
THE JOURNAL OF PHILOSOPHY

VOLUME LXXXVI, NO. 6, JUNE 1989

BIOSEMANTICS

Causal or informational theories of the semantic content of mental states which have had an eye on the problem of false representations have characteristically begun with something like this intuition. There are some circumstances under which an inner representation has its represented as a necessary and/or sufficient cause or condition of production. That is how the content of the representation is fixed. False representations are to be explained as tokens that are produced under other circumstances. The challenge, then, is to tell what defines certain circumstances as the content-fixing ones.

I.

Note that the answer cannot be just that these circumstances are *statistically* normal conditions. To gather such statistics, one would need to delimit a reference class of occasions, know how to count its members, and specify description categories. It would not do, for example, just to average over conditions-in-the-universe-any-place-any-time. Nor is it given how to carve out relevant description categories for conditions on occasions. Is it "average" in the summer for it to be (precisely) between 80° and 80.5° Fahrenheit with humidity 87%? And are average conditions those which obtain on at least 50% of the occasions, or is it 90%? Depending on how one sets these parameters, radically different conditions are "statistically normal." But the notion of semantic content clearly is not relative, in this manner, to arbitrary parameters. The content-fixing circumstances must be *nonarbitrarily* determined.

A number of recent writers have made an appeal to teleology here, specifically to conditions of normal function or well-functioning of the systems that produce inner representations. Where the represented is *R* and its representation is "R," under conditions of well-functioning, we might suppose, only *Rs* can or are likely to produce

“Rs.” Or perhaps “R” is a representation of *R* just in case the system was designed to react to *Rs* by producing “Rs.” But this sort of move yields too many representations. Every state of every functional system has normal causes, things that it is a response to in accordance with design. These causes may be proximate or remote, and many are disjunctive. Thus, a proximate normal cause of dilation of the skin capillaries is certain substances in the blood, more remote causes include muscular effort, sunburn, and being in an overheated environment. To each of these causes the vascular system responds by design, yet the response (a red face), though it may be a natural sign of burn or exertion or overheating, certainly is not a representation of that. If not every state of a system represents its normal causes, which are the states that do?

Jerry Fodor¹ has said that, whereas the content of an inner representation is determined by some sort of causal story, its status *as* a representation is determined by the functional organization of the part of the system which uses it. There is such a thing, it seems, as behaving like a representation without behaving like a representation of anything in particular. What the thing is a representation of is then determined by its cause under content-fixing conditions. It would be interesting to have the character of universal I-am-a-representation behavior spelled out for us. Yet, as Fodor well knows, there would still be the problem of demonstrating that there was only one normal cause per representation type.

A number of writers, including Dennis Stampe,² Fred Dretske,³ and Mohan Matthen,⁴ have suggested that what is different about effects that are representations is that their function is, precisely, to represent, “indicate,” or “detect.” For example, Matthen says of (fullfledged) perceptual states that they are “state[s] that [have] the function of *detecting* the presence of things of a certain type . . .” (*ibid.*, p. 20). It does not help to be told that inner representations are things that have representing (indicating, detecting) as their function, however, unless we are also told what kind of activity repre-

¹ “Banish Discontent,” in Jeremy Butterfield, ed., *Language, Mind and Logic* (New York: Cambridge, 1986), pp. 1–23; *Psychosemantics: The Problem of Meaning in the Philosophy of Mind* (Cambridge: MIT, 1987).

² “Toward a Causal Theory of Representation,” in Peter French, Theodore Uehling Jr., Howard Wettstein, eds., *Contemporary Perspectives in the Philosophy of Language* (Minneapolis: Minnesota UP, 1979), pp. 81–102.

³ “Misrepresentation,” in Radu Bogdan, ed., *Belief: Form, Content, and Function* (New York: Oxford, 1986), pp. 17–36.

⁴ “Biological Functions and Perceptual Content,” this JOURNAL, LXXXV, 1 (January 1988):5–27.

senting (indicating, detecting) is. Matthen does not tell us how to naturalize the notion "detecting." If "detecting" is a function of a representational state, it must be something that the state effects or produces. For example, it cannot be the function of a state to have been produced in response to something. Or does Matthen mean that it is not the representational states themselves, but the part of the system which produces them, which has the function of detecting? It has the function, say, of producing states that correspond to or covary with something in the outside world? But, unfortunately, not every device whose job description includes producing items that vary with the world is a representation producer. The devices in me that produce calluses are supposed to vary their placement according to where the friction is, but calluses are not representations. The pigment arrangers in the skin of a chameleon, the function of which is to vary the chameleon's color with what it sits on, are not representation producers.

