon which reidentification rests." Apparently, holistic neural representations are prior to representations of single properties.

Besides perceptual tracking abilities and other perceptual constancies that may be largely built in, there is evidence that infants may have built into them systems designed, specifically, to recognize human faces. It is well known that they have a strong disposition from the earliest days to track and study human faces (e.g., Johnson, Dziurawiec, Ellis and Morton 1991). Also, many species that recognize individual conspecifics instinctively use smell for this purpose, and in the early months human infants also know Mama by smell (MacFarlane 1977). It appears that the infant may know innately at least two good ways conceptually to track individual conspecifics. Faces and personal odors are indicative of individual identity; clothes, postures, and so forth, are not.

An extension of perceptual tracking through space is a kind of conceptual tracking through space. Even some quite lowly species are equipped with the capacity to keep track of their positions as they move about within their immediate spatial locales. This is the same, of course, as keeping track of where other things are in relation to them.<sup>3</sup> Where something was when you encountered it last is often a clue to where it would or might be when you encounter it again, thus serving as an aid to identifying it.<sup>4</sup> Things that don't move at all can easily be kept track of this way, and things that move slowly or only intermittently can be kept track of this way over short interruptions in perceptual tracking. This extends the period over which other identifying properties can be observed or committed to memory. For example, at the beginning of term I often have concepts of various students that I am not yet able to recognize anywhere outside my classroom. The look of a new face or new kind of animal may take a while to sink in, perceptual tracking and conceptual tracking through space filling in temporarily.

Sometimes, on the other hand, we may find a use for merely temporary concepts rooted in this sort of tracking. Consider the concept you have of your glass at a cocktail party. You keep track of it by keeping it in your hand, or by setting it down somewhere that you remember. But if you turn your back and someone straightens up a bit, that may be the end of the tracking trail for that glass. When the party is over, you lose track anyway, but it doesn't matter. Similarly, concepts of individual dishes in a matching set in one's own cupboard are likely to be only temporary. If these dishes have no individual salient distinguishing marks, and you have no cause to remember special happenings concerning any of them, every time the dishes are done and put away again, all your individual concepts of cups, glasses, and plates disappear, and new concepts of the same old individual dishes must be born again next meal. As an experiment, try to think, right now, serially, of each individual fork in your silver drawer.

#### ' 5.6 Conceptual Tracking Using Inference

---

3 Whitehead is supposed to have claimed that he always knew where he was, but that sometimes he didn't know where the other things were.

4 Compare Gareth Evans (1982, ' 8.3).

When perceptual tracking and conceptual tracking in space are coupled with exploratory manipulation, probing and testing, this may reveal properties and dispositions that prove to be better tracers of a substance than more easily observed properties. An easy example is the tool bag of tests and routines that chemists use in order to identify chemical stuffs. Tests of this latter sort are typically employed with an explicit understanding of the properties one is looking for. One has a disposition, for example, to make an explicit inference from "the stuff has gone green" to "there's copper in it" (Quine 1960). Identifications of this sort generally do presuppose the application of prior property concepts. Further, any explicit knowledge that you have of the properties of a substance can help you to identify it, even if these properties are not unique to it. No, we think, that can't be Sally after all because Sally doesn't know French, or that can't be real gold in the window because real gold would cost more than that.

It is because knowledge of the properties of substances are so often used in the process of identifying them that it is easy to assimilate having a concept of a substance to having knowledge of properties that would identify it, and to assimilate identifying to classifying, to applying a description. But consider: recognizing Mama by smell certainly is not classifying her nor is it conceiving of her as whatever bears that smell. It is more accurate to imagine it as a tokening of the mental term "Mama" in response to a smell. The thought is of Mama, not of smells, but it arises in response to a smell. Similarly, recognizing copper by the fact that the stuff has gone green is not conceiving of it as being, just, a green-turning stuff. Rather, one tokens a mental term for copper in response to the knowledge it has gone green. What makes it a mental term for copper is not that it occurs in response to knowledge of these or those properties, but the fact that it serves as a repository for incoming information<sup>5</sup> about copper and its tokenings are controlled by previous manifestations of copper in one's experience. These include, of course manifestations by which explicit knowledge about copper has previously been gained (for example, through language—see Chapter Six).

