Chapter 4

Ruth Millikan

CHAPTER FOUR
PRODUCTIVITY AND EMBEDDING IN NATURAL SIGNS

Before turning to the relation between recurrent natural signs and intentional representations, I want to discuss two features well known to characterize the parade cases of intentional signs, namely, conventional linguistic signs, but that are not generally recognized to characterize natural signs. First, locally recurrent natural signs are productive. For in their own way, they are something like compositional. Second, locally recurrent natural signs allow embedding.

From now on by "natural signs" I will mean locally recurrent natural signs, unless I say otherwise. Natural signs are not just objects or properties of objects. They are occurrences or states of affairs --I will say "world affairs" or just "affairs." World affairs, as I understand these, are structured or articulated aspects of the real world roughly of the sort that are sometimes called "truth makers." I will not say "truth makers," however, because it so strongly suggests correspondence to just one particular sort of sign (namely, a sign having clear subject-predicate structure that is also sensitive to a negation transformation). World affairs are mind-independent, unless minds happen to be part of their subject matter. Natural signs are structured world affairs and the things of which they are signs are also structured world affairs, analogous to the correlates of complete sentences rather than open sentences or sentence parts. Strictly speaking it is not the black cloud that is a sign of rain. Rather, the structure that is a black cloud in the sky at a certain time, *t*, moving toward a certain place, *p*, may be a sign of the structure that is rain occurring shortly after *t* at *p*. Similarly, the structure that is an ε-track at a place, *p*, and a time, *t*, may be a sign of the structure that is a quail passing p shortly prior to t. Structures are often referred to using "that..." clauses. Another way to put this same point, then, is to say, "that there is a black cloud at a certain time, *t*, moving toward a place, *p*, is a sign that it will rain at *p* shortly after *t*."[1] Signs that tell by their own time and/or place something about the time and/or place of something else are very simple signs, but it is crucial to see that, as signs, they are in this way structured.

Their structure determines their meaning architecturally. The meaning of the sign is determined as a function of values of significant variables or determinables exhibited by the sign. Put another way, the meaning varies systematically to parallel significant (mathematical) transformations of the sign. It is often said that the meaning of public language sentences is determined "compositionally." Exhibiting compositionality, in this sense, is just one among other ways of being architecturally structured. Representations that exhibit compositionality are transformed into other representations in the same system by rearranging the same parts or by substitution of parts. It is not compositionality in particular, but architectural structuring more generally, that yields the productivity of sign systems, their capacity to say new things or to give new information.

In the very simplest cases, the significant variables in natural signs often are merely time and/or place. But even something as simple as tracks in the mud can include other significant variables as well. The size of the track may be a sign of the size of the animal, the distance between the tracks a sign of how fast the animal was moving, the angle or depth of the track may be a sign that the animal is pregnant, and so forth. Then size, and distance between, and angle or depth, are additional variables that help, structurally, to determine a more complex affair as the one signified.

In Connecticut, geese flying south are local recurrent natural signs of the approach of winter. Now consider what it is that recurs. That geese are flying south through Connecticut on

November 25, 2003 is a natural sign that there will be winter in Connecticut soon after November 25, 2003. Exactly this "same sign" --another token of the same sign type-- will recur, I suppose, if later that same day more geese fly south through Connecticut. But that kind of "recurrence" of "the same sign" does not teach us anything new. We already knew from the first sign that winter was approaching Connecticut. If natural signs recurred only in that sense of recurrence, they would be useless. Learning what a certain sign meant would not generalize; one could not learn anything from encountering "that same sign" again.[2]

By "recurring" in the phrase "recurring natural sign" we need to understand not that the same sign, in the above sense, itself recurs, but that the same sign-signified relation recurs. The interesting thing that recurs is the relation of the time of some geese passing through to the time of some winter. That is, what recurs is the applicability of a certain natural, structural, semantic mapping. The structure of the sign includes its own time and place. What is signified depends on the determinations of these determinables, on the arguments for these variables. The rule determines the determinate structure of the signified from the determinate structure of the sign. It fills in where and when a winter will occur given where and when the geese are flying.

