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An Input Condition for Teleosemantics? Reply to Shea (and Godfrey-Smith)[1]

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In his essay ''Consumers Need Information: Supplementing Teleosemantics with an Input Condition'' (this issue) Nicholas Shea argues, with support from the work of Peter Godfrey-Smith (1996), that teleosemantics, as David Papineau and I have articulated it, cannot explain why ''content attribution can be used to explain successful behavior.'' This failure is said to result from defining the intentional

[1]Thanks to Veebha Bhatt and Gunnar Bjo¨ rnsson for helpful readings of this essay.

contents of representations by reference merely to historically normal conditions for success of their ''outputs,'' that is, of their uses by interpreting or consuming mechanisms, bypassing the more traditional focus, of those who would naturalize intentional content, on causal or informational inputs. Shea proposes to ''add an input condition to teleosemantics,'' requiring that simple representations must carry ''correlational information.'' I am grateful to Shea for his paper, as it presents me with an opportunity to clarify two fairly central features of my position on intentional content, one of which seems to have been overlooked in the literature (Millikan, 1993a), the other of which I have stated previously only in a confusing way (Millikan, 2004, Chapters 3-4). The first clarification concerns the general form that I take explanation by reference to intentional states to have. The second concerns my description of ''locally recurrent natural information,'' why this kind of information is needed in place of Shea's ''correlational information'' to explain what feeds simple representational systems, and why no reference to natural information is needed to account for the success of behaviors by reference to the truth of representations that motivate them.

Part 1. Dr. Pangloss

Consider first Shea's argument—which he attributes in part to Godfrey-Smith—that current teleosemantics cannot account for the fact that the success of a behavior is sometimes explained by reference to the truth of a representation motivating it. The argument turns on a hypothesized analogy between intentional explanation understood on the teleosemantic model and Dr. Pangloss's explanation that opium puts one to sleep because it possesses a dormative virtue. Shea claims that, in simple cases, teleosemantics defines a true representation as one that corresponds to a condition in the world that has historically caused a certain kind of success (when the representation was reacted to—used—in a certain manner).

He concludes that reference to the truth of such a representation cannot then be used to explain an occurrence of this kind of success (given this kind of reaction) without circularity. Following Godfrey-Smith, Shea leads into this conclusion by first considering a simpler theory of representational content, which he calls ''success semantics,'' which claims that the truth of a representation just IS its corresponding to a condition in the world that will cause success (given a normal reaction or use). If truth just IS corresponding to a condition that causes success, clearly success can't be explained by truth. Shea then claims that the teleologist's move according to which truth is defined as corresponding not just to any condition that will cause success but to a condition of a kind that has historically caused success (given a normal reaction or use) does not solve this problem.

To see exactly what Shea's argument yields here, I propose to examine what happens if you add a reference to history to Dr. Pangloss's explanation rather than if you subtract a reference to history from the teleosemanticist's explanation as Shea and Godfrey-Smith have done. Let us put history into Dr. Pangloss's explanation in a way that mirrors its occurrence in the teleologist's suggested definition of a true representation. Assume that a ''sleeping pill'' is something that, by definition, has in its history that is was selected for manufacture owing to containing something capable of causing sleep. Dr. Pangloss then claims that sleeping pills put one to sleep because they have a dormative virtue (a sleep-

producing effect). Analogously, teleosemantics claims that true representations produce success because they correspond to environmental conditions that have a success-producing effect.

> Obviously, this will not do. As Shea observes, if the teleosemanticist's explanation of how true representations explain success includes nothing more than this kind of a reference to history, ''being caused by a true representation does nothing further to explain why acting on R in that way leads to survival and reproduction—it just did in the past and it does still.'' But is that how the teleologist's explanations of success by reference to truth actually go? Are explanations by reference to the truth of representations attempts to explain why acting on representations that are true leads to success?

Suppose that rather than explaining why sleeping pills put one to sleep, Dr. Pangloss offers to explain merely why the pills that John took put him to sleep. Answer: because they were sleeping pills. This does seem to help. For the pills John took could have put him to sleep instead, say, because they were insulin pills and he didn't need insulin, or because he thought they were sleeping pills so they had a placebo effect, and so forth. A parallel would be if teleosemanticist offers to explain why the beliefs John had helped him to succeed by pointing out that they were true. The beliefs John had could have helped him to succeed instead because he told them to Sam and Sam took pity on his naivete and rigged John's success despite them, or because they lead him into success in any of various entirely accidental ways. It appears then that although explanations for success of the ''because his beliefs were true'' kind may not be exciting, they need not be circular.[2] Of course, like other ordinary explanations, this kind of explanation is not

[2]Shea dismisses this kind of explanation without argument, calling it ''thin.''

a complete explanations. In a moment I will say something about the kind of incompleteness it displays.

