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Methodological consequences of weak embodied cognition and shared intentionality

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ABSTRACT

Embodied approaches to cognition have been empirically successful both in developmental psychology and robotics. Shared intentionality has been similarly productive in developmental and comparative psychology. However, embodiment and shared intentionality both have a rich philosophical history. As a consequence, researchers who aim to benefit from the methodological advances of these literature must navigate through a variety of different usages, many of which rest on potentially contentious philosophies regarding the nature of mind. We attempt to identify renditions of embodiment and shared intentionality that can motivate research while making relatively modest assumptions. As we will see, such readings already exist in the embodied cognition literature. We find most uses of shared intentionality, however, to be unnecessarily strong theses that inevitably tie a researcher to contentious frameworks. We suggest a usage-based explication of shared intentionality that is far weaker, and may motivate research in the absence of such assumptions.

1. Introduction

A recent wave of research has departed from traditional views on cognitive processing and instead advocated an embodied approach. "Embodiment," of course, carries a variety of meanings, but a common tenant is that cognition depends more heavily upon bodily morphology and subtle environmental cues than previously recognized. This aspect of the thesis is often described as situated, distributed, or even extended cognition, but embodiment is not just an emphasis on the form of the body but carries commitments on the body's interaction with the environment. The majority of these accounts have consequences for how computational modelling should be done. That is, they place constraints on model or robot architecture. This has lead to the construction of situated robots and agent-based simulations, which are just systems designed to satisfy constraints imposed by some notion of embodiment. Embodiment has also played a strong role in the recommendation of specific methodologies and formal tools to psychologists (e.g. Thelen & Smith, 1994). The empirical success of these recommendations has, in turn, provided more motivation to develop and further specify embodied theories of cognition, many of which still retain slightly different usages of the term.

While the ensuing sea change has, of course, been informed by seminal research on infant development, its ripples have only recently come into contact with the largely independent research on the role of shared intentionality in social, cognitive and linguistic development. Shared intentionality is thought to be a uniquely human motivation to share intentions with others (Tomasello, 2014). Shared intentionality, and the collective action literature from which the concept was derived, would seem to have some prima facie relationship to the notion of embodiment in that the manner in which individuals share intentions depends on their bodily form in some particular environment and a shared intentional state rather than a solitary cognizer, or the like. However, there are reasons for thinking about shared intentionality as an independent thesis, perhaps the most important of which is the fact that the relationship between the two notions is still unclear. Thompson, Sameen, Bibok, & Racine (2013) argued that situated robotics will encounter serious difficulties in trying to reconcile embodiment and shared intentionality. The chief problem, they argue, is that depending on one's particular philosophies of 'embodiment', and 'shared intentionality', methodology could be constrained in unforeseen ways, making it difficult even for researchers operating within similar frameworks to recognise the value of each-other's work.

This quagmire is due to the fact that each explication of the

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notion rests upon different theoretical constraints. One example would be Brooks' (1991) seminal call for a blurring of the distinctions between perceptual and motor systems in robotic architectures. ‘An embodied approach’, on the other hand, might refer to one with a particular solution to the symbol-grounding problem (Searle, 1980). On yet other accounts, one might aim to eventually produce truly autopoetic robots, not mere simulations (e.g. Sharkey & Ziemke, 2001). Models that fail to meet such constraints are of less theoretical interest from the purview of the embodiment framework in question. Shared intentionality imposes similar constraints, mostly because it identifies some behaviours as more deeply social than others. For example, exhaustive reviews of the pointing capacities of great apes have suggested comparable pointing capacities to those of older infants (e.g. Leavens & Racine, 2009), but shared intentionality is nevertheless invoked to explain what is uniquely human about pointing (Tomasello, 2008; Tomasello, Carpenter, & Liszkowski, 2007). From such perspectives, shared intentionality makes certain classes of points (typically declarative and informative pointing) possible (Tomasello et al., 2007). But while there is debate on, for example, whether humans are really uniquely capable of pointing with the motive to share attention (Wereha & Racine, 2012), the fact remains that shared intentionality makes a certain class of points more social than those of which chimpanzee's are capable (Tomasello, Carpenter, Call, Behne, & Moll, 2005). Social behaviours made possible by other developmental processes, such those of conditioned learning or the emergence of communicative patterns without intentional imitation (see ontogenic ritualization; e.g., Tomasello, 2008), are accordingly of less theoretical interest. Any apparent social understanding purchased by the ‘incorrect’ causal mechanisms are consequently of suspect value from the purview of shared intentionality.