Put another way, what "recurs" in the case of recurrent signs are other members of the same system of signs, where a sign system consists in a set of possible sign types, designatable transformations of which ("transformations" in the mathematical sense) correspond systematically to transformations of what they signify. Consider ε-tracks again. If, on a particular ε-track, we perform the (mathematical) transformation "move it ahead five years, move it south 2 miles, and cut it down to half its size" and perform the same operations on the place, time and size of the (cross section of the) quail indicated, we arrive at another (possible) natural sign in the same sign system. Notice that in this sort of case, times that represent times and places that represent places are perfectly ordinary ingredients of natural signs; they are not, for example, special "indexical" elements. Exactly similarly, size represents size in this example, but size surely is not an indexical. We can invent a special term for the case where a sign element represents itself. Call these sign elements "reflexive."

In this manner "recurring natural signs" are really recurring relations between, or functions from, signs to signifieds. Call these functions "semantic mapping functions." Semantic mapping functions define isomorphisms between the set of possible signs in a certain sign domain and the set of their possible signifieds. Natural signs are abstract "pictures" of what they represent, indeed, sometimes, as in the example just given, these pictures are not even particularly abstract. When natural sign systems have more significant variables than just time and/or place, it becomes more natural to call them not just "natural signs" but "natural representations," and to speak of the (local) "information" they carry. Thus a close relation between an "informational" theory of signs and a "picture" theory of signs emerges.

The semantic mapping function that mediates between a domain of signs and its corresponding domain (range) of signifieds can be a function that maps many different signs onto the same signified. Consider as an analogy the plus function in mathematics. Many different pairs of numbers may map by addition to the same sum, for example, 5+5, 4+6, 3+7, 2+8 and so forth. A single function may operate on a variety of different arguments or on different values of relevant variables to produce the same value. Consider various images of a three dimensional object as reflected in a mirror. Depending on the angle of the mirror and its distance from the object, a variety of different patterns of light reflected from the mirror will all correspond to the same object shape and color[3] in accordance with a single many-one rule of projection. There is a

mapping from the domain of patterns reflected from the mirror into the range of shapes and colors that have caused these patterns, given uniform channel conditions of lighting and so forth. It is not that there is a probability of one, given a certain pattern reflected from the mirror, that a certain shape is present before the mirror. But there is a domain **in which this mapping holds** where channel conditions continue to exist or to recur (revolutions of the earth) for a reason.

Where one structure represents another structure, it is natural to speak of aspects of the first that correspond to definite aspects of the second as themselves representing or being signs of those aspects. So we say that the place of the track signifies the place of the quail and the size of the track signifies the size of the quail. But it is essential to keep in mind that this kind of sign-signified relation is only derivative. It exists only relative to the mapping of the complete sign to the complete signified, and relative to the larger sign system from which it has been abstracted. It is a serious mistake to suppose that the architectural or compositional meaning of a complex sign is derived by combining the prior independent meanings of its parts. Rather, the meanings of the various significant parts or aspects of signs are abstracted from the prior meanings of complete signs occurring within complete sign systems. It is not that place means place and size means size and an ε-track means a quail and that when you combine these you have a sign meaning there is a quail of a certain size at a certain place. Obviously time does not mean time, nor does size mean size, not out of context. (Similarly, words do not have meanings first and then get combined into sentences. Nor does the ability to think begin, say, with the ability to think "horse" for horses and then other parts of propositions get added on later. But once again, I am ahead of my story.)

Let me illustrate these principles with some richer examples. I have said (Chapter Three) that assuming a gas gauge is connected up correctly, the position of the needle on the gauge may be a recurrent natural sign of the amount of gas in that car. The hookup and surrounding conditions that cause this particular gas gauge to work right today will probably sustain themselves so that it continues to work right tomorrow. The reference class containing readings of this gauge, from the time it is initially installed until the time that it first breaks down, is the natural domain of a locally recurrent natural sign. The semantic mapping function for this recurrent sign is a function from positions of this pointer on this gauge at various times to amounts of gas in this car's tank at those same times. But, of course, unlike the case of the size of the ε-tracks in our previous example where transformations on track size corresponded to transformations on bird size, here transformations on pointer positions map to transformations on gas volume. (This semantic mapping function need not be a linear function, of course, to be a natural semantic mapping. In most cars, in my experience, this semantic mapping function is not linear.) In a similar way, every individual well-made undamaged measuring instrument, gauge, meter, or scope, of any kind, produces locally recurrent signs within its own individual domain that map by some semantic mapping function onto its own individual range of signified world affairs.

