**Millikan’s biological explanation of mental representation – a critical introduction**

**M. Polo Camacho and John Symons**

1. **Introduction**

Millikan’s use of biological concepts to solve traditional problems in the philosophy of mind has been very influential in recent years. In this short critical introduction we will consider one prominent aspect of her work; her effort to explain the biological basis of meaning or content. Very roughly, her view, which she calls *biosemantics* - holds that we can explain some of the most puzzling features of mental representations in terms of the biological role that they play in the lives of organisms. Unlike most other accounts of semantic content, Millikan’s account is grounded in the evolutionary history of biological systems.   
 Millikan’s account, as we will describe below, attempts to explain the “intentionality” (or aboutness) of our mental representations. For example, Vicki’s belief that she owns a blue ladder is *about* the ladder which happens to be sitting in her garage. But how does her thought of the ladder connect, or relate, to the ladder sitting in the garage? The relational aspect of representation becomes even more puzzling when our thoughts are about things that have no causal relationship to our brains. Alexius Meinong (1899) famously noted that those things towards which beliefs and desires are directed are not always physically present to the organism, they need not be real ladders in the garage or other causally efficacious aspects of our environment. One can have beliefs concerning fictional entities or even impossible objects. These are among the many puzzling features of intentionality and one of the central tasks in 20th century philosophy had been to provide an explanation for it that accounts for its place in the physical world. Millikan’s insight is that the intentional content of a belief (what the belief is about) is explainable in terms of the biological mechanisms responsible for producing and using my representation of the ladder. Millikan’s biosemantics is an attempt to bridge the gap between the puzzling aspects of mental life and the less puzzling aspects of the world that are revealed to us by biology.

One fundamental conceptual challenge for theories that account for representation in biological terms is to understand how normativity can be grounded in non-normative aspects of reality. For example, what does it mean in purely biological or physical terms for our thoughts to *correctly* or *incorrectly* represent reality? To put it in another way, what does it mean to apply the normative judgment of rightness or wrongness to what is happening in the brain of an animal? Likewise, when we say that an animal or a person made a mistake, that they have a false belief, or are in error in some other way, how do we reconcile our normative claim with the non-normative claims of natural science?[[1]](#footnote-0) Milikan’s approach is motivated by the insight that any explanation of representation ought to be, at the same time, an explanation of the possibility of misrepresentation. Her account of the normative aspect of representation is focused on the way that quasi-normative notions like biological purpose or function can be explained scientifically. In Millikan’s approach, biological accounts of function provide a way of bridging the normative and the non-normative. For philosophers such as Millikan and before her Daniel Dennett a naturalistic approach to purposes is already available and widely accepted, namely the theory of natural selection.[[2]](#footnote-1) These philosophers would regard the traditional challenges to naturalistic accounts, for example the charge of circularity, regress, and anthropomorphism as being solved simultaneously in the biological explanation of the origin of purposive systems.

In what follows, we offer an overview of Millikan’s approach to representational content, and discuss whether Millikan’s attempt to bridge the gap between mind and world is successful. Section 2 of this paper begins with a hypothetical scenario, which will serve to illustrate the various concepts underpinning Millikan’s biosemantics. In Section 3, we consider two challenges facing Millikan’s theory: the *Indeterminacy Problem* and the *Problem of Novel Contents*. After considering potential replies to these objections, we conclude in Section 4.

**2. Raincoats and Car Keys**

Suppose Sally is running late for work one day. She hurriedly gets dressed and eats breakfast when all of a sudden she hears a clap of thunder. She looks outside her window and notices that it is raining heavily outside. She realizes that she will need her raincoat. She finishes her breakfast, grabs her raincoat, fetches her car keys and walks out of her house towards the car. She thinks to herself that if she takes the backroads, she might make it in time.