More exciting, however, would be if Dr. Pangloss were to explain why John fell asleep rather than why the pill he took put him to sleep. Let Dr. Pangloss claim that John fell asleep because he took a sleeping pill. This could well be a valid and useful explanation, for there are lots of other familiar reasons why John might have fallen asleep instead. He might have been dead tired, or bored, or his mother might have sung to him, or the room might have been too hot or too close and stuffy. A parallel would be explaining why John succeeded in getting to Boston by saying that he used a map that was up to date and accurate, or that he followed the road signs and the road was well and clearly posted, or that he had prior beliefs about the route that were true. Another parallel would be explaining that the frog succeeded in ingesting a fly because its fly detectors correctly detected the fly's location at the time of its presence. Though not complete explanations, these do feel like valid explanations, in part because in each case there could have been entirely different, perhaps merely accidental, reasons for success instead. What may even make them exciting explanations is that the successes of the behaviors of humans and animals may depend, besides on accident, on any of a number of different kinds of representations (say, maps, beliefs, perceptions) or may instead depend on no representations at all. Many animal behaviors are not normally controlled by representations, as when you wake up and stretch or when the caterpillar spins its cocoon. Success controlled by true representations is a special kind of success that can deserve mention when it occurs.

These examples are enough to indicate that explanations of success by reference to true representations defined in the traditional teleosemanticist's way need not be empty in the way the explanations Voltaire

attributed to his Dr. Pangloss were empty. But we should try to understand exactly how this kind of explanation actually works. For there is another very familiar and more direct objection to the teleosemantic program on the grounds that it cannot account for the obvious validity of ''intentional explanations,'' hints of which objection are to be found as well both in Shea's paper and in the Godfrey-Smith chapter on which he draws. The objection is that the reference to evolutionary or learning history that figures in the teleologist's description of an intentional representation cannot be right, because behaviors are often explained by reference to the operation of intentional states, and whether or not a state has a certain kind of history has no bearing on the operation of its current causal powers. Current causal powers of mental states are what explain behavior. How they happen to have acquired those causal powers, or why states with those causal powers happen to be around (say, after natural selection has acted), is irrelevant. The property of intentionality, as this property is described by teleosemantics, is causally inert.

If the property of intentionality were nothing but a historical property, of course it would be inert. The historical aspect of the property of intentionality IS inert. Explanations by reference to the presence of intentional states do not[3] use their historical aspect directly as explanatory premisses. How then do these explanations work?

Explanations by reference to intentional states are a subclass of a far more common kind of explanation, possibly the most common kind of explanation there is in everyday use. These explanations appear to explain according to the purposes of things, but can also be given a deeper analysis. Here are some examples:

[3] in the first instance. But see the discussion below of a ''deeper aspect'' of intentional explanation that invokes something like Dretske's ''structuring causes.''

(1). An alarm goes off and John asks Sam, ''Why is the alarm ringing?'' Sam replies, ''You are smoking your pipe under a smoke detector.''

(2). The back of John's shirt suddenly catches fire. Sam explains, ''you leaned against the knob for the front stove burner.''

(3). John ran hard into the back wall of the garage and Sam explains, ''He stepped on the gas instead of the brake.''

(4). John ran hard into the back wall of the garage and Sam explains, ''his brakes failed.''

You will not understand these explanations unless you first understand the purposes, the functions, of the objects called into them: that the purpose of a smoke detector is to ring an alarm in the presence of smoke; the purpose of the knob for the front burner is to turn it on thus producing a flame; the purpose of the gas pedal is to accelerate the car; the purpose of the brake is to stop the car. These explanations appear then to be explanations by reference to purposes. But that a thing has a purpose does not give it ''causal powers.'' Being a smoke detector does not give a thing causal powers. Some smoke detectors don't work. Purposes are not, as such, causes. What then is the deeper analysis?

We do not need to invoke any more general theory of the nature of purposes to see that in the case of artifacts, at least, having a purpose is a matter of a thing's history. Fire detectors, stove burner knobs, gas pedals and brakes are fire detectors, stove burner knobs, gas pedals and brakes by reason of what they were either designed or copied for the purpose of doing—by reason, that is, of their origins. Having a certain kind of history is definititional of them. Explanations that invoke the purposes of artifacts are explanations that make reference to his

tory. And yet, that a thing has a history of having been designed or created for a certain purpose is no guarantee that it can serve that purpose. Nor is the fact that a thing historically acquired its causal powers in a certain way any help in explaining the efficacy of those powers. How then do explanations by reference to purposes use history? How do they work?

The philosopher's favored kind of explanation is explanation by reference to covering causal laws. Explanations by reference to purposes are less direct. They are, in the first instance, only (Russellian) definite descriptions of explanations by reference to covering laws. Consider ''The alarm is ringing because you are smoking your pipe under a smoke detector.'' It implicitly offers a definite description of the cause of the alarm. The cause of the alarm is the operation, in accordance with its design, of a certain mechanism, situated over your head, that was designed to sound an alarm when it encounters smoke. Exactly what that correctly operating mechanism amounts to is not explained; it is merely described definitely as the mechanism that is inside the thing over your head by design. History, used in this way, is no part of the explanation proper. History (i.e., function) is used as a convenient way to give a definite description of the mechanism that is causally involved.