Now consider modern gas gauges more generally. Is there a reason why one can learn from experience with a few gas gauges how to interpret others? Of course there is. These gauges are, in general, purposefully made so that people who know how to read one will know how to read another. The idea of having a gas gauge and the rough design at the dashboard are copied from one model of car to another. There is a reason why learning how to read one gas gauge prepares one to read another. Don't trust what looks like that needle when you go up to Mars, but here on earth, the positions of needles on gas gauges all fall in the same roughly defined locally recurrent sign domain. Notice however that an additional sign variable has been added when we move from the

domain of a single car's gas gauge readings to the larger domain that includes readings of gas gauges on other cars. A "which car?" variable has been added. That the gas gauge pointer of car C_1 is part way up signifies that the gas tank in car C_1 is partly full. Just as a time can reflexively represent a time or a size reflexively represent a size, an individual can reflexively represent an individual. If you don't know which car the gauge is in, clearly you won't know which gas tank is partly full. The reflexive "which car?" variable is crucial. It supplies the subject term for the information supplied by the pointer, the subject term in this generalized sign domain being variable.[4] Of course, pointing needles on gas gauges in this broader domain are not nearly as well correlated with gas levels in gas tanks as is the pointing needle on the working gauge of most individual cars. There are rather large differences in the semantic mapping functions that map needle positions to gas levels in different individual cars. Mine, for instance, reads a quarter full when it is about half full. Gas gauge readings, within this broad domain of recurrence, are not very accurate signs.

Here are some other examples of articulation within local natural signs. Due to conditions prevailing and persisting in prevailing in most places on earth, the world affair that is the pattern of sunlight, including wavelength, intensity and direction, passing though each point of unoccupied space at each moment in time contains a great quantity of locally recurrent natural information. When the patterns passing through small spatially and temporally contiguous regions of points are pooled, the amount of information is vastly increased. Eyes, especially lens eyes, have been designed by natural selection to convert the locally recurrent natural representations found in the light surrounding an organism into natural representations having semantic mapping functions that are more user-friendly. The patterns of light typically striking the retinas of human eyes over small continuous intervals of time are or contain naturally recurrent signs of a variety of kinds of world affairs.

First, there is a great deal of local information contained about the spatial layout of the immediately surrounding environment. Much effort has been spent by students of perception trying to describe, as exactly as possible, the natural semantics of these natural representations. Within naturally continuing domains, they often contain local natural information, for example, about the distances, sizes, shapes, colors and textures of currently nearby objects. In these natural representations, as with the quail tracks, the time of the representation corresponds to the time of what is represented. And although the location of the representation is not the same as the location of what is represented, the second is a direct function of the first. The location is not strictly a reflexive element of the sign, but we might call it a "relative reflexive" (to echo "relative adjective"). Similarly, if one inch on a blueprint stands for one inch, length is a reflexive element of the blueprint sign. If one inch stands for one foot, length is a relative reflexive. The semantic mapping function transforms a determinate of the representation into a determinate of the represented that falls within the same determinable range.

A natural sign of a natural sign of an affair is itself a natural sign of the same affair. That is, Dretske's "Xerox principle" is preserved for local information (Dretske 1981.) This assumes, of course, that what is meant by a "natural sign of a natural sign" is not merely a natural sign of a certain sign form, since the same sign form (say, a certain shape) may be a local sign of different things in different local domains. Rather, a natural sign of a natural sign has to signify the presence of a sign form within a certain domain. For example, a photograph of an ε-track may be a natural sign of an ε-track having once born a certain relation to a camera (see the paragraphs on

photographs below), but if it has nothing in it to indicate the particular ε-track domain in which this ε-track occurred, it is not a natural sign of a natural sign in the sense intended.[5]