Let’s consider what kinds of events are occuring in the hypothetical example above. For example, as she is eating her breakfast she suddenly notices the clap of thunder, which then prompts her to look outside, we might say she is in a belief-like mental state.[[3]](#footnote-2) That is, she is in a mental-state that is *representing* a state of the world. Within this particular slice of time and space, she holds the belief that it is raining outside, which implies that she is in a state that represents the fact that it is raining outside.[[4]](#footnote-3)

Not only is she in a mental state that is representing the world, but also her representational state is descriptive, which we might distinguish from non-descriptive states.[[5]](#footnote-4) To grasp this distinction, recall a.) the moment she was prompted to look outside and, b.) the moment before she got up to fetch her raincoat. In representing the world, Sally’s belief is *describing* the world as thus-and-so; in this case, her belief is representing, and thus offering a description of, her physical surroundings. Contrast this belief-like mental states from what we might call desire-like mental states. When Sally sees that it is raining outside, and forms the belief that it is raining, she then forms a desire to get her raincoat. Desires differ from beliefs in that not everything one believes is to be desired. For example, when opening my refrigerator, I may form a belief that there are onions next to the tomatoes, but this does not imply that I *desire to eat the onions* next to my tomatoes. Conversely, desires to not imply that I am representing the world in any particular way. I may desire to kick around a seven-sided polyhedron, but this does not imply the forming a belief-like mental representation of the world that contains a seven-sided polyhedron. Desires, when coupled with the appropriate beliefs, prompt action. Millikan notes that:

“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.” (p. 296)

In other words, belief-like states (which serve to describe the world in particular ways) by themselves will not bring about action. In order to do this, the belief must be accompanied by the appropriate motivations or desires. Recall that Sally’s belief that it is raining outside and that a raincoat will protect her from the elements, when coupled with the desire to avoid the rain prompt her to get up and grab her raincoat. Similarly, my belief that there’s an onion in the refrigerator alone will not prompt me to eat the onion. However, if the belief is coupled with a desire to eat the onion, I may then be prompted to eat the onion.

So, in this way of thinking about the relationship between beliefs, desires, and actions, one can represent a state of the world in a manner that is descriptive, and that can cause certain kinds of action when coupled with the appropriate desire.

**2.1 Millikan’s Biosemantics: Intentionality and Proper Functions**

Millikan (1989) believes that cognitive structures, which include representations, are solutions that resulted via natural selection to problems that emerged over the course of natural history. She writes

“[I]t 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.” (p. 294)

In other words, mental states like belief—which serve to represent states of the world—are the byproduct of evolution by natural selection, which—very roughly—says that physical traits (in this case, a human being’s representational mechanisms) to qualify as an adaptation, the trait must come about as a result of *heritability, fitness* and *variation*.[[6]](#footnote-5) In short, this means that for a phenotypic trait, like a beavers iron-enriched teeth, to count as an evolutionary adaptation, it must be the case that the trait varied within a population of organisms; so, at some point in a beavers evolutionary past, there existed beavers *with* iron-enriched teach and *without* iron-enriched teeth.[[7]](#footnote-6) Also, such traits must be *heritable*; it must be possible for a beaver to pass this trait to its offspring via reproduction. Finally, the trait itself must be *fit*; a beavers iron-enriched teeth must allow it to navigate its environment in a way that promotes its survival. In this case, the beavers' iron-enriched teeth allow it to chomp wood more efficiently, thereby allowing it to build better dams for its survival. So, in much the same way a beaver’s iron-enriched teeth promote the survival of the beaver, so do representational mental states (like beliefs) promote the survival of human beings.

This evolutionary approach to explanation allows her to explain one’s ability to form the belief that it is raining outside. For Millikan, the mechanisms responsible for producing this representation allow an organism to track features of its environment, which, in combination with other mechanisms, promoted the survival of its ancestors.

