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Comments on John Kulvicki's "Analog Representation and Structure Preservation"

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Kulvicki's paper defends a structure preservation account of analog representation. It is an elegant account and the tenor of my comments will be predominantly appreciative. Nonetheless, allow me to nitpick just a little so as to mount a modest challenge to some of the details of the account. Perhaps in the process I can push Kulvicki to say some more. Before the nitpicking, though, a brief outline of the argument…

The argument:

On the traditional view, analog representation is understood in terms of a system's capacity for continuous syntactic variation, and the saturation of the resulting continuum of syntactic types with a distinct semantic content for each syntactic type. Associated with Goodman (1968) (although he originally formulated his definition in terms of syntactic and semantic density rather than continuity, a decision superseded by subsequent consensus in the literature) and Haugeland (1981), the traditional view thus equates the analog-digital distinction with the distinction between the mutually exclusive classes of continuous and discrete representational systems.

Goodman's motivation for preferring to conceive of the analog in terms of continuity (rather than analogy) stems from his commitment to ridding theories of representation of any and all appeals to resemblance. Moreover, as the continuous-discrete distinction is independently significant for formal and computer engineering purposes, choosing to leverage the analog-digital

distinction from it seems well motivated. But as it turns out, one might concede Goodman's widely accepted criticisms of the role of resemblance *simpliciter* in representation, and still think that analog representation requires *structural isomorphism* between a system's syntax and semantics.

Kulvicki's "puzzle" shows that - because the exact identities of the syntactic units in continuous systems are beyond ordinary interpreters' discriminatory capacities - continuous systems are uninterpretable absent a structure preservation constraint on the mappings from syntax to semantics. Thus he formulates his preferred version of such a structure preservation constraint in terms of mappings from approximations to syntactic identity, to approximations to semantic contents, such that precise discrimination of syntactic identity is not necessary for interpretation.

The set of systems meeting this structure preservation condition intersects with the set of continuous systems. Kulvicki proceeds to argue that members of the former set, irrespective of whether they are continuous, further support an interesting pattern of interpretive interaction, namely open-ended searches for content across levels of abstraction. Given that such systems are unified as an interpretive kind in this way, the argument goes, we have *prima facie* reason for treating them as a representational kind too - and we can do this by simply dropping the continuity constraints on analog systems and retaining just the structure preservation condition.

This yields the interesting result that some digital (discrete?) systems are no longer excluded from the category of the analog. Many of the digital systems that are structure preserving in the relevant way, also support the right pattern of interaction. But among digital systems that meet the structure preservation constraint, Kulvicki disqualifies from the analog those systems that are of sufficiently coarse grain that they fail to support the open-ended search pattern of interaction in normal contexts of use. Thus he completes his identification of the analog representational kind with the interpretive kind that turns out to be the real centrepiece of his paper.

Comments:

The puzzle about the interpretability of representations in continuous systems gives us a compelling, perhaps even conclusive, reason for accepting a structure preservation constraint on analog systems. As Kulvicki mentions, though, he is not the first to suggest a structure preservation account of analog representation - cf. Lewis (1971), Bach (1971), Shepard (1978), Blachowicz (1997), and Maley (2011). Given the list of precedents, a good way to evaluate Kulvicki's proposal is to focus on how it compares not to the traditional continuity account, but instead to other structure preservation accounts. This approach promises to bring the novel and distinctive parts of his view into sharper focus.

