Discussion

People v. objects: a reply to Rakison and Cicchino

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In our Brief Article (KBW, this issue), we present data showing that 5-month-old infants interpret the movements of inanimate objects according to the constraint of spatiotemporal continuity, but do not interpret peoples’ motion according to this same constraint. We suggest from this finding that infants may possess distinct systems for learning, interpreting, and reasoning about the actions and interactions of inanimate material objects, on the one hand, and intentional agents (of which the canonical exemplar is people), on the other. Rakison and Cicchino (R&C) raise several issues in their valuable commentary, both methodological and conceptual.

Methodological Issues. R&C worry about the “small sample of infants” in each of our conditions. In fact, the number of subjects in our experiments is similar to those in infant experiments on related topics, which frequently range from 8–12 per condition (e.g. Luo & Baillargeon, in press; Oaks, 1994; Quinn & Eimas, 1998; Sodian, Schoepner, & Metz, 2004; Spelke, Breinlinger, Macomber, & Jacobson, 1992). It is also similar to that of the original study we replicated in Experiment 1 (Spelke, Kestenbaum, Simons, & Wein, 1995). Moreover, statistical analyses are for precisely the purpose of determining the chance likelihood of a set of results, given the sample size. Both parametrically and nonparametrically, the chance likelihood of our results in Experiment 1 (Boxes) is well below the “0.05” standard (with \( P \)-values of \( \leq 0.02 \)), and in Experiment 2 (Humans) is above the standard (\( P \)-values > 0.4). And the effect sizes in the two experiments differ by a full order of magnitude (0.41 versus 0.04). These analyses support our claim that infants are responding substantially differently to our human versus inanimate stimuli.
R&C express concern “that one condition alone—the continuous habituation condition with the box in Experiment 1—may be driving force behind the statistical significance of results. That is, it is not clear that infants in both conditions in Experiment 1 responded by looking longer at the anomalous event than the event consistent with that seen during habituation” (R&C, p. 1). However, because infants may have different baseline preferences to different displays, the meaningful comparison is between conditions. Many studies have shown that infants have a modest perceptual preference for 2 objects over 1 (e.g. Cohen & Marks, 2002), including the study we replicated in our Boxes experiment (Spelke et al., 1995). This preference likely enhanced infants’ longer looking to (and the number of infants preferring) the anomalous 2-Box event in the Continuous group, and minimized longer looking to (and the number of infants preferring) the anomalous 1-Box event in the Discontinuous group. Thus one would not expect equally strong looking preferences to the anomalous event in each condition.

Finally, R&C raise the question of whether infants perceive people in 2-dimensional movies as humans. Many studies indicate that they do; video and photograph displays of humans have been used quite often—and successfully—as stimuli in infant research, including studies of social interaction (e.g. Bigelow & DeCoste, 2003); gaze direction (e.g. Farroni, Johnson, Brockbank, & Simion, 2000; Hains & Muir, 1996); human/animal categorization (e.g. Quinn & Eimas, 1998); gender differentiation (Eichstedt, Serbin, Poulin-Dubois, & Sen, 2002); and goal attribution (e.g. Baldwin, Baird, Saylor, & Clark, 2001; Sodian et al., 2004)1.

**Conceptual Issues.** R&C propose that understanding of the physical and social worlds emerges through general learning mechanisms such as associative learning. This theory is inconsistent with the findings of KBW. As R&C note, infants have only ever seen humans, like other material objects, behave in a spatiotemporally continuous manner. An associative learning process would presumably capture this regularity at least as early for humans as for other objects. Thus, if their learning account were correct, we should not have obtained the finding we did, namely, that infants use the cue of discontinuous movement of inanimate objects, but not of humans, to infer the presence of distinct individuals.

Our theory is different. We suggest that infants possess different systems—or modes of construal—for reasoning and learning about inanimate material objects versus reasoning about people (and possibly, all intentional entities). This is supported by the present data, as well as by a body of research suggesting that infants interpret inanimate objects in terms

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1 What about R&C’s suggestion that in our Humans movie infants may have attended more to local dynamic features than to global motion across the screen? This possibility is not necessarily incompatible with our own interpretation. Local motions are important to reasoning about the goal- and social-directedness of humans: Head turns indicate attentional focus; moving arms or hands may indicate a goal object. It is certainly possible that infants found the local dynamics of our Humans movies more salient—they are potentially more important than overall motion paths when interpreting the actions of an animate entity, and indeed certain local dynamic patterns may actually specify an entity as animate. For just this reason we do not believe a “robot” offers a good test case as R&C suggest. It is unclear whether infants would think of such robots as animate/social entities or as inanimate objects. For example, although 9- and 12-month-old infants responded with negative affect to a self-propelled robot (Poulin-Dubois, Lepage, & Ferland, 1996), 10-month-olds did not find it odd if a person was seen talking to a previously socially-interactive robot (Arita, 2003). And if a robot is sufficiently complicated, as depicted in science fiction, even adults treat them as sentient beings.
of physics and not goals (e.g. Woodward, 1998; see also Kuhlmeier, Wynn, & Bloom, in preparation), and interpret people and other animate entities—but not inanimate objects—in terms of goals (e.g. Meltzoff, 1995; Shimizu & Johnson, in press; Woodward, 1998). We suggest that these systems are not the product of past learning. Instead, they provide the foundation for future learning.

It might be that at a minimum, categorizing something as an animate entity impedes infants’ application of, and learning about, physical object principles—perhaps because a more salient set of goal/social principles has been invoked, or perhaps because animates do violate some principles of object physics (e.g. “contact”, Spelke, Phillips, & Woodward, 1995), and it may take time for infants to learn to apply object principles in something other than an all-or-none fashion. Or, it may even be that these systems are initially mutually exclusive, such that if a thing is construed as an animate entity, it is not construed as a material object, and vice-versa. In either case, the results in KBW suggest developmental changes in how we cope with the duality of people—the overarching developmental achievement may be in the successful partial integration of these two modes of construal. That is, we come to realize that although people are not constrained by some principles of inanimate-object physics (e.g. capable of action at a distance and self-generated motion), they are nonetheless also physical entities bound by principles that are universal to all material bodies, such as solidity and spatiotemporal continuity.

This integration may never be fully complete, however, given that even adults do not fully think of people as objects. Substance dualism has a strong intuitive pull (Bloom, 2004). Many people, for instance, believe that some agents do violate object principles (e.g. Christ) and that personhood—one’s identity as a psychological agent—survives the destruction of the body. Perhaps the assumptions of 5-month-olds explored in KBW are not all that different from those of adults.

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References


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