In Millikan’s thought, moreover, evolution by natural selection also plays a role in accounting for the intentionality of mental states. Millikan provides a naturalistic (or evolutionary) perspective on intentionality. A beaver, for example, splashes its tail in the presence of danger, signalling to other beavers to take caution. (Millikan, p. 288) The human heart pumps blood to the body, thereby supporting organ function. Kidneys filter blood, thereby removing toxins from the body. Given this, we might say that the splash of the beaver's tail, the pumping of blood by the heart, and the filtering of blood by the kidneys all designate specific biological purposes. The purpose of the beaver tail splash is to signal danger. The purpose of the human heart is to support organ function. The purpose of one’s kidneys is to remove harmful toxins. Millikan’s account of biological purposes appeals to the notion of *proper function*. At this point, we should pause to get a clear grasp of what a proper function is and how it figures in accounting for the intentional content of mental states.

To begin with, let’s consider the notion of a function. The easiest way to think about functions is to consider artifacts like a scythe. A scythe comes equipped with a scythe handle and blade. The function of the scythe is to cut grass. To explain the function of the scythe handle would require that we understand the scythe’s function as a whole.[[8]](#footnote-7) Similarly, explaining the function of beliefs requires that we understand how the belief functions in the organism as a whole. The function of a representation, in Millikan's view, is to provide organisms with descriptions of states of the world that serve action. Selective pressures over the course of natural history give rise to cognitive mechanisms responsible for *producing* representations. When one forms the belief that it is raining outside, there is a cognitive mechanism (or a set of cognitive mechanisms) responsible for producing this belief that it is raining outside. Moreover, Millikan takes it that there exist cognitive mechanisms responsible for using (or in Millikan’s language “consuming”) these representations. These cognitive mechanisms cooperate in ways that promote the survival of the organism as a whole. When one sees that it is raining outside, one forms a belief that it is raining outside, and this belief is produced by cognitive evolutionary mechanisms. One can then use this information to determine my course of action. Mammals like us have cognitive mechanisms responsible for using (or consuming) this representation to determine the appropriate action. In short, for Millikan, human beings possess producer-consumer mechanisms that, when functioning properly, promote the human being’s survival and, thus, define the intentional content of mental representations. In a reply to Peter Godfrey-Smith (2013), Millikan notes:

“Intentional content might be thought of very crudely as purposeful content, blurring together two meanings of “intentional.” It is not defined by reference to any current causal or statistical tendencies. It is defined by reference to the purposes of sign producers and sign consumers rather than to their actual achievements, these “purposes” being analyzed as what the producers and consumers were selected for doing by some means of selection (genic, cultural, learning).” (p. 60)

Simply put, the intentional content of mental representations are defined not so much by the manner in which mental states, like belief, map onto the world, but rather by the proper functioning of representation-producing and representation-consuming mechanisms. These mechanisms, in turn, are the result of selective biological pressures.[[9]](#footnote-8)

It is important to stress that what determines the proper functioning of belief is its role in evolutionary history. Above, we saw that, according to Millikan, “the cognitive structures with which man is endowed were originally nature's solution to some very simple demands made by man's evolutionary niche.” (1989, p. 294) This means that, at some point in our evolutionary past, the ability to form mental representations made it possible for human beings to better adapt to our environmental surroundings.[[10]](#footnote-9) . As we have seen, for Millikan, the relevant purposes are the proper functions of the organism’s representational systems. Again, the proper function of a system is simply what it ought to do in virtue of what it is. Any system can serve a variety of functions, not all of these functions will count as the system’s proper function. There is an important sense in which the judgment of what counts as the purpose or function of some system is in the eye of the beholder. So, for example, one of the functions of the heart is to serve as a symbol of love in some cultures. This is why Millikan and others emphasize the notion of proper function. Serving as the symbol of love would *not* count as a proper function of the heart, neither would the sound it makes, its weight, what it tastes like in a stew, etc. Instead, we would ordinarily say that the proper function of the heart is to help circulate blood in the organism’s body. Other functions are accidental by-products of the function for which it was selected.[[11]](#footnote-10)

To recap, for Millikan, beliefs are mental representations that describe states of the world. These representational states are produced and utilized by other cognitive mechanisms that underwent some form of selection to determine action. When all of these mechanisms are functioning properly, they promote the survival of the organism.