Stampe and Dretske do address the question what representing or (Dretske) "detecting" is. Each brings in his own description of what a natural sign or natural representation is, then assimilates *having the function of representing R* to being a natural sign or representer of *R* when the system functions normally. Now, the production of natural signs is undoubtedly an accidental side effect of normal operation of many systems. From my red face you can tell that either I have been exerting myself, or I have been in the heat, or I am burned. But the production of an accidental side effect, no matter how regular, is not one of a system's functions; that goes by definition. More damaging, however, it simply is not true that representations must carry natural information. Consider the signals with which various animals signal danger. Nature knows that it is better to err on the side of caution, and it is likely that many of these signs occur more often in the absence than in the presence of any real danger. Certainly there is nothing incoherent in the idea that this might be so, hence that many of these signals do not carry natural information concerning the dangers they signal.

II.

I fully agree, however, that an appeal to teleology, to function, is what is needed to fly a naturalist theory of content. Moreover, what makes a thing into an inner representation is, near enough, that its function is to represent. But, I shall argue, the way to unpack this insight is to focus on representation *consumption*, rather than representation production. It is the devices that *use* representations which determine these to be representations and, at the same time (contra

Fodor), determine their content. If it really is the function of an inner representation to indicate its represented, clearly it is not just a natural sign, a sign that you or I looking on might interpret. It must be one that functions as a sign or representation *for the system itself*. What is it then for a system to use a representation *as* a representation?

The conception of function on which I shall rely was defined in my *Language, Thought, and Other Biological Categories*⁵ and defended in "In Defense of Proper Functions"⁶ under the label "proper function." Proper functions are determined by the histories of the items possessing them; functions that were "selected for" are paradigm cases.⁷ The notions "function" and "design" should not be read, however, as referring only to origin. Natural selection does not slack after the emergence of a structure but actively preserves it by acting against the later emergence of less fit structures. And structures can be preserved due to performance of new functions unrelated to the forces that originally shaped them. Such functions are "proper functions," too, and are "performed in accordance with design."

The notion "design" should not be read—and this is very important—as a reference to innateness. A system may have been designed to be altered by its experience, perhaps to learn from its experience in a prescribed manner. Doing what it has learned to do in this manner is then "behaving in accordance with design" or "functioning properly."⁸

My term 'normal' should be read normatively, historically, and relative to specific function. In the first instance, 'normal' applies to explanations. A "normal explanation" explains the performance of a particular function, telling how it was (typically) historically performed on those (perhaps rare) occasions when it was properly performed. Normal explanations do not tell, say, why it has been common for a function to be performed; they are not statistical explanations. They cover only past times of actual performance, showing how these performances were entailed by natural law, given certain conditions, coupled with the dispositions and structures of the rele-

⁵ Cambridge: MIT, 1984 (hereafter LTOBC).

⁶ *Philosophy of Science*, LVI, 2 (June 1989): 288–302.

⁷ An odd custom exists of identifying this sort of view with Larry Wright, who does not hold it. See my "In Defense of Proper Functions." Natural selection is not the only source of proper functions. See LTOBC, chs. 1 and 2.

⁸ See LTOBC; and "Truth Rules, Hoverflies, and the Kripke-Wittgenstein Paradox," *The Philosophical Review* (forthcoming).

vant functional devices.⁹ In the second instance, 'normal' applies to conditions. A "normal condition for performance of a function" is a condition, the presence of which must be mentioned in giving a full normal explanation for performance of that function. Other functions of the same organism or system may have other normal conditions. For example, normal conditions for discriminating colors are not the same as normal conditions for discriminating tastes, and normal conditions for seeing very large objects are not the same as for seeing very small ones. It follows that 'normal conditions' must not be read as having anything to do with what is typical or average or even, in many cases, at all common. First, many functions are performed only rarely. For example, very few wild seeds land in conditions normal for their growth and development, and the protective colorings of caterpillars seldom actually succeed in preventing them from being eaten. Indeed, normal conditions might almost better be called "historically optimal" conditions. (If normal conditions for proper functioning, hence survival and proliferation, were a statistical norm, imagine how many rabbits there would be in the world.) Second, many proper functions only need to be performed under rare conditions. Consider, for example, the vomiting reflex, the function of which is to prevent (further) toxification of the body. A normal condition for performance of this function is presence, specifically of poison in the stomach, for (I am guessing) it is only under that condition that this reflex has historically had beneficial effects. But poison in the stomach certainly is not an average condition. (Nor, of course, is it a normal condition for other functions of the digestive system.¹⁰)