However, while these philosophical debates may have important consequences for cognitive science, we should not expect researchers to have the training required to carefully examine every philosophical presupposition which inspired a particular research program or study. Instead, we expect them to enthusiastically adopt and exploit innovative research techniques whenever possible. Most of this time, the adoption of innovative research techniques is unlikely to be philosophically precarious; the vast majority of the methodologies employed in cognitive science remain comprehensible even from the purview of radical philosophies. For example, none of the philosophies discussed here bear upon whether it is a good idea to study the helping behaviours of infants by appropriating the active helping paradigm (Tomasello & Warneken, 2006; 2007), or to exploit the mathematics of dynamical systems theory (Thelen & Smith, 1994) to model a particular class of behaviour. Consequently there is a need to consider which of the recent methodological innovations in developmental psychology and robotics can be justified by even the weakest and least philosophically interesting theories, as these are the methods researchers should exploit with impunity.

Our goal here, then, is to elucidate a class of research tools and methodologies from the embodiment and shared intentionality literature which are useful and relatively free of unwanted philosophical or metatheoretical complexity or debate. This is perhaps a slightly unusual goal for conceptual work because it is typically more concerned with the adoption of false presuppositions than it is with suspending judgement on stronger, but perhaps true, claims about the mind. The former error is especially problematic from a methodological point of view, as methodologies grounded in a bad theoretical framework (e.g. phrenology) are likely useless, while methodologies grounded in sparse ontologies (e.g. conditioning) remain useful whatever their ontological status. We prefer the latter sort of tradeoff, and so we pay special attention to whether the methodological innovations stemming from these literature can be supported by weaker theses that, while perhaps not philosophically interesting enough to account for the richness of all human behaviour, are less likely to have their utility completely overthrown.

More detailed accounts of the various notions of embodiment (Anderson, 2003; Clark, 2008; Gallagher, 2005; Shapiro, 2011; Wilson, 2002) and shared (and collective) intentionality (Gilbert, 1989; Searle 1995; Tomasello et al., 2005, 2007; Tomasello & Carpenter, 2007; Tuomela, 1995; for a review see Racine, 2012) can be found elsewhere. This approach is also useful for researchers who would like to consolidate these two philosophical theses in a single research program, as the risk of philosophical confusion will, no doubt, be smaller when dealing with modest theories.

We touch on, on the one hand, a number of common definitions of embodiment (e.g. Barsalou, 1999; Brooks, 1990; Clark & Chalmers, 1998; Sharkey & Ziemke, 2001; Thelen & Smith, 1994), and identify those requiring only minimal assumptions. We find, in a brief discussion of shared intentionality, as it is described in the work of Tomasello and colleagues (e.g. Tomasello, 2008, 2014; Tomasello et al., 2005, 2007; Tomasello & Carpenter, 2007), that it is rather difficult to recruit the methodological contributions of this literature without also taking up a relatively contentious framework. In order to avoid these problems, we propose a construal of shared intentionality that requires fewer assumptions but yet still motivates the experimental research on the social capacities of human infants and non-human primates (for a review, see e.g. Tomasello, 2008; Tomasello et al., 2005). We argue that to do this, however, one must produce a notion of shared intentionality that does not type social behaviours on the basis of their cause but on the basis of their folk sociality.

2. The use of embodiment in robotics

Embodied approaches to robotics are increasingly being informed by developmental theory (Breazeal, Buchsbaum, Gray, Gatenby, & Blumberg, 2005; Dominey & Warneken, 2011; Scassellati, 2002; Smith & Gasser, 2005), and appears very likely that developmental psychology has much to learn from robotic models of cognitive development (Kelley & Cassenti, 2011; Scassellati, 2000). Situated embodiment, like the term embodiment, itself, has been used in a variety of ways. It has been used, for example, in calls for dynamical approaches to studying development (Thelen & Smith, 1994), as some form of third framework which transcends the nativism-empiricism debate (Overton, 2004), and been proposed as a crucial factor in the study of social understanding generally. Almost every construal of the notion takes issue with some aspects of traditional computational theories of mind (Fodor, 1975; Pinker, 1994), typically because traditional views are seen as underestimating the extent to which our bodies contribute to human cognition (e.g. Clark, 1999; Thelen & Smith, 1994). Situated cognition has guided developmental psychology (Daum, Sommerville, & Prinz, 2009; Schlesinger, 2003), computational modelling, and developmental robotics (Pfeifer, Lungarella, & Sporns, 2008; Stoytchev, 2009). Since it is typical to view embodiment as a composite of four independent but related theses regarding human cognition, it makes sense to treat the embodied, embedded, enactive and extended view of the mind as separate forms of embodiment requiring their own evaluation.

2.1. Cognition is embodied

To say cognition is embodied is, first, to adopt the view that our cognitive abilities are made possible not only by the brain, but also the body and the interactive capacities it permits (Anderson, 2003;