These considerations invite many questions; among them is the following: what does it mean then for mental representations to fail? After all, in the example sketched above, it is perfectly possible for my mental representation of the rain to be skewed. Imagine, for example, that I was mistaken in forming the belief that it is raining outside, because, as a matter of fact, my neighbor's sprinkler is misfiring and hitting the window pane, causing me to mistakenly form the false belief that it is raining. Concerns about misrepresentation are ultimately concerns about the content of our representations. In the Section below, we discuss two challenges to Millikan’s biosemantics related to content.

**3. Two Challenges to Millikan’s Biosemantics**

This section sketches two challenges to Millikan’s Biosemantics: the *Indeterminacy Problem,* and the *Problem of Novel Contents.* After characterizing each of these challenges, we offer potential replies and their shortcomings.

3.1. *The Indeterminacy Problem*

One might point out, as others have (Fodor, 1990), that Millikan’s Biosemantics faces an indeterminacy problem. As noted previously, one’s belief that it is raining serves the purpose of describing and detecting a feature in one’s environment. Similarly, when a coyote detects a rabbit, we might say it is a proper function (via selection) of the coyote's cognitive capacities to detect the rabbit. The issue with this explanation, however, is that the coyotes behavior can be interpreted in many different ways. If it is a proper evolutionary function of the coyote’s cognitive capacities to detect a rabbit, then it is equally plausible to interpret the coyote as detecting a fluffy rabbit-like object, rabbit stages or undetached rabbit parts. Similarly, the content of my belief that it is raining outside might be translated in many different ways. For Fodor, these considerations imply that the mechanisms responsible for producing representational content cannot discern between features of the environment (i.e the rabbit) that contribute to the coyote’s fitness from features of the environment that do not necessarily contribute to the coyote’s fitness (i.e. fluffy rabbit-like objects).

Millikan (1990) has responded to this worry by emphasizing the role of our biological cognitive mechanisms responsible for the consumption—or use—of the representation. In the case above, much emphasis is being paid to the formation (or, to use Millikan’s language, the production) of my belief, when emphasis should be paid to the organism's ability to use the information. The consumer mechanism was “designed… by a selection process to cooperate with a representation producer.” (p. 153) For Millikan, the coyote might use a wide-array of content that prompts it to chase after the rabbit; the coyote may even mistakenly chase after a plush doll. The full explanation, for Millikan, involves the evolutionary history that shaped the representation producer and consumer mechanisms, which necessarily involve chasing after prey and not plush dolls. In short, the content of the coyote’s belief may vary so long as the content is grounded in the coyote’s evolutionary history.

It is important to note that philosophers have offered various responses to Millikan’s reply to the indeterminacy problem (Neander, 2012). Since the aim is to provide an overview of Millikan’s biosemantics, we will not discuss them further.

3.3. *The Problem of Novel Contents*

Another challenge to Millikan’s Biosemantics (and Biosemantic accounts generally) concerns the problem of novel contents.[[12]](#footnote-11) As noted previously, Millikan accounts for representational mental states (like belief) by appealing to their proper function, which in turn is accounted for by evolutionary considerations. The proper function of my belief that it is raining outside is to help me detect features of my surroundings. At this point, we might say that though Millikan’s Biosemantics successfully accounts for our ability to track *some* features of our environment—like food and water—, it does not necessarily account for novel features of our environment. After all, we encounter features of the environment that, presumably, were not a part of our evolutionary past, such as toasters, computers and smartphones. Given the inability of Millikan’s Biosemantics to account for this, we might be inclined to reject it.