If it is actually one of a system's functions to produce representations, as we have said, these representations must function as representations for the system itself. Let us view the system, then, as divided into two parts or two aspects, one of which produces representations for the other to consume. What we need to look at is the consumer part, at what it is to use a thing *as* a representation.

⁹ This last clarification is offered to aid Fodor ("On There Not Being an Evolutionary Theory of Content" [hereafter NETC], forthcoming), who uses my term 'Normal' (here I am not capitalizing it but the idea has not changed) in a multiply confused way, making a parody of my views on representation. In this connection, see also fns. 13 and 17.

¹⁰ "Normal explanation" and "normal condition for performance of a function," along with "proper function," are defined with considerable detail in LTOBC. The reader may wish, in particular, to consult the discussion of normal explanations for performance of "adapted and derived proper functions" in ch. 2, for these functions cover the functions of states of the nervous system which result in part from learning, such as states of human belief and desire.

Indeed, a good look at the consumer part of the system ought to be all that is needed to determine not only representational status but representational content. We argue this as follows. First, the part of the system which consumes representations must understand the representations proffered to it. Suppose, for example, that there were abundant "natural information" (in Dretske's¹¹ sense) contained in numerous natural signs all present in a certain state of a system. This information could still not serve the system *as* information, unless the signs were understood by the system, and, furthermore, understood as bearers of whatever specific information they, in fact, do bear. (Contrast Fodor's notion that something could function like a representation without functioning like a representation of anything in particular.) So there must be something about the consumer that *constitutes* its taking the signs to indicate, say, *p*, *q*, and *r* rather than *s*, *t*, and *u*. But, if we know what constitutes the consumer's *taking* a sign to indicate *p*, what *q*, what *r*, etc., then, granted that the consumer's takings are in some way systematically derived from the structures of the signs so taken, we can construct a semantics for the consumer's language. Anything the signs may indicate qua natural signs or natural information carriers then drops out as entirely irrelevant; the representation-producing side of the system had better pay undivided attention to the language of its consumer. The sign producer's function will be to produce signs that are true *as the consumer reads the language*.

The problem for the naturalist bent on describing intentionality, then, does not concern representation production at all. Although a representation always is something that is produced by a system whose proper function is to make that representation correspond by rule to the world, what the rule of correspondence is, what gives definition to this function, is determined entirely by the representation's consumers.

For a system to use an inner item as a representation, I propose, is for the following two conditions to be met. First, unless the representation accords, *so* (by a certain rule), with a represented, the consumer's normal use of, or response to, the representation will not be able to fulfill all of the consumer's proper functions in so responding—not, at least, in accordance with a normal explanation. (Of course, it might still fulfill these functions by freak accident, but not in the historically normal way.) Putting this more formally, that the representation and the represented accord with one another, *so*, is a

¹¹ *Knowledge and the Flow of Information* (Cambridge: MIT, 1981).

normal condition for proper functioning of the consumer device as it reacts to the representation.¹² Note that the proposal is not that the content of the representation rests on the function of the representation or of the consumer, on what these do. The idea is not that there is such a thing as behaving like a representation of *X* or as being treated like a representation of *X*. The content hangs only on there being a certain condition that would be *normal* for performance of the consumer's functions—namely, that a certain correspondence relation hold between sign and world—whatever those functions may happen to be. For example, suppose the semantic rules for my belief representations are determined by the fact that belief tokens in me will aid the devices that use them to perform certain of their tasks in accordance with a normal explanation for success only under the condition that the forms or “shapes” of these belief tokens correspond, in accordance with said rules, to conditions in the world. Just what these user tasks are need not be mentioned.¹³

Second, represented conditions are conditions that vary, depending on the *form* of the representation, in accordance with specifiable correspondence rules that give the semantics for the relevant *system* of representation. More precisely, representations always admit of significant transformations (in the mathematical sense), which accord with transformations of their corresponding representeds, thus displaying significant articulation into variant and invariant aspects. If an item considered as compounded of certain variant and invariant aspects can be said to be “composed” of these, then we can also say that every representation is, as such, a member of a representational system having a “compositional semantics.” For it is not that the represented condition is itself a normal condition for proper operation of the representation consumer. A certain correspondence between the representation and the world is what is normal. Coordinately, there is no such thing as a representation consumer

¹² Strictly, this normal condition must derive from a “most proximate normal explanation” of the consumer's proper functioning. See LTOBC, ch. 6, where a more precise account of what I am here calling “representations” is given under the heading “intentional icons.”