Similarly, that John fell asleep because he took a sleeping pill implicitly offers a definite description of the mechanism that caused him to sleep. The cause was ingesting a substance inside a particular pill that had been manufactured and/or put in pill form for the purpose of causing people to sleep, and it caused him to sleep in the same way it has caused people to sleep in past cases that gave rise to the knowledge of its dormative virtues, thus leading to its manufacture. (The italicized part is the Rosaline definite description.) Otherwise it is not because he took a sleeping pill that he fell asleep but, perhaps, because he thought it was a sleeping pill and it had a placebo effect, or because it contained a substance that

had an unexpected or unusual effect on him that ultimately caused him to sleep none the less.

Maybe you will want to say that this kind of explanation shouldn't count as REAL explanation at all, or not, as Shea puts it, as ''substantive,'' because the causal mechanism involved is not directly described? All that is given is a reference to the existence of a definite historically and currently exemplified causal mechanism that might be found by examining the substance (the pill) or the mechanism (the smoke detector) itself or its history, That's all right with me. You can refuse that such an explanation is substantive. However, we should keep in mind that ordinary folk do count these forms as explanations and use them all the time. They seem to be capable of relieving puzzlement. The teleosemanticist claims that explaining success by reference to the truth of representations is this kind of explanation. It relieves puzzlement even if you prefer not to call it ''substantive.''

Thus the historical aspect of its intentionality need play no direct role in explaining how or why a representation's truth or falsity is tied to successful or unsuccessful (c.f., his brakes failed) behaviors. But the right kind of history is not the only requirement the teleosemanticist (at least this one) has placed on intentionality. Intentionality is a property of representations, and the mechanism of representation can play a substantial explanatory role, even if a fairly abstract one, in explaining behavior.

Representations are not defined by their history alone.

Representations are produced by mechanisms that have historically operated on a certain kind of principle. Producing successful behavior by means of correctly operating representations is producing them in accordance with a mechanism that uses mappings or isomorphisms in simple or, sometimes, very complicated ways. In paradigm cases, the set of possible representations in a representational system runs parallel to a set of possible environmental conditions, such that transformations (in the

mathematical sense) of the representations correspond systematically to transformations of the conditions. Very simple transformations such as transformations of time and place may be involved, or extremely complex ones such as the transformations upon the representations that constitute one's perceptions of one's surroundings or that constitute one's beliefs. An effective use of such isomorphisms, not the historical aspect of intentionality, is what accounts with some substance for the magic of success when representations are used successfully.[4]

Normally-produced representations carry variable information about variable environmental circumstances. The use of a representational system allows an organism to be constantly learning new things, constantly producing new representations—in simple cases, just so as to keep up with the comings and goings immediately around it. For example, Kermit the Frog's representation of something to eat over here to the left now is a different representation from yesterday's representation of something to eat over there to the right then. Each tells a different tale and requires its own response. Explanations of success by reference to the use of representations are thus considerably more substantial than the ''because he took a sleeping pill'' kind of explanation. They tell us on what general sort of principle the mechanism causing success was working. They are more like saying, of an old fashioned grandfather clock, say, that it runs ''by gravity.'' That doesn't tell us how the principle of using gravity is effected in the concrete. It won't

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[4] Having equated the truth condition for a descriptive representation with its ''success condition,'' Shea tells us that ''[t]he specific success condition [for a bee dance] is fixed by the direction the consumer bees generally fly to, in response to the particu-

lar dancing pattern.'' Taken as a statement of general principles involved in teleosemantics, this oversimplifies in several ways that should be explained to the reader not familiar with the teleosemantics literature. It ignores that functions that a mechanism has been selected for performing (here, functions of the consumer-bee reaction mechanisms) are often functions that it is capable of performing only a small proportion of the time. More important, it ignores that, according to teleosemantics,

truth conditions are determined by history, not by current statistics. Still more important, and in connection with the current point, it ignores that a system that works by creating and using mappings of aspects of its environment can create and use maps that have never been created and used before. It ignores, that is, the most important general principle behind uses of representational mechanisms, namely, that they are intrinsically productive, designed to enable organisms to react appropriately to new situations, situations that neither they nor their ancestors have encountered before. More on this later. On the intrinsic productivity of all representational systems, even the simplest of indicator systems, see my Varieties of Meaning, Chapters 3-4.

help us to know how to design such a clock. But surely it has some substance as an explanation none the less.