Recall now that certain combinations of size, shape, color or texture may comprise local signs of the presence of a certain kind of object. --of fox, for example, or of elm tree. Or they may combine to yield a local sign of the current presence of Jill or of Johnny. Here again, time stands for time, and the location of the properties shows the location of fox, say, or of Johnny. A retinal image occurring at location l_1 at time t may be a natural sign of a certain combination of size, shape, color or texture at a certain location, hence may be a natural sign of a natural sign, say, of fox, or of Johnny, being at l_2 (a closely related place) at t. But the time and place of the retinal image shows the time and place both of the properties and of what they in turn signify. So the effect is as though only part of the image-as-sign --the part that's left if we omit place and time of occurrence-- was a sign of a sign --more accurately, a sign of a part of a sign. Then one sign appears to be embedded within the other. A sign of a sign of Johnny thus becomes a sign of Johnny, although neither sign, of course, is a complete sign apart from spatial and temporal context. The semantic mapping functions for such embedded signs result from applying the semantic mapping functions of succeeding signs on the route one after the other. The resulting function, if grasped, can also stand alone and be applied directly.

Call an affair signified by a sign, B, where B is in turn signified by another sign, A, a "more distal affair" signified by A. Then say that B is part of the "route" from A to that more distal affair. Given that the geese passing through is a sign that winter is on the way, and given that the presence of fresh droppings by the pond is a sign that the geese are passing through, the presence of the fresh droppings is a sign of the more distal affair that winter is on the way, and the geese passing through is part of the route from the droppings to this more distal affair. Similarly, a combination of the shape, color, texture, and location characteristic of fresh goose droppings occurring at a place may be a local sign of the presence of fresh goose droppings at that place, hence signify the more distal affairs that the geese are passing through and that winter is on the way, the second affair being part of the route to the third and hence also to the fourth and furthest affair. And if certain patterns occurring at a certain place and time on the retina are a local sign of the occurrence of the kind of location, shape, color and texture that are a local sign of goose droppings, then these patterns have the four previously mentioned affairs all as more distal signified affairs, each being part of the route to the next. Of course, different natural signs may signify the same more distal affair by different routes, or by routes that are only partially the same. Gathering that there are quail in the wood by seeing their tracks and gathering this by seeing their stray feathers utilize retinal signs indicating different routes to a common distal affair. (Of course, retinal patterns themselves are not perceptions or intentional signs of anything, certainly not just as such.)

Natural signs may be interpreted at any level of embedding or at more than one level of embedding. Retinal patterns of the sort just described might result in the observer' s recognizing certain colors and shapes but not in recognizing goose droppings as such, or in the observer recognizing goose droppings but not that geese are passing through or that winter is on the way. Moreover, since there is always a semantic mapping function that goes directly from a sign of a sign to the more distal affair signified, it is often possible to recognize distal signifieds without recognizing all or any of the signs on the route. We recognize colors and shapes, not patterns on the retina. Similarly, a creature may recognize foxes or Johnny without recognizing the colors and

shapes that locally signify foxes or Johnny. It is well known, for example, that infants are able to recognize Mama, doing so, of course, only on account of her having quite definite perceptible properties that signify her locally, but that they do this years before they have concepts of any properties at all.[6]

Where retinal patterns occurring at certain times and locations are local natural signs of other things occurring at the same times and at related locations, the times and places of the retinal images are, once again, perfectly ordinary parts of these signs. There are no "indexical" elements in a retinal image. Especially important, the retinal representations of observed individuals are perfectly ordinary. They are just like natural signs of natural kinds such as fox and elm tree. What makes a retinal image be a natural representation of Johnny is not, for example, that it is caused by Johnny, but that it contains a local sign of Johnny, a sign of the presence of certain features, which are, in turn, a recurrent sign of Johnny within a certain locale. Parallel to this, a retinal image signing the presence of fox will also be a sign of the presence of Reynard the fox, but not indexically, and not merely because it is caused by Reynard.[7] It will be a very local sign, correctly readable only by someone able to keep track of Reynard's very local domain. Indeed, if there are lots of Reynard's twin brothers playing with Reynard, it may be that keeping track is not possible without, quite literally, keeping an eye on him.