Accurate understanding of the ontological principle or principles that ground a substance can certainly help in tracking it in difficult cases. The psychologists Medin, Gelman, Keil, and Gopnik & Meltzoff, especially, have been interested in tracing the origin and development of children's understanding of these principles, and they have observed that both children and adults appreciate that there must be some such principles underlying their substance concepts. But they have not been clear that understanding of this sort is not necessary to having a concept of a substance, and that having or lacking such understanding need make no difference to the extensions of one's substance concepts.

#### ' 5.7 Developing Substance Templates

So much for learning to track substances. But how does the child know what questions she should expect to be answerable about each substance? This requires at least a

---

<sup>5</sup> That is, information derived from natural information encountered by the senses. On information, see Appendix B. .

rough grasp of relevant substance templates. As mentioned in Chapter Two, there is evidence that some preliminary grasp of some substance templates, such as physical kinds, animal kinds, plant kinds, artifact kinds, social kinds and so forth, may be endogenous (Keil 1979, 1989; Carey 1985; Atran 1989; Markman 1989; Spelke 1989, 1993; Gelman and Coley 1991; Gallistel et al 1993; Marler 1993, Boyer 1998). Mandler (1997, 1998) claims that "the earliest conceptual distinctions infants make is at the level of animal and vehicle, not at the level of dog and cat" (1998, P. 79). If true, this is an interesting contrast to the order in which they acquire the words "dog" and "cat" versus the words "animal" and "vehicle." This makes sense, however, when we consider how few things there are to be learned about either animal or vehicle (as such) on the one hand and how important these are as substance templates on the other. What is most interesting about animals, for example, is that they divide into species, and that roughly the same sorts of questions can be asked about each of these species, and answered once and for all after one or a few observations. Since animal is not something there is much to find out about, there also is not much to say about it. So it is not surprising that the word "animal" enters the child's vocabulary rather late. But since recognizing the substance template animal is crucial to learning about the various species of animals, it is equally unsurprising that animals might be recognized as such very early. Indeed, as the various psychologists mentioned above suggest, grasp of such substance templates may have a strong boost from endogenous factors.

However acquired, an adult possesses innumerable substance templates of more and less generality. The ability to recognize substance instances falling under these templates immediately supplies not only answerable questions to ask of these substances but the ability to learn how to track each new instance encountered very efficiently. Things that are likely to vary in posture but not size or color can be tracked using size and color but not posture; things that can be more than one place at once (kinds and stuffs) are not tracked by place, or rather, their tracking can carry over from one place to another, and so forth. Huge numbers of substances are not merely substances, but bring with them templates for more concrete substances falling under them. For example, the ability to identify cats is easily applied to discovering what sorts of questions can be asked about individual cats. What color is this cat (it won't change as with chameleons), is it tame or untamed (not applicable to flies), and does it have feline leukemia (not applicable to dogs) or a loud purr?

Whether we have built in templates and ways of conceptually tracking stuffs or real kinds of any particular sort is clearly a matter for empirical research. Research of the sort that the psychologists mentioned above, among others, have been doing, though I am suggesting a somewhat different framework for interpretation of experimental results. Without doubt, the results of more traditional studies of concept formation also cast light on how conceptual tracking develops. Although tradition has pretty single-mindedly taken substance concepts to be classifiers, much experimental work is easily reinterpreted as implicitly addressed to the question how we track substances and how we learn to track them. Examining "the function" from "learning instances plus the target items to categorize" to "the set of possible category judgments," as Billman put it (1992), should

help us to discern what kinds of traces are followed as people attempt conceptual tracking, at various ages, and for different domains of real kinds. But I believe that experiments need to be designed and interpreted with it in mind that the cognitive systems are designed by evolution and tuned by experience to find real-world substances, not random logically possible ones. Close attention needs to be paid to the details of real world ontology, to the principles that hold real substances together, and the relevance of experiments using artificial objects and kinds should be carefully justified.

One more fundamental medium through which conceptual tracking is achieved is language. That is what Chapter Six is about.

.