Moreover, on a second look, every explanation by reference to purpose also has a deeper substantive aspect. It is true that whether or not a mechanism or state has a certain kind of history has no bearing on how its current causal powers effect their results. And it is true that if one knew exactly what the current mechanism was that effected, say, the sounding of a smoke detector's alarm or the effect of a belief upon someone's successful action, then one would have in hand a complete explanation of the alarm or of that success at a certain level. But causes of causes are also causes, indeed, our everyday knowledge of causes is typically only of causes of causes. One may know, for example, that leaving potatoes in a hot oven for a while will soften them without knowing what intermediate steps produce this effect. Although a description of the construction and current causal powers of given smoke detector or mental state might indeed explain its effects, it doesn't follow that how they happen to have acquired those causal powers is

irrelevant. An explanation by reference to a purpose includes an explanation by reference to what Dretske (1988) has called a ''structuring cause'' (as opposed to a ''triggering cause'') of an event. It includes that the mechanism involved was structured so as to be capable of causing the effect it had because it was designed or selected for doing so. For example, the smoke detector has, as such, qua smoke detector, a history that explains why it is constituted such that it sounds an alarm when you smoke under it. Returning to intentional states, although we might explain that Swampman—Davidson's fabled accidental double—was very often successful in performing actions that helped him to survive because he had mechanisms inside him that were constructed in exactly the same way human neural mechanisms are constructed, using complicated isomorphisms with the environment in the process of determining his actions, we would be mistaken if we tried to explain why Swampman was successful by saying that he had true beliefs. For that would imply that there had been a certain kind of reason or cause of his being so constructed (namely, the success of similar mechanisms in ancestors, leading to their survival hence his conception).[4] In fact there was no such reason. His being constructed that way was a massive accident. That the alarm is ringing because you are

smoking your pipe under a smoke detector tells a more complete kind of story than can be told for Swampman's successes.

In sum, three factors help to make explanation of success by reference to true representations useful in explaining behavior on the teleosemanticist's view. Intentional explanations offer a Russellian definite description of the psychological mechanism that helped to produce success. They indicate that this mechanism worked by the use of isomorphisms. On the assumption that the hearer knows

[4] For more discussion, see my ''On Knowing the Meaning; With a Coda on Swampman,'' forthcoming.

something about how artifacts or body organs, and so forth, normally originate, they tell or imply the kind of origin the mechanism involved had.

Now according to teleosemantics (at least mine) a representation is produced by a mechanism whose proper function is to produce structures (the representations) that correspond to the world by some definite (semantic) rule. Also, nothing has a proper function unless there is a normal (causal order) explanation for how it performed that function in the past so as to be selected for.[5] In the kind of simple cases that concern Shea, the normal explanation would always be that the producing system was responding to some kind of natural information.[6] Shea, following Price (2001), suggests that random production of an item—a candidate representation—that causes some reaction of an organism might coincide, often enough, with some very commonly present useful condition that helps the reaction to produce success, and that the random producing device

[5] I have not emphasized this in previous essays because I take my job to be describing representation as a natural phenomenon, not giving a logically tight necessary and sufficient definition of representation. I have described representation as a common phenomenon appearing in this world without considering other possible worlds containing ridiculously long runs of coincidence, or ridiculously short runs that accidentally produce the extinction of competing traits. Biologists do have to be aware that such runs are not logically impossible, but only a philosopher would try to carve out a language that painstakingly takes account of such things. In ''On Knowing the Meaning; With a Coda on Swampman'' (forthcoming) I argue that there is a deep and principled reason why cutting between all logically possible cases is not usually even a coherent philosophical ideal.

[6] Shea paraphrases me as saying that ''representation producers must have a systematic way of making representations that parallel affairs in the world, and carrying information is one way of doing so,'' but of the kind of simple cases he is interested in I said ''the explanation would have to be that the ...perceptual systems were sensitive to some kind of recurrent natural sign...'' (Millikan, 2005, p. 85).

might then be selected for. And indeed, if that were all that was needed for representation, every device that initiates a useful movement, say, in a fish, would count as a representation of the water that surrounds the fish since this water helps to make everything that the fish does possible, and so forth. So let me state things more carefully. Let me say that a representation must be produced by a mechanism whose proper function is to produce a correlation, by some correspondence rule (a mapping rule), between certain

structures, Rs, that it produces and certain environmental conditions, Cs.[8] The producer's job—the job of each token producer—is to make it that when it produces an R that raises the probability that a corresponding C obtains. (Representation producers are designed to produce numerous representations. They aren't selected for saying one thing once.) Given that where there are proper functions there must have been normal explanations, it follows that representation producers (types) have always been selected for owing in part to past non-accidental correlations between the outputs of their members (tokens) and the occurrence of what these outputs have represented. In any event, ''[t]he producer's job is ... to make a sign that corresponds in the right way to a world affair. If it does this in its normal way, by its normal mechanisms, the intentional sign it makes will also be a local natural sign'' (Millikan, 2005, p. 80; italics now added).[9]