On the other hand, keeping track of an individual is often accomplished by recognizing recurrent signs of a more general type exemplified by the individual. In a certain locale, all signs of fox may be signs of Reynard. Suppose you are trying to keep track of a squirrel that you just saw running up a tree in your yard. Call him "Scamper." You will track Scamper by catching various glimpses of squirrel shape or, just, small-animal shape, then seeing where the branches are shaking, seeing or hearing where the hickory nuts fall, perhaps by hearing the squeaks, and so forth. Any sign of squirrel in this immediate vicinity is a sign of Scamper. In this manner you tell where Scamper is now and what he is doing. Alternatively you may be able to recognize Scamper by signs of the presence of a more specific kind of animal. He is the neighborhood squirrel with only half a tail.

Next consider photographs. Unlike a retinal image, a photograph, considered as a member of a certain local sign domain, contains no information as to the time or place of anything. It does, usually, contain the information that there was once a camera, c, and a time, t, and a spatial layout, s, such that s was in front of c at t. But that sort of information, taken just by itself, is completely general. It goes, as it were, under existential quantification. On the other hand, a photograph may contain the information that it was a fox, or that it was Johnny, that was in front of a camera, and that this object had such and such additional properties. It does this by being a sign of a kind of spatial layout, hence of properties, that are locally recurrent signs of the presence of fox or of Johnny. A photograph tacked to the cabin wall where I spent childhood summers showed a brown short-haired dog wearing a coat and tie standing on its hind legs beside a long-haired white dog wearing a dress and a lady's hat. It interested me enough that I still have not forgotten the fact that there once existed an *x* and a *y* such that *x* was a brown short-haired dog...and so forth. We seem to be peculiar among the animals in being able to record and make use of this very general kind of information (Chapter Nineteen below).

A photograph may contain as a distal affair the local information that Johnny, at a certain rough age, was once flying a purple kite. But again, it is not merely because Johnny caused the picture that it contains a natural sign of Johnny. It represents Johnny because it shows characteristics that are distinctive of Johnny, distinctive at least in a local information domain.

Suppose the photograph was of a particular copy of The New York Times and showed nothing else. There would be exactly one individual copy of The New York Times that that photograph was a photograph of. But the photograph would not contain any information about that particular copy of The New York Times because it could not inform us as to which individual copy it was a photograph of. Although both photographs and recurrent natural signs are "pictures" in the sense that certain significant isomorphisms determine their representational values, the "ofness" or "aboutness" of a photograph of an individual is not the same kind of "ofness" or "aboutness" as that of a recurrent natural sign of an individual. (Later I will argue that the ofness or aboutness of intentional representations of individuals is like that of recurrent natural signs in this way.[8])

Now consider the retinal image produced by looking at a photograph. It too may contain the local information that Johnny was once flying a kite in front of a camera. But the semantic mapping functions that mediate between the image and the kite-flying affair are not the same as those for a direct retinal image of Johnny flying a kite. The sign route begins with a sign of the spatial layout of the immediate environment, but this layout is a natural sign only of the presence of a photograph, certain properties of which are signs of a spatial layout once in front of a camera, which in turn signify certain properties of Johnny, which signify Johnny --but not, of course, Johnny as being at the same place and time that the photograph is.

But, of course, the fact that all of this natural information is bombarding the retina does not mean that the organism behind that retina is capable of interpreting or using any of this natural information. Clearly, seeing what's in a photograph requires interpreting differently than seeing directly. Also, a hugely important difference between the photograph and a direct retinal image of Johnny is that the latter, but not the former, contains information about the spatial and temporal relation of the observer to the observed. Animals don't see anything in photographs, or if they do, they take what they see to be present. Their seeing capacities are designed only for use in immediate practical activities. They have no ability to use information about, just, what once existed sometime and somewhere or other. Most animals don't see anything even in mirrors, for although mirrors can be used to guide immediate practical activity, special semantic mapping functions must be utilized for this and most animals are not that flexible. The crucial functions by which relations of things seen to the seer must be interpreted are shifted over when a mirror is used. At first interested, a kitten soon begins to interpret the image in the mirror just as a hole in information space. It no more sees anything there than you see the reflections of the people inside the train in the train window when you are concentrating on the scenery outside.