¹³ In this particular case, one task is, surely, contributing, in conformity with certain general principles or rules, to practical inference processes, hence to the fulfillment of current desires. So, if you like, all beliefs have the *same* proper function. Or, since the rules or principles that govern practical inference dictate that a belief's “shape” determines what other inner representations it may properly be combined with to form what products, we could say that each belief has a *different* range of proper functions. Take your pick. Cf. Fodor, “Information and Representation,” in Philip Hanson, ed., *Information, Language, and Cognition* (Vancouver: British Columbia UP, 1989); and NETC.

that can understand only one representation. There are always other representations, composed other ways, saying other things, which it could have understood as well, in accordance with the same principles of operation. A couple of very elementary examples should make this clear.¹⁴

First, consider beavers, who splash the water smartly with their tails to signal danger. This instinctive behavior has the function of causing other beavers to take cover. The splash means danger, because only when it corresponds to danger does the instinctive response to the splash on the part of the interpreter beavers, the consumers, serve a purpose. If there is no danger present, the interpreter beavers interrupt their activities uselessly. Hence, that the splash corresponds to danger is a normal condition for proper functioning of the interpreter beavers' instinctive reaction to the splash. (It does not follow, of course, that it is a usual condition. Beavers being skittish, most beaver splashes possibly occur in response to things not in fact endangering the beaver.) In the beaver splash semantic system, the time and place of the splash varies with, "corresponds to," the time and place of danger. The representation is articulate: properly speaking, it is not a splash but a splash-at-a-time-and-a-place. Other representations in the same system, splashes at other times and places, indicate other danger locations.

Second, consider honey bees, which perform "dances" to indicate the location of sources of nectar they have discovered. Variations in the tempo of the dance and in the angle of its long axis vary with the distance and direction of the nectar. The interpreter mechanisms in the watching bees—these are the representation consumers—will not perform their full proper functions of aiding the process of nectar collection in accordance with a normal explanation, unless the location of nectar corresponds correctly to the dance. So, the dances are representations of the location of nectar. The full representation here is a dance-at-a-time-in-a-place-at-a-tempo-with-an-orientation.

Notice that, on this account, it is not necessary to assume that most representations are true. Many biological devices perform their proper functions not on the average, but just often enough. The protective coloring of the juveniles of many animal species, for example, is an adaptation passed on because *occasionally* it prevents a

¹⁴ These examples are of representations that are not "inner" but out in the open. As in the case of inner representations, however, they are produced and consumed by mechanisms designed to cooperate with one another; each such representation stands intermediate between two parts of a single biological system.

juvenile from being eaten, though most of the juveniles of these species get eaten anyway. Similarly, it is conceivable that the devices that fix human beliefs fix true ones not on the average, but just often enough. If the true beliefs are functional and the false beliefs are, for the most part, no worse than having an empty mind, then even very fallible belief-fixing devices might be better than no belief-fixing devices at all. These devices might even be, in a sense, “designed to deliver some falsehoods.” Perhaps, given the difficulty of designing highly accurate belief-fixing mechanisms, it is actually advantageous to fix too many beliefs, letting some of these be false, rather than fix too few beliefs. Coordinately, perhaps our belief-consuming mechanisms are carefully designed to tolerate a large proportion of false beliefs. It would not follow, of course, that the belief consumers are designed to *use* false beliefs, certainly not that false beliefs can serve all of the functions that true ones can. Indeed, surely if none of the mechanisms that used beliefs ever cared at all how or whether these beliefs corresponded to anything in the world, beliefs would not be functioning as representations, but in some other capacity.