Still, Shea is correct in observing, ''It is not part of any evolutionary function for [its] effect to have been caused in a particular way. So it does not follow from teleosemantics= reliance on evolutionary functions that representations must carry correlational [or, I add, any other kind of natural] information. Unmodified teleosemantics is [well, almost] entirely output-based. Even representations produced entirely at random can count as contentful...'' Even this last phrase of Shea's is correct if we read it as about individual token representations that might be produced accidentally. Producing systems that generate representations do always ride on the wake, at least, of past representations that did carry natural information; any randomly produced representations would have to have had informative ancestors. However, although normally produced true representation tokens always do carry natural information, false representation tokens do not, and representation tokens that are true by accident also do not.[7] It is not

[7] At least not natural information with the same content as their intentional content.

definitional of a token representation, as Shea wishes it to be, that either it itself carry

[8] Notice that it doesn't follow that it is the job of a representation producer to produce "correlational information" in Shea's sense. Shea requires of correlational information that the correlation determining it occur for some reason. But it is not the job of the representation producer to produce 'a correlation due to some reason.' The reason the correlation is produced concerns only the normal explanation for how the producer produces it. More on the distinction between proper functions and normal explanations below.

[9] It should be noted that on my account, although there are more kinds of natural information than locally recurrent natural information that may be used by systems that produce intentional representations (Millikan 2004, Chapter 3), true intentional representations that are produced in accordance with Normal explanations are themselves always locally recurrent natural signs (ibid. Chapter 4). Indeed, Shea was helpful in encouraging me to characterize locally recurrent natural signs such that this would be true of them (see Varieties chapter 6, note 4.)

information or that it is in an area where other representations of its type carry or have carried information. Is this a bad thing?

False representations cannot be used to explain success unless with a special story, likely an amusing story about a lucky accident. Even then the falseness itself will be unlikely to figure in the explanation (though I did give an example above where it did figure—Sam helps naive John out). But on my teleosemantic account, an accidentally true representation can explain without any such special story. Recall from the Meno that true belief is just as good as knowledge so long as it stays put. True representations that are true accidentally are just as good for the representation consumer as if they did carry natural information. When they produce successes, these successes are explained in the three-part manner that I have already sketched.[8] When a true belief has also been normally produced,

[8] Shea claims that there is no explanation at all for success in such cases according either to traditional teleosemantics or to his own modification of it (footnote 28).

however—when it constitutes knowledge (Millikan 1984b)—then the explanation of its success goes a step deeper. It is this deeper kind of explanation that Shea is interested in—a legitimate interest, but the more partial or superficial explanation accorded by mere truth is also legitimate. (Neither kind of explanation is complete, of course.)

Shea says ''for Millikan it is information, not true representation that explains success.'' What I have tried to show is that for Millikan, both information and the truth of representations can help to explain success in different ways at different levels.

Part 2. Correlational Information versus Locally Recurrent Natural Information

The description of simple representation that Shea favors differs from my own in two basic ways. First, as Shea points out, on my view ''carrying [natural] information is not a function of a representation.'' ''[I]t is not a purpose of the producer system to produce items that carry correlational [or, I add, any other kind of natural] information'' (compare footnote 8 above). Shea claims that a useful

description of simple representation should require representations to carry correlational information. Second, although Shea says that I was responsible, in Varieties of Meaning, for ''formulating the theoretical concept of information that is relied on in the present [i.e., Shea's] paper,'' in fact the concept of information that I formulated there—the concept of ''locally recurrent natural information''—is different from that of Shea's ''correlational information.'' I am anxious to explain exactly what that difference is and why it is important, for not only Shea but a number of other writers have misunderstood my position on this kind of natural information. I think this is because I stated the position unclearly, and even somewhat wrongly, in Varieties of Meaning, so I would like to remedy that. I will also argue that Shea's own description of ''correlational information'' does not capture anything definite. But first, why is carrying natural information not one of the functions of a representation?

First, both Shea's definition of ''correlational information'' and my own of ''locally recurrent information'' require of the sign carrying natural information that it have a certain sort of history.[12] Shea requires that the correlation should not be accidental ''for a purely accidental explanation would be explanatorily impotent.'' He unpacks this by suggesting that the representation's (R's) content condition (C, it's truth condition) might cause R, or something else might cause

both C and R, or ‘‘[t]here may even be a natural reason why R correlates with C in some domain when R and C are not causally connected at all.’’ I am thinking that for this last possibility, which he doesn’t unpack, Shea may have in mind my own example of the way the direction of magnetic north, if you are within the oceans of the northern hemisphere, continues to correlate with the direction of lesser oxygen, because the earth’s magnetic field stays put in accordance with conservation principles and the earth’s atmosphere also stays put for similar reasons—a correlation used by bacteria that navigate using magnetosomes. In each of these various kinds of cases we are looking to the causes of representations to explain their correlations, and causes occur in a thing’s history. But the function of an item, in the teleologist’s sense, is always something that it effects, and a thing cannot effect its own history. It cannot be responsible for the way it was caused. As Shea too has told us, ‘‘[i]t is not part of any evolutionary function for the effect to have been caused in a particular way.’’ So a representation cannot have as one of it’s functions to carry this kind of correlational information.