Equally important, so I reemphasize it here, interpreting a sign of a sign of a sign need not involve recognizing all, indeed any, of the signs along the route as such. Each sign along the route shifts the semantic mapping function. But each sign is a sign of each of its more distal signifieds in accordance with a resultant direct semantic mapping function as well, and this direct function may be the only relevant one in simple cases. The rabbit need not perceive, need not harbor an intentional representation of, what is happening on its retina, or what is happening to light impinging on external objects, or even what the color, shape, texture, motion and so forth are that locally signify a fox, in order to recognize fox and take cover. It is possible that its nervous system should produce an inner intentional representation of fox directly from retinal stimulations. Similarly, it is in principle possible that a creature might recognize Johnny directly from retinal stimulations without going through the process of first recognizing the shape of his face. But here I have gotten ahead of my story again, for it is only intentional representations that can signify distal affairs without at the same time signifying all the more proximal ones in between, and intentional

representations are the subject of the next two chapters. There I will argue that not just the origins but the uses of intentional representations are involved in determining their semantic values. If they are not used for representing any intermediate signs on the route from A to B they do not represent any of these intermediate signs intentionally.

I have said that embedding in natural signs is like embedding in natural languages. Two kinds of embedding occur in natural language. I will discuss only the simpler kind in this chapter. In these simpler cases, linguistic signs represent things not directly, but by intentionally representing properties that are natural signs of these things. More accurately, the linguistic signs accomplish this granted that they are functioning properly, that is, functioning in the way that has accounted for their proliferation in a language community (Chapter Two). To function properly, the properties they represent must actually be natural signs of something. In the more complex kind of embedding, to be the subject of Chapter Seven, linguistic signs intentionally represent other representations as representations, and the represented representations, if they are intentional representations, may or may not be signs of anything real. Linguistic signs of this latter kind are what produce the phenomenon of intenSionality (with an 's').

Simpler cases of embedding in language involve what I will call "defining descriptions" of various kinds. Descriptions such as "the 16th president of the United States" are well known to philosophers under the name "definite descriptions." But there are many other defining descriptions that operate in much the same manner that are not naturally expressed using the definite article. Examples are "taller than Sally," "avocado colored," "a strong Greek accent," "moves like a karate blackbelt," "as close to Boston as New York." A characteristic of defining descriptions is that something like Donnellan's distinction between "referential" and "attributive" uses applies to them all (Donnellan 1966). For our purposes here, I am interpreting Donnellan's distinction as follows.[9] Recall the distinction between a public linguistic form's own function or purpose and a particular speaker's purpose in using it (Chapter Two). In using a defining description, sometimes the purpose of the speaker will be accomplished whether or not the hearer understands/knows, independently, to what the description applies. It will be accomplished, that is, whether or not the hearer knows what the property mentioned in the description is a local sign of. Other times the speaker's purpose will not be accomplished unless the hearer does independently know to what the description applies.[10] Thus, although taller than Sally is taller than a definite height, a hearer may come to believe that Jane is taller than Sally without coming to believe, for a definite height, that Jane is taller than that. Donnellan's distinction concerns whether this matters or not, given a particular speaker's purpose. Similarly, a hearer may or may not know/understand what color avocados are, or what a strong Greek accent is like, or how karate blackbelts move, and this may or may not matter to a speaker's purpose in using a sentence that makes reference to these properties. Knowing to what a description applies is knowing, for any complete affair in which those descriptive properties are exemplified, within the relevant domain, what further affair is instantiated there. Compare: John is in the place and at the time that the peculiar contours of his face are instantiated.

It is worth adding to this way of articulating Donnellan's distinction a further distinction as well. There are times when a speaker's purpose will be accomplished only if the hearer both understands, independently, to what the description applies and also knows and keeps in mind the particular properties mentioned in the description. Then the speaker's purpose will fail if the hearer goes straight through to the furthest embedded affair represented and does not hold in mind the properties mentioned. Here is an example where understanding what properties are meant and

knowing what instantiates them are both important: "I see that the smallest child has taken the largest piece of cake again!" (Millikan 1984, chapter 11).

