Brian Leahy and I agree that Ruth Millikan's teleosemantics, or something very much like it, is the correct approach to the naturalization of intentionality. On the other hand, Leahy's interesting and careful piece suggests that we disagree about the extent to which teleosemantics needs to be ammended, perhaps supplemented, if it is to accommodate human-language productivity (HLP) successfully. I will suggest here that, in fact, the disagreement does not run very deep.

In (Martinez 2013), I argued that HLP cannot be, as Millikan has it, essentially the same phenomenon as the simpler forms of productivity one finds in bee dances, vervet monkey alarm calls, or the begging behavior in nestling magpies. The argument, in a nutshell, was that, if it *were* the same phenomenon, we would observe gaps in the compositional semsntics of human languages that we fail to observe:[1]

1. Indexically productive systems (i.e., the simpler signaling systems, examples of which I have given above) are *gappy*: some of the signals that can be derived via transformation rules from other, meaningful, signals in the same system are meaningless.

2. There is no basic difference between simpler signaling systems and human language, as regards their productivity.

Conclusion: Human language is gappy: some of the signals that can be derived via transformation rules from other, meaningful, signals are meaningless.

Premise 2 is explicitly endorsed by Millikan: "there is no basic difference [between simpler and human-language representations] in the kind of compositionality involved" (2013, p. 86).

The case for Premise 1, in my 2013, was based on the observation that the scope of indexically productive signaling systems depends on whatever causal facts should figure in a Normal explanation of the success of the system in question (cf. Shea 2013, p. 72). There is, I claimed, no grounds to decide among indefinitely many ways in which one might extend our content-fixing recipes to cases in which these causal facts no longer hold. It follows that signals outside of what I called the *causally-grounded domain* should be considered meaningless. It should be noted that Millikan now appears to endorse, at least more clearly than before, a similar view:

> [W]hat I also *should* have had in mind but didn't have, or not clearly, was that ... these correspondence rules ... needn't be universally applicable. There might be sub-domains ... in which [transformations] would not yield a (significant) icon. (Millikan 2013, p. 82)

The conclusion of the argument is unpalatable: for example, perfectly meaningful sentences arising from the more-or-less free combination of noun and verb phrases (e.g.,

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[1] I would like to thank Brian Leahy for prompting me to be explicit about the main argument of my 2013 paper, and in general for very generously helping me with this response.

"Fido the dog is tech-savvy") would come out meaningless. This undermines the claim that HLP can be fully explained in the Millikanian framework of mapping functions and Normal explanations.

Leahy challenges my case for Premise 1: he denies that we need to choose among the indefinitely many mapping functions that agree in the causally-grounded domain, and disagree outside of it. Instead, he argues, we can construct principled, universally applicable rules—just gappy ones. One of his examples: "[i]f the orientation of the dance is x° off the vertical and x is less than 42 or greater than 45, fly x° of the line from the hive entrance to the sun." (p. 27). This rule does not comment on what is to be done between 42 and 45 degrees; yet it is, in a sense, universal: it is always and everywhere true that bees should do as it says (in the fictional case discussed in Leahy's paper).

Thus, while I claimed (and Millikan now appears to claim) that indexically productive systems depend on rules which do not apply universally, Leahy advocates modeling these systems with universal rules with the gaps built in, so to say, as part of their content. But this makes no difference to Premise 1 in my argument: Leahy-style rules also leave us with indexically productive signaling systems in which many signals (those falling in the built-in gaps) are meaningless. The argument can, then, proceed unmodified.

Leahy's reconstruction of the teleosemantic content-attributing recipe is incomplete in an important additional respect. One consequence of this is that, had he provided a way to identify gap-free mapping functions instead of the gappy ones he argues for in his paper, gappy signaling systems would still be possible:

What Leahy calls *mapping functions* (e.g., the Standard, Quuslike and Gappy rules in p. 27) does not agree with the sense commonly given to this notion in teleosemantic theorizing. Mapping functions, to a first approximation, take signals to (perhaps merely possible) states of affairs; Leahy's rules, instead, take world states to behaviors. Selection for this kind of behavioral rules gives rise to *proper functions*, not contents. An extra step is needed to derive contents out of proper functions; the standard idea is to rely on Normal explanations of the selection for behavioral rules as the way to take this extra step (see point 4b in Millikan 1984, p. 97). Suppose, then, that we had established that the correct rule to describe the behavior of bees was what a gap-free rule such as what Leahy calls the *Standard* one:

Standard rule: If the orientation of the dance is x° off the vertical, fly x° of the line from the hive entrance to the sun. (Leahy, forthcoming, p. 27)

In order to derive a content attribution from this rule, we need to identify the Normal explanation of the way in which bee dances helps foraging bees reach sources of nectar; and the content of the dance will involve the entities appealed to in that explanation. But, even if a behavioral rule is gap-free, its associated Normal explanation will typically not be: for example, only in a certain limited area around the hive will following the Standard rule result in nectar – dances that prompt you to go farther than that will in all likelihood be just abnormal, and carry no information about nectar.

Mapping functions and Normal explanations are central to teleosemantic theory; yet the present exchange (and the exchange between Shea and Millikan 2013) show that

they are remarkably slippery and, to a large extent, underdeveloped. It is an open question whether a sharper understanding of these notions would vindicate the ambitious continuity thesis presented in Premise 2 above, and endorsed by Leahy. I believe that, if we are to judge by our present rather incipient grasp of them, the more skeptical position outlined in my 2013 is, however, still warranted.

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