[12] Shea also claims that the ‘‘nomic force’’ of the ‘‘objective probabilities’’ underpinning his correlational information is like that of the ‘‘50% chance that a lump of 4.5 billion atoms of uranium-238 will emit an alpha particle in a year,’’ but this must be a misunderstanding. The statistics we encounter in the everyday world are determined by the prior arrangements and distributions of ordinary bits of matter in space and time. Given all relevant information, the objective probabilities of single events are, in general, either zero or one. The judgments of intermediate probabilities that we use in everyday life depend on the (vast amounts of) information that we lack. Based on different initial information, these judgments might always have been different. I will pick up this point below in my discussion of the need to determine a reference class relative to which to judge the probability of a representation’s being true.

Second, Shea requires of a sign carrying correlational information that it occur in an area in which other signs of the same type also carry this kind of information. A correlation requires a plurality of correlated items. But no representation effects that it be a member of a such a plurality. No representation can cause that the other members in its area correspond to their truth conditions. So, again, it cannot be a function of a representation to effect that it carries correlational information.[9]

My own locally recurrent natural information is also defined by reference to its token carriers' histories, and defined with reference to the existence of similar token carriers in the same family of recurrent signs carrying the same kind of information. That is why I must maintain that it is not a function of the representation to be a natural sign or to carry natural information. It carries natural information if it is true and has been normally produced, that is all. Similarly, the representation producer's function is to produce a representation that corresponds as the consumer needs it to, a representation that is ''true.'' But the producer cannot bear a responsibility for what other producers of the same kind do, so it cannot have producing natural information as it's function. Besides (as I argued in detail in Varieties Chapter 5) all the consumer needs is a representation that coincides with a represented in the right way. If the producer brings this about by accident rather than in the normal way, the job has been done none the less.

In general, we understand matters more clearly, I think, if we keep straight in our minds the difference between a thing's functions, what it was selected for achieving, and the normal ways that it manages to fulfill those functions, for example, between having as a function to produce a correlation, and fulfilling that function in a normal way by relying on, hence producing, natural information. If

[9] This argument originally appeared in Millikan, 1990.

one prefers not to make this distinction, of course nothing made in heaven will enforce it. Then one may indeed end by saying that a function of the representation producer is to produce natural information, but the change will be merely a verbal one. I don't recommend this way of speaking. It blurs together things that are best kept separate. Functions are selected for. Ways of performing them are not usually selected for independently. Natural selection is not usually offered different ways of performing the same function to choose between.

Now for my reason for rejecting correlational information in favor of locally recurrent natural information in the explanation of how organisms produce simple representations. The notion of correlational information is empty unless a reference class for the correlation is specified, and there seems to be no way to specify such a reference class except arbitrarily. Correlations exist or fail to exist depending on the reference class one chooses.[14] If no single natural or non-arbitrary reference class can be defined, the notion of correlational information is empty. The threat of a hole of this sort in the description of natural information is what lead me to develop the notion of locally recurrent natural information in Varieties of Meaning. So I want to discuss correlational information, as Shea has described it, with some care.[10]

Consider, for example, the natural information on which northern hemisphere, oceanic, magnetosome-bearing bacteria rely. They rely on magnetic north to indicate geomagnetic north hence the direction of lesser oxygen. (Oxygen is poisonous to them.) On Shea's analysis, for the direction in which a northern hemisphere bacterium's magnetosome points to carry correlational information about the direction of lesser oxygen, it must not only point toward lesser oxygen, there must also be a positive correlation between the direction of magnetic north,

[10] I did describe this hole with considerable care in Varieties chapter 3, but the positive description I subsequently gave of the ''domain of a locally recurrent natural sign'' was ambiguous, seeming to imply the same error over again.

which determines the magentosome's orientation, and the direction of lesser oxygen. What then is the probability that magnetic north corresponds to the direction of lesser oxygen?