Shifting our focus from producing devices to consuming devices in our search for naturalized semantic content is important. But the shift from the *function* of consumers to *normal conditions* for proper operation is equally important. Matthen, for example, characterizes what he calls a “quasi-perceptual state” as, roughly, one whose job is to cause the system to do what it must do to perform its function, given that it is in certain circumstances, which are what it represents. Matthen is thus looking pretty squarely at the representation consumers, but at what it is the representation’s job to get these consumers to do, rather than at normal conditions for their proper operation. As a result, Matthen now retreats. The description he has given of quasi-perceptual states, he says, cannot cover “real perception such as that which we humans experience. Quite simply, there is no such thing as *the* proper response, or even a range of functionally appropriate responses, to what perception tells us” (*op. cit.*, p. 20).¹⁵ On the contrary, representational content rests not on univocity of consumer function but on sameness of normal conditions for those functions. The same percept of the world may be used to guide any of very many and diverse activities, practical or theoretical. What stays the same is that the percept must correspond to environmental configurations in accordance with the same correspondence rules

¹⁵ Dretske (in “Misrepresentation,” p. 28) and David Papineau [in *Reality and Representation* (New York: Blackwell, 1987), p. 67ff] have similar concerns.

for each of these activities. For example, if the position of the chair in the room does not correspond, so, to my visual representation of its position, that will hinder me equally in my attempts to avoid the chair when passing through the room, to move the chair, to sit in it, to remove the cat from it, to make judgments about it, etc. Similarly, my belief that New York is large may be turned to any of diverse purposes, but those which require it to be a *representation* require also that New York indeed be large if these purposes are to succeed in accordance with a normal explanation for functioning of my cognitive systems.

III.

We have just cleanly bypassed the whole genre of causal/informational accounts of mental content. To illustrate this, we consider an example of Dretske's. Dretske tells of a certain species of northern hemisphere bacteria which orient themselves away from toxic oxygen-rich surface water by attending to their magnetosomes, tiny inner magnets, which pull toward the magnetic north pole, hence pull down (*ibid.*). (Southern hemisphere bacteria have their magnetosomes reversed.) The function of the magnetosome thus appears to be to effect that the bacterium moves into oxygen-free water. Correlatively, intuition tells us that what the pull of the magnetosome represents is the whereabouts of oxygen-free water. The direction of oxygen-free water is not, however, a factor in *causing* the direction of pull of the magnetosome. And the most reliable natural information that the magnetosome carries is surely not about oxygen-free water but about distal and proximal causes of the pull, about the direction of geomagnetic or better, just plain magnetic, north. One can, after all, easily deflect the magnetosome away from the direction of lesser oxygen merely by holding a bar magnet overhead. Moreover, it is surely a function of the magnetosome to respond to that magnetic field, that is part of its normal mechanism of operation, whereas responding to oxygen density is not. None of this makes any sense on a causal or informational approach.

But on the biosemantic theory it does make sense. What the magnetosome represents is only what its *consumers* require that it correspond to in order to perform *their* tasks. Ignore, then, how the representation (a pull-in-a-direction-at-a-time) is normally produced. Concentrate, instead, on how the systems that react to the representation work, on what these systems need in order to do their job. What they need is only that the pull be in the direction of oxygen-free water at the time. For example, they care not at all how it came about that the pull is in that direction; the magnetosome that

points toward oxygen-free water quite by accident and not in accordance with any normal explanation will do just as well as one that points that way for the normal reasons. (As Socrates concedes in the *Meno*, true opinion is just as good as knowledge so long as it stays put.) What the magnetosome represents then is univocal; it represents only the direction of oxygen-free water. For that is the only thing that corresponds (by a compositional rule) to it, the absence of which would matter—the absence of which would disrupt the function of those mechanisms which rely on the magnetosome for guidance.

It is worth noting that what is represented by the magnetosome is not proximal but distal; no proximal stimulus is represented at all. Nor, of course, does the bacterium perform an inference from the existence of the proximal stimulus (the magnetic field) to the existence of the represented. These are good results for a theory of content to have, for otherwise one needs to introduce a derivative theory of content for mental representations that do not refer, say, to sensory stimulations, and also a foundationalist account of belief fixation. Note also that, on the present view, representations manufactured in identical ways by different species of animal might have different contents. Thus, a certain kind of small swift image on the toad's retina, manufactured by his eye lens, represents a bug, for that is what it must correspond to if the reflex it (invariably) triggers is to perform its proper functions normally, while exactly the same kind of small swift image on the retina of a male hoverfly, manufactured, let us suppose, by a nearly identical lens, represents a passing female hoverfly, for that is what it must correspond to if the female-chasing reflex it (invariably) triggers is to perform its proper functions normally. Turning the coin over, representations with the same content may be normally manufactured in a diversity of ways, even in the same species. How many different ways do you have, for example, of telling a lemon or your spouse? Nor is it necessary that any of the ways one has of manufacturing a given representation be especially reliable ways in order for the representation to have determinate content. These various results cut the biosemantic approach off from all varieties of verificationism and foundationalism with a clean, sharp knife.