Just as with embedding in natural signs, an interpreter of a defining description in natural language may recognize what properties are signified without recognizing of what they are the properties. Or an interpreter may recognize both what properties are signified and what these properties in turn signify. Or an interpreter may recognize the more distal affair signified without recognizing the properties that signify it, as when a small child recognizes that "the president of the Paleontological Society" is her mother without knowing what a president is, what a society is, or what paleontology is. The child may use a direct semantic mapping function, and this may be enough to fulfill a speaker's purpose in speaking, even though as a public language sign "the president of the Paleontological Society" is indirect.

Defining descriptions in natural language generally signify occurrences of properties which occurrences are local signs rather than context-free signs of referents. Occasionally the local domain of the property occurrence intended is our entire universe. This does not make the property occurrence into a context-free natural sign. Context-free signs signify what they do by virtue only of natural or logical necessity, never merely by virtue of contingent truths of our universe. Often the properties signified by defining descriptions might have any of numerous different significances depending on the domains in which they occur. The shape and characteristic motion of a cat in one local domain is a sign of Felix, in another it is a sign of Zeke. Similarly, being an exemplification of catkind in the one domain signifies Felix, in the other Zeke. A hearer of the simple description "the cat" must gather from context which local sign domain is the one within which the occurrence of catness is being referred to by the speaker. Tracking local sign domains through language bears many similarities to tracking local sign domains in nature. ("Please bring the book on the table." "Which book on which table do you mean?") A lot of attention has been paid recently to the phenomenon of joint attention between participants in a conversation. To understand joint attention completely would be to understand how speakers and hearers manage to follow the focus of one another's minds during ordinary conversation so that the hearer's attention is successfully drawn to the local domains on which the speaker is focusing. This theme will be taken up again in Chapters Ten and Eleven.

FOOTNOTES

---

1. Compare Wittgenstein: "That '*a*' stands in the relation *R* to '*b*' says *that aRb*" (Tractatus Logico Philosophicus 3.1432).

2. A friend asks: "But what is wrong with the other approach: type together all flockings of geese....that sign type then carries the information 'winter soon'? What is wrong is that the phrase 'winter soon' does not express a piece of information. It does not name a world affair. You have to place that phrase at a particular time and in a particular place in order to get it to refer to a world affair. To carry information is to refer to some state of affairs.

3. The same partial shape, to be exact, allowing that not all the same parts of the object are reflected in each of these views.

4. So far as I know, Dretske never addresses the issue of how the subject terms of propositions such as his "*s* is *F*" ever get represented either by natural signs or by intentional signs.

5. We can be more exact. Assuming that the picture is a sign of an ε-track having occurred on earth during a fairly specific historical era, within which local domain such ε-tracks were correlated both with pheasant and quail, then we might say it is either a sign of a sign of pheasant or a sign of a sign of Quail. ("These spots might mean measles or they might mean scarlet fever.") Depending on which, the picture itself is either definitely a sign of pheasant or definitely a sign of quail. So the Xerox principle still holds. (Thanks both to Gunnar Björnsson and to Nicholas Shea for requesting clarification on signs of signs!)

6. More extended discussion of these matters is in (Millikan 2000) Chapter Five.

7. It must, of course, be caused by Renard to be a natural sign of him, however, just as the spots on Johnny's face must have been caused by measles to be a natural sign of measles.

8. That is, looking ahead, what an intentional representation represents is not what caused it, nor what would have caused it, or the thing whose properties it would have signified had the biological mechanisms producing it been operating properly. This is a crucial departure, as I see it, from Cummins view (Cummins 1996), from Evans' view (Evans 1982), and also, I think, from Dretske's view.

9. I do not claim that Donnellan himself had just this in mind

10. The notion "knowing independently what such and such is" is not an easy notion, however. For a full discussion of it see (Millikan 2000) Chapter 13 ff.. See also (Böer and Lycan 1986).