Clearly this is not a probability of the uranium-238 half-life kind. For the exact position of any given bacterium at any given time, the probability is either one or zero. But if the reference class is given instead as the points within a chosen area, the probability will depend on the area chosen. It will depend on the hapstance of local environmental arrangements, such as, say, how many electric fish and wind generators are in the area producing magnetic fields, how many bar magnets have accidentally been dropped in the area and, of course, within which hemisphere the area lies. (In the southern hemisphere, magnetic north will usually be in the direction of more rather than lesser oxygen; southern hemisphere bacteria have their magnetosomes reversed.) Certainly the statistics on points universe-wide cannot be what determines whether the magnetosome of a certain bacterium in one of our oceans is or is not carrying natural information. Should the reference area then be the oceans of the earth, or of the northern hemisphere, the southern hemisphere, the western hemisphere, all regions within two miles of shore, within seven feet of a dolphin—or within

[14] According to Dretske (1981) a signal carrying natural information must have a probability of one of coinciding with its signified. Gilbert Harman immediately pointed out that this requirement was empty unless a reference class was specified within which that probability is to obtain (Harman 1983).

some specified distance from the particular bacterium you are interested in? Any single bacterium lies within an infinite number of different designatable areas, but to speak meaningfully of ''correlational information'' we must decide on some limited reference class. How?

We could sidestep this problem. Representations, described as any teleosemanticist would describe them, are members of ''historical kinds'' (Millikan

1997, 2000). Shea's simple representations all fall into historical kinds for the same easy reason. They are members of families of representation tokens produced by (token mechanisms arising from) a common gene pool, and gene pools are located historical entities in the same sort of way that, say, the extended John Adams family is. A simple representation token belongs essentially to an historical family of tokens all of which are (mathematical) transforms of itself, all expressed, as it were, in the same (historically located) language. So a natural reference class in which to consider any such representation token would be the members of its immediate biological family. Taking this class as a our reference class, we could meaningfully ask whether membership correlates positively with some kind of corresponding environmental condition. For example, assuming that the northern hemisphere bacteria inherit the orientation of their magnetosomes from their ancestors and the southern hemisphere bacteria from theirs, there are two separate historical kinds of magnetosomes to consider here, and the readings of the actual members within each class may correlate very well with the direction of lesser oxygen. Consonant with this, Shea tells us:

> ...since the correlation exists at the level of types, instances of a [representation] type R which carries correlational information about [condition] C can be tokened even when C does not obtain. Even instances for which C does not obtain are instances of the type which carries correlational information.

But there are serious drawbacks. First, notice that this will not give us a general description of natural information, under which the information carried by simple representations then falls. It yields only a specialized description of what makes a

simple representation into a representation, leaving the question of whether simple representations carry any sort of natural information (whatever that is) to one side.

Perhaps we could say that although the information carried by simple representations is not natural information, it is its own kind of information, say, ''biological information.'' But there are peculiarities with such a notion of ''biological information'' that would destroy its usefulness as well as detracting from its intuitiveness or naturalness.

Suppose, for example, that every year the gulf stream were to carry more than half of the bacteria spawned in the southern hemisphere into the northern hemisphere where they slowly propelled themselves to the surface and died. This kind of pattern is not at all uncommon in biology where, for example, a mother mouse may deliver eight new babies every three weeks for two years (this is about right) yet on average only two babies per mother survive to reproduce, and where a spider mother may lay 10.000 eggs to achieve her average of two reproducing off-spring. Or for a closer analogy, American possums wander off from their birth places in all directions, soon populating very large territories where the winters are occasionally too cold for them, so that every few years a major portion of them are suddenly killed off. So it could turn out that the statistics on southern-hemisphere-spawned magnetosomes showed a negative rather than a positive correlation with the direction of lesser oxygen. None of their magnetosomes would then carry ''biological information.''

Or consider a lightning bug species that finds conspecifics of the opposite sex by the pattern of light signals they send. The lightning bug possesses a special detector for this specific light pattern, which causes it to approach the signal, Then there evolves a mimicking predator species that sends out the same signal, thus

seducing that species of firefly to come hither and be eaten. (I didn't make this up). Gradually, the predator signals come to outnumber the conspecific signals so that the signal detectors are mostly wrong, causing the firefly species slowly to die out. And somewhere along the way, at some perfectly definite point in time, it suddenly becomes true that the reference class containing all the firings of all of the signal detectors of all of these fireflies, past and present, no longer correlates with nearness of conspecifics. At that very moment of time, suddenly it becomes true that none of those firings ever had carried any ''biological information.''[11]

So I think we should not suppose that our ''biological information'' is what Shea has in mind with his term ''correlational information,'' but look instead to other passages to discern his meaning.

> The correlation between R and C need not have universal application. It may extend only through some local area inhabited by the representer. Similarly, it may not last for all time. A correlation which is spatio-temporally local to the representer may still be of great use to natural selection. Whenever there is some local domain D within which R predicts C better than chance and there is a common underlying reason for the correlation between R and C in D, R carries correlational information about C within D. Occurrences of R when C does not obtain fall within the same reference class as those where C obtains (and thereby count as >false positives=) just in case they are instances, tokened within D, of the non-semantically-individuated type R. [Italics mine]

[11] An amusing question might also be what happens if ones perceptual systems represent that A and that B but A and B is a contradiction, hence something is represented that has a probability of 0? This actually happens, for example, with the waterfall illusion, when an object is simultaneously represented as moving rapidly upward and as staying in the same place. See Crane 1988.