IV.

But perhaps it will be thought that belief fixation and consumption are not biologically proper activities, hence that there are no normal explanations, in our defined sense, for proper performances of human beliefs. Unlike bee dances, which are all variations on the

same simple theme, beliefs in dinosaurs, in quarks, and in the instability of the dollar are recent, novel, and innumerable diverse, as are their possible uses. How could there be anything *biologically* normal or abnormal about the details of the consumption of such beliefs?

But what an organism does in accordance with evolutionary design can be very novel and surprising, for the more complex of nature's creatures are designed to learn. Unlike evolutionary adaptation, learning is not accomplished by *random* generate-and-test procedures. Even when learning involves trial and error (probably the exception rather than the rule), there are principles in accordance with which responses are selected by the system to try, and there are specific principles of generalization and discrimination, etc., which have been built into the system by natural selection. How these principles normally work, that is, how they work given normal (i.e., historically optimal) environments, to produce changes in the learner's nervous system which will effect the furthering of ends of the system has, of course, an explanation—the normal explanation for proper performance of the learning mechanism and of the states of the nervous system it produces.

Using a worn-out comparison, there is an infinity of functions which a modern computer mainframe is capable of performing, depending upon its input and on the program it is running. Each of these things it can do, so long as it is not damaged or broken, "in accordance with design," and to each of these capacities there corresponds an explanation of how it would be activated or fulfilled normally. The human's mainframe takes, roughly, stimulations of the afferent nerves as input, both to program and to run it.¹⁶ It responds, in part, by developing concepts, by acquiring beliefs and desires in accordance with these concepts, by engaging in practical inference leading ultimately to action. Each of these activities may, of course, involve circumscribed sorts of trial and error learning. When conditions are optimal, all this aids survival and proliferation in accordance with an historically normal explanation—one of high generality, of course. When conditions are not optimal, it may yield, among other things, empty or confused concepts, biologically useless desires, and false beliefs. But, even when the desires are biologically useless (though probably not when the concepts expressed in them are empty or confused), there are still biologically normal ways for

¹⁶ This is a broad metaphor. I am not advocating computationalism.

them to get fulfilled, the most obvious of which require reliance on true beliefs.¹⁷

Yet how do we know that our contemporary ways of forming concepts, desires, and beliefs do occur in accordance with evolutionary design? Fodor, for example, is ready with the labels “pop Darwinism” and “naive adaptationism” to abuse anyone who supposes that our cognitive systems were actually selected for their belief and desire using capacities.¹⁸ Clearly, to believe that every structure must have a function would be naive. Nor is it wise uncritically to adopt hypotheses about the functions of structures when these functions are obscure. It does not follow that we should balk at the sort of adaptationist who, having found a highly complex structure that quite evidently is currently and effectively performing a highly complex and obviously indispensable function, then concludes, *ceteris paribus*, that this function has been the most recent historical task stabilizing the structure. To suspect that the brain has not been preserved for thinking with or that the eye has not been preserved for seeing with—to suspect this, moreover, in the absence of any alternative hypotheses about causes of the stability of these structures—would be totally irresponsible. Consider: nearly every human behavior is bound up with intentional action. Are we really to suppose that the degree to which our behaviors help to fulfill intentions, and the degree to which intentions result from logically related desires plus beliefs, is a sheer coincidence—that these patterns are irrelevant to survival and proliferation or, though relevant, have had

