



Infants perceive human point-light displays as solid forms [☆]

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Abstract

While five-month-old infants show orientation-specific sensitivity to changes in the motion and occlusion patterns of human point-light displays, it is not known whether infants are capable of binding a human representation to these displays. Furthermore, it has been suggested that infants do not encode the same physical properties for humans and material objects. To explore these issues we tested whether infants would selectively apply the principle of solidity to upright human displays. In the first experiment infants aged six and nine months were repeatedly shown a human point-light display walking across a computer screen up to 10 times or until habituated. Next, they were repeatedly shown the walking display passing behind an in-depth representation of a table, and finally they were shown the human display appearing to pass through the table top in violation of the solidity of the hidden human form. Both six- and nine-month-old infants showed significantly greater recovery of attention to this final phase. This suggests that infants are able to bind a solid vertical form to human motion. In two further control experiments we presented displays that contained similar patterns of motion but were not perceived by adults as human. Six- and nine-month-old infants did not show recovery of attention when a scrambled display or an inverted human display passed through the table. Thus, the binding of a solid human form to a display in only seems to occur for upright human motion. The paper considers the implications of these findings in relation to theories of infants' developing conceptions of objects, humans and animals.

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1. Introduction

While much has been learned about infants' developing sensitivities to human faces (Turati, Simion, Milani, & Umiltà, 2002) relatively little is known about infants' developing representations of the properties of the human body. Recently, it has been discovered that eight-month-old infants show differential event-related potentials (ERPs) for biologically plausible and implausible movements of the human arm (Reid, Belsky, & Johnson, 2005) and that five-month-old infants appear to be sensitive to violations involving a moving hand passing through a hidden object behind a screen (Saxe, Tzelnic, & Carey, 2006). Thus, there is evidence that infants are able to understand some of the properties and actions of arms and hands (Woodward & Guajardo, 2002). However, we still know relatively little about infants' representations of the *whole* human form.

This area is surprisingly under-researched, given that a 'body concept' may be a precursor to infants' developing understanding of other people as agents with a single, unified goal (Gallagher, 1995, 2005). Also the development of a representation of the whole body could underpin infants' developing abilities to differentiate humans from other animals (Quinn & Eimas, 1998). Of specific importance may be the ability to represent the vertical human trunk. Particularly at a distance, the vertical trunk distinguishes humans from most animals, and the direction the trunk is facing also gives an indication of the focus of a person's attention. Therefore, one could speculate that while infants may initially have a prototype that applies to people and animals alike, consisting of a face combined with a generic body form, later there may emerge a specific human prototype that consists of a human face combined with a vertically aligned body (Quinn, 2004).

The few studies that have looked at infants' understanding of the whole human body are intriguing. One study found that not until 18 months do infants show differential attention to scrambled pictures of whole human bodies where the arms and legs are moved to atypical locations (Slaughter, Heron, & Sim, 2002). This shows a surprisingly late-developing ability in comparison to infants' early responses to scrambled human faces (Johnson, Dziurawiec, Ellis, & Morton, 1991). Another study, however, suggests that infants may encode aspects of the human form much earlier. Specifically, infants at three months show differential brain activity (ERPs) to scrambled pictures of headless bodies when a leg is moved to the head's location (Gliga & Dehaene-Lambertz, 2005). It may be that, while infants do not have access to an *explicit* pictorial representation of the human form before 18 months, younger infants may have access to *implicit* representations, at least of parts of bodies, which allow them to make sense of others' movements and intentions. However, it is not

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