A fair amount of the comparative work is already done for us by Kulvicki. In a longer version of the paper he calls his structure preservation condition "compatible" with those of Blachowicz and Maley, for instance. And like Kulvicki, other proponents of structure preservation views have also tended to drop the traditional continuity constraints. In fact, if he had stopped at making structure preservation the essence of analog representation, it would not be clear that he is giving a new account of the analog at all. Although formulated in different terms, it looks like his structure preservation condition is really equivalent to, say, Maley's, unless I am missing something. This need not be an unwelcome result for Kulvicki, because his interpretation puzzle would then stand as novel independent, convergent support for an account he would share with Maley, Blachowicz, Shepard, etc.[1]

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[1] Kent Bach does seem to hint at a similar kind of motivation to Kulvicki's, even if he did not present it as his main reason for his structure preservation requirement: "An important advantage of a genuinely continuously correlative system, with non-arbitrary orderings of characters and compliance-classes, is that, given correlations of a finite number of characters and their compliance-classes, the compliance-class of a new character can at least be approximated as being between those of the nearest pair of characters that the new character is between; and the character with which a new compliance-class is correlated can at least be approximated as being between those two characters with nearest compliance-classes that the new compliance-class is between." (Bach 1971: 130)

But Kulvicki does not rest with structure preservation. He further restricts the class of analog systems to those that are fine-grained enough that their mappings between abstractions over syntax and content substantially outstrip the informational needs of their interpreters in normal contexts of use (i.e. systems that support open-ended searches for content). This restriction is his sole deviation from previous structure preservation accounts. It is the paper's crucial and, to my mind, most contentious move.

First notice that - perhaps not in spirit but nonetheless technically - it is a move back in the direction of the continuity account we started with. Continuous systems are, by definition, fine-grained enough to support the pattern of interaction Kulvicki takes to be criterial of analog systems in any and all contexts of use. This is perhaps a virtue of Kulvicki's account, because it captures something of the original motivation for tying analogicity to syntactic and semantic continuity. Moreover there is no doubt that Kulvicki's paper introduces an interesting and putatively important kind of interpretive interaction typically - and perhaps exclusively - mediated by representations in fine-grained structure preserving systems. But are these considerations sufficient to motivate restricting analog representation to systems that mediate such interpretive interaction?

One reason to think not, is that the restriction isolates Kulvicki's account from other structure preservation accounts with regards to the support they draw on. Consider other sources of support (than Kulvicki's interpretation puzzle) for the move away from continuity constraints towards a structure preservation account. Maley (2011: 120-122), for instance, argues for a structure preservation condition on the basis that structural isomorphism between representational medium and represented quantity best explains some seminal findings about the (putatively analog) mental representations involved in rotation tasks in spacial reasoning. The argument runs entirely orthogonal to questions about the relative grain of the representational systems the mind employs in the relevant kind of spacial reasoning. In fact, the role analog representation is taken to play in this kind of reasoning does not seem, at first blush at least, to depend on whether it supports *open-ended* searches across levels of abstraction.

Kulvicki clearly thinks that his account promises some pay-off in research about mental representation. In earlier work he already makes a good case for thinking that perceptual states have vertically articulate content, for instance. The question I am asking is just whether it is a good idea to further restrict the analog not just to systems that support vertically articulate content, but to ones that support a degree of vertical articulateness that meets a variable threshold fixed by normal contexts of use. This starts looking very much like a kind of response-dependence account of analogicity, which I am not sure is what Kulvicki really wants. Why should facts about the types of interpretive interaction supported for ordinary interpreters in normal contexts of use, have anything to do with whether a representation is of a certain representational kind?

So, in sum, my challenge to Kulvicki can be understood as a dilemma. On one horn, there is the option to align completely with other structure preservation accounts. Accepting this horn would detract from the novelty of his proposal by locating his paper's main contribution outside its actual account of what analogicity is, in its discussion of an extrinsic feature - the interesting kind of interpretation supported by fine-grained analog systems. To my mind this would by no means be a bad option, but it would make it a paper about an interpretive kind, not a representational kind.

On the other horn of the dilemma, there is the insistence that the support of an open-ended search pattern of interaction in normal contexts of use is the ultimate criterion for analogicity. Such insistence makes for a much more novel account of the analog, but also a more contentious one, especially in that it indexes the criterion for calling a representational system analog to the normal contexts in which representations in the system are used. Aside from raising the difficulty of how to characterise "normal contexts of use", especially across the boundary between artifactual and mental representation, this also makes analogicity a response-dependent matter.