¹⁷ A word of caution. The normal conditions for a desire’s fulfillment are not necessarily fulfillable conditions. In general, normal conditions for fulfillment of a function are not quite the same as conditions which, when you add them and stir, always effect proper function, because they may well be impossible conditions. For example, Fodor, in “Information and Representation” and NETC, has questioned me about the normal conditions under which his desire that it should rain tomorrow will perform its proper function of *getting* it to rain. Now, the biologically normal way for such a desire to be fulfilled is exactly the same as for any other desire: one has or acquires true beliefs about how to effect the fulfillment of the desire and acts on them. Biologically normal conditions for fulfillment of the desire for rain thus include the condition that one has true beliefs about how to make it rain. Clearly this is an example in which the biological norm fails to accord with the statistical norm: most desires about the weather are fulfilled, if at all, by biological accident. It may even be that the laws of nature, coupled with my situation, prohibit my having any true beliefs about how to make it rain; the needed general condition cannot be realized in the particular case. Similarly, normal conditions for proper function of beliefs in impossible things are, of course, impossible conditions: these beliefs are such that they cannot correspond, in accordance with the rules of mentalesse, to conditions in the world.

¹⁸ *Psychosemantics* and NETC.

no stabilizing effect on the gene pool? But the only alternative to biological design, in our sense of 'design', is sheer coincidence, freak accident—unless there is a ghost running the machine!

Indeed, it is reasonable to suppose that the brain structures we have recently been using in developing space technology and elementary particle physics have been operating in accordance with the very same general principles as when prehistoric man used them for more primitive ventures. They are no more performing new and different functions or operating in accordance with new and different principles nowadays than are the eyes when what they see is television screens and space shuttles. Compare: the wheel was invented for the purpose of rolling ox carts, and did not come into its own (pulleys, gears, etc.) for several thousand years thereafter, during the industrial revolution. Similarly, it is reasonable that the cognitive structures with which man is endowed were originally nature's solution to some very simple demands made by man's evolutionary niche. But the solution nature stumbled on was elegant, supremely general, and powerful, indeed; I believe it was a solution that cut to the very bone of the ontological structure of the world. That solution involved the introduction of representations, inner and/or outer, having a subject/predicate structure, and subject to a negation transformation. (Why I believe that that particular development was so radical and so powerful has been explained in depth in LTOBC, chapters 14–19. But see also section v.6 below.)

v.

One last worry about our sort of position is voiced by Daniel Dennett¹⁹ and discussed at length by Fodor.²⁰ Is it really plausible that bacteria and paramecia, or even birds and bees, have inner representations in the same sense that we do? Am I really prepared to say that these creatures, too, have mental states, that they think? I am not prepared to say that. On the contrary, the representations that they have must differ from human beliefs in at least six very fundamental ways.²¹

(1) *Self-representing Elements*. The representations that the magnetosome produces have three significant variables, each of

¹⁹ *Brainstorms* (Montgomery, VT: Bradford Books, 1978).

²⁰ "Why Paramecia Don't Have Mental Representations," in P. French, T. Uehling Jr., and H. Wettstein, eds., *Midwest Studies in Philosophy*, x (Minneapolis: Minnesota UP, 1986), pp. 3–23.

²¹ Accordingly, in LTOBC I did not call these primitive forms "representations" but "intentional signals" and, for items like bee dances, "intentional icons," reserving the term 'representation' for those icons, the representational values of which must be identified if their consumers are to function properly—see V.5 below.

which refers to itself. The time of the pull refers to the time of the oxygen-free water, the locale of the pull refers to the locale of the oxygen-free water, and the direction of pull refers to the direction of oxygen-free water. The beaver's splash has two self-referring variables: a splash at a certain time and place indicates that there is danger at that same time and place. (There is nothing necessary about this. It might have meant that there would be danger at the nearest beaver dam in five minutes.) Compare the standard color coding on the outsides of colored markers: each color stands for itself. True, it may be that sophisticated indexical representations such as percepts and indexical beliefs also have their time or place or both as significant self-representing elements, but they also have other significant variables that are not self-representing. The magnetosome does not.

(2) *Storing Representations.* Any representation the time or place of which is a significant variable obviously cannot be stored away, carried about with the organism for use on future occasions. Most beliefs are representations that can be stored away. Clearly this is an important difference.