One possible reply to this problem has been offered by Garson and Papineau (2019). According to Garson and Papineau, Millikan’s recent work in her book *Beyond Concepts* (2017) points to a potential solution to this problem. Though the details of their solution may be found in their paper “Teleosemantics, selection and novel contents,” it is worth offering a very brief sketch of their response here. According to Millikan, we possess cognitive mechanisms responsible for tracking features of our environment. When we encounter a novel feature in our environment, we are able to form new tracking mechanisms—via an ontogenetic selection process—for identifying novel features in our environment.

A potential issue with this response, and the problem of novel contents generally, has to do with how we explain what it means for features in an organisms’ environment to be “novel.” One might say, for example, that the rabbit, which is being tracked by the coyote, is novel in that the coyote has never encountered that particular rabbit, but it is not novel in the sense that the coyote has encountered organisms of that type in the past. Similarly, my representation of the window pane is novel in that many of my hominid ancestors perhaps never encountered a window pane created by a local company in 2017, but it is not novel in the sense that I am observing a fixture protecting me from the elements, which, in this case, is rain. So, we might efore the problem of novel contents can be construed as a “problem,” we must first get clear on what it means to encounter “novel” features of our environment in the first place.

**4. Conclusion**

The aim of this paper was to offer a sketch of Millikan’s biosemantics. We saw that, for Millikan, mental representations—and the cognitive systems underpinning them—are accounted for by their proper function. In turn, their proper functions are determined by their role in our evolutionary history. Though there is much to recommend her account, we saw that Millikan’s Biosemantics faces several challenges, which seem to boil down to how we understand what it means to explain the contents of representational states.[[13]](#footnote-12)

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1. This aspect of Millikan’s account is presented in detail in her book *Language, Thought, and Other Biological Categories* (1984) and elaborated upon in her (1993) and (2004). For a discussion of the different kinds of demands for explanation that appear in the philosophical literature on biology and mind see Symons (2016) and Symons and Calvo (2014). [↑](#footnote-ref-0)
2. For more on Dennett’s use of the theory of natural selection in the explanation of intentionality see his (2008). For a compact exposition see Symons (2002) especially Chapter Three. [↑](#footnote-ref-1)
3. Some philosophers might characterize this belief-like state as a *propositional attitude.* Indeed, Millikan characterizes it as such in her book *Beyond Concepts* (2017, p. 67). For expediency’s sake, we will not be using this terminology. [↑](#footnote-ref-2)
4. For Millikan, a more accurate description of this event is that I am in a belief-like state representing the world at some time t1 within a particular region of space s1. [↑](#footnote-ref-3)
5. Millikan, for example, distinguishes from indicative (or descriptive) mental states and imperative (or connative) mental states. For more on this, see Millikan’s “Biosemantics.” (pp. 295-296) [↑](#footnote-ref-4)
6. This is a general sketch of Darwin’s theory of evolution by natural selection. For more on the theory, see Sterelny and Griffiths (2012). [↑](#footnote-ref-5)
7. It is important to note that these traits emerged randomly within the populations. [↑](#footnote-ref-6)
8. Millikan uses this example in *Beyond Concepts* (2017, pp. 156-160). [↑](#footnote-ref-7)
9. I should point out that Millikan has a lot more to say, especially when it comes to the intentionality of language. Very roughly, for Millikan, the intentionality of linguistic tokens are defined by the historical coordination of linguistic token senders and receivers. For more on this, see Millikan (Chapter 12). [↑](#footnote-ref-8)
10. It should be noted, however, that some have questioned this idea. (Schulz, 2018) [↑](#footnote-ref-9)
11. This paragraph draws heavily on Symons (2016). [↑](#footnote-ref-10)
12. For a recent sketch of this debate and the problem of novel contents, see Garson and Papineau (2019). [↑](#footnote-ref-11)
13. For a detailed discussion of the variety of kinds of explanations that can be demanded from a theory of representational content see Symons 2016. [↑](#footnote-ref-12)