Clearly Shea's ''D,'' his domains of correlation, his reference classes, are supposed to be determined as spatio-temporal areas. They do not consist merely of all actual candidate representations in particular bio-logical families. How then are these spatio-temporal areas to be circum-scribed or bounded?

What Shea needs is a way of determining, in a principled and useful way, for any candidate representation, what spatio-temporal area it falls within for the purpose of checking correlations. How it this to be done? Suppose, for example, that the candidate representation falls at the center of various spheres within which no correlation obtains, but at the center of various wider spheres where a correlation does obtain, and at the center of various still wider spheres where no correlation obtains. Or perhaps we should consider various cubes or equilateral pyramids at the center of which it falls instead? We might draw the closest convex boundary, or perhaps just a connect-the-dots boundary, that exactly encloses a (four-dimensional-worm-shaped) space-time area just big enough to contain all of our candidate's ''true'' relatives, those that correspond correctly, and then look to see whether our candidate falls inside or outside this worm's boundaries. But, unfortunately, that relatives at the edges of such an area are all ''true'' is no guarantee that the entire enclosed population exhibits a positive correlation of the right kind.

What we need to appreciate here is that a probability of coincidence is not like a force that distributes itself evenly or with smooth gradients throughout an area. Probabilities of coincidence do not attach to space-time positions. Space-time points are not like uranium-238 atoms, each possessing a certain intrinsic objective probability that if an R occurs there it will coincide with a C. ''Containing correlational information'' cannot be a property of some tokens but not others as distinguished merely by their locations.

The notion of a ''locally recurrent natural sign'' carrying natural information developed in my Varieties of Meaning was designed to capture a certain

species of natural information that can be very useful to animals even though exactly the same physical sign types may carry quite different messages depending on their different causal histories. Although I called them ‘‘locally recurrent,’’ these natural signs are not

signs of their signifieds because of their locations. They are not defined by reference to their locations. Rather, they tend to bunch up in spacetime areas of various shapes (sometimes these are very serpentine or branching shapes), altering the statistics within these areas, because of their recurrent natures. They tend to bunch up enough to be useful to organisms that either live in these areas full time or are able to track these areas by some (always fallible) means. Often organisms live and reproduce entirely within such areas for many generations, or individual organisms may spend their lifetimes within them. Humans, in particular, are often quite good at finding ways to discern, though fallibly, when they are and are not within some of these areas.

What then is a locally recurrent natural sign? It is one that corresponds to its represented in the same way, and for the same reason, that other signs of the same recurrent type correspond to theirs, and where there is a reason why examples of this kind of correspondence (with the same kind of cause) tend to spread from one location into nearby space-time locations. Thus, as mentioned before, from within the oceans of the northern hemisphere at any given time, the coinciding of the direction of magnetic north with the direction of lesser oxygen spreads forward in time because the earth’s magnetic field stays put in accordance with conservation principles and the earth’s atmosphere also stays put. Similarly, a correspondence of fever and rash with measles tends to spread forward in time, and also sideways, hydra like, into various roughly connected areas, because the measles virus causes fever and rash and itself tends to spread in this way. Thus a doctor who

wants to know whether Johnny's fever and rash is a natural sign—a symptom—of measles or instead of some other malady will have his eye on local measles statistics in Johnny's school when making his (fallible) diagnosis, and on statistics in nearby places where Johnny or other children from the school have recently been. In this way he tries to ''track the domain'' of this particular locally recurrent natural sign. (Other kinds of examples of locally recurrent natural signs and much further discussion can be found in Varieties of Meaning, Chapter 3, and throughout the rest of the book.)

The confusing point is that the ''domains'' of locally recurrent signs are not the same as areas in which they correlate with their represent-

eds, unclarity or equivocation on this point having muddied some fairly central passages in Varieties of Meaning. Instead, the ''domain'' of a locally recurrent natural sign is like the domain of a function or quantifier. It is merely the set of all actual instances falling under that locally recurring sign type. Since ''areas'' can be of any shape whatever, including shapes with numerous irregularly shaped holes in them, the domain of a recurrent natural sign type does not determine any definite

area. On the other hand, the domain does help determine, for any given area, the proportion of signs of the same physical type that are also within that domain. Although its area of residence does not determine whether a physical sign does or does not fall in a given locally recurrent sign domain, locally recurrent sign domains do help determine statistics on already given areas. Sometimes organisms just happen to live and die within areas where the statistics on a certain recurrent sign are good or good enough. Other times they may develop crude or less crude ways of tracking locally recurrent sign domains well enough to be useful—ways of tracking that work, at least, in the areas in which they live.

In Varieties I argued that locally recurrent natural information is the basic stuff on which the possibility of intentional representation is built. But the relation

between natural information and intentional representation is not quite as direct as Shea would have it.

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