(3) *Indicative and Imperative Representations.* The theory I have sketched here of the content of inner representations applies only to indicative representations, representations which are supposed to be determined by the facts, which tell what is the case. It does not apply to imperative representations, representations which are supposed to determine the facts, which tell the interpreter what to do. Neither do causal-informational theories of content apply to the contents of imperative representations. True, some philosophers seem to have assumed that having defined the content of various mental symbols by reference to what causes them to enter the "belief box," then when one finds these same symbols in, say, the "desire box" or the "intention box," one already knows what they mean. But how do we know that the desire box or the intention box use the same representational system as the belief box? To answer that question we would have to know what constitutes a desire box's or an intention box's using one representational system rather than another which, turned around, is the very question at issue. In LTOBC and "Thoughts Without Laws; Cognitive Science With Content,"²² I developed a parallel theory of the content of imperative representations. Very roughly, one of the proper functions of the consumer system for an imperative representation is to help *produce* a corre-

²² *The Philosophical Review*, XLV, 1 (1986):47-80.

spondence between the representation and the world. (Of course, this proper function often is not performed.) I also argued that desires and intentions are imperative representations.

Consider, then, the beaver's splash. It tells that there is danger here now. Or why not say, instead, that it tells other nearby beavers what to do now, namely, to seek cover? Consider the magnetosome. It tells which is the direction of oxygen-free water. Or why not say, instead, that it tells the bacterium which way to go? Simple animal signals are invariably both indicative and imperative. Even the dance of the honey bee, which is certainly no simple signal, is both indicative and imperative. It tells the worker bees where the nectar is; equally, it tells them where to go. The step from these primitive representations to human beliefs is an enormous one, for it involves the separation of indicative from imperative functions of the representational system. Representations that are undifferentiated between indicative and imperative connect states of affairs directly to actions, to specific things to be done in the face of those states of affairs. Human beliefs are not tied directly to actions. Unless combined with appropriate desires, human beliefs are impotent. And human desires are equally impotent unless combined with suitable beliefs.²³

(4) *Inference*. As indicative and imperative functions are separated in the central inner representational systems of humans, they need to be reintegrated. Thus, humans engage in practical inference, combining beliefs and desires in novel ways to yield first intentions and then action. Humans also combine beliefs with beliefs to yield new beliefs. Surely nothing remotely like this takes place inside the bacterium.

(5) *Acts of Identifying*. Mediate inferences always turn on something like a middle term, which must have the same representational value in both premises for the inference to go through. Indeed, the representation consumers in us perform many functions that require them to use two or more overlapping representations together, and in such a manner that, unless the representeds corresponding to these indeed have a common element, these functions will not be properly performed. Put informally, the consumer device *takes* these represented elements to be the same, thus identifying their representational values. Suppose, for example, that you intend to speak to

²³ Possibly human intentions are in both indicative and imperative mood, however, functioning simultaneously to represent settled facts about one's future and to direct one's action.

Henry about something. In order to carry out this intention you must, when the time comes, be able to recognize Henry in perception as the person to whom you intend to speak. You must identify Henry as represented in perception with Henry as represented in your intention. Activities that involve the coordinated use of representations from different sensory modalities, as in the case of eye-hand coordination, visual-tactile coordination, also require that certain objects, contours, places, or directions, etc., be identified as the same through the two modalities. Now, the foundation upon which modern representational theories of thought are built depends upon a denial that what is thought of is ever placed before a naked mind. Clearly, we can never know what an inner representation represents by a direct comparison of representation to represented. Rather, acts of identifying are our ways of "knowing what our representations represent." The bacterium is quite incapable of knowing, in this sense, what its representations are about. This might be a reason to say that it does not understand its own representations, not really.

(6) *Negation and Propositional Content*. The representational system to which the magnetosome pull belongs does not contain negation. Indeed, it does not even contain contrary representations, for the magnetosome cannot pull in two directions at once. Similarly, if two beavers splash at different times or places, or if two bees dance different dances at the same time, it may well be that there is indeed beaver danger two times or two places and that there is indeed nectar in two different locations.²⁴ Without contrariety, no conflict, of course and more specifically, no contradiction. If the law of non-contradiction plays as significant a role in the development of human concepts and knowledge as has traditionally been supposed, this is a large difference between us and the bacterium indeed.²⁵ In LTOBC, I argued that negation, hence explicit contradiction, is dependent upon subject-predicate, that is, propositional, structure and vice versa. Thus, representations that are simpler also do not have propositional content.

In sum, these six differences between our representations and those of the bacterium, or Fodor's paramecia, ought to be enough amply to secure our superiority, to make us feel comfortably more endowed with mind.

RUTH GARRETT MILLIKAN

University of Connecticut/Storrs

²⁴ On the other hand, the bees cannot go two places at once.

²⁵ In LTOBC, I defend the position that the law of noncontradiction plays a crucial role in allowing us to develop new methods of mapping the world with representations.