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Infants' representations of others' goals: Representing approach over avoidance

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ABSTRACT

Goals fall into two broad types – approach and avoidance. Research on infants' early goal understanding has focused only on approach goals, usually assuming that infants will encode an ambiguous display where an actor picks one object over another as the actor wanting to approach the former rather than avoid the latter. We investigated infants' understanding of approach and avoidance separately by presenting 7-month-olds with a hand either consistently approaching, or consistently avoiding, an object. Infants dishabituated to a disruption of the consistent approach pattern, but not of the consistent avoidance pattern. In the second experiment, we show that 14-month-olds, who have a richer understanding of goals, still do not dishabituate when a hand first reaches to and picks up an object it has consistently avoided before. A third experiment found that 7-month-olds successfully dishabituated to the first motion of a previously stationary object when all the objects moved on their own with no hand present, ruling out several low-level interpretations of infants' failure to dishabituate to the violations of the avoidance pattern in Experiments 1 and 2. We conclude that infants do not represent avoidance from the same type of evidence they can use to represent approach.

1. Introduction

Convergent research indicates that young infants, even neonates, create representations of agents and attribute intentions to their actions (e.g. Luo & Johnson, 2009; Senju & Csibra, 2008; Sommerville, Woodward, & Needham, 2005; Woodward, 1998; Gergely & Csibra, 2003; Onishi & Baillargeon, 2005; Senju, Southgate, Snape, Leonard, & Csibra, 2011; see Baillargeon et al., 2014 for a review). Much less is understood, however, about the form those representations take and how they are computed.

Consider a paradigm introduced by Woodward (1998) to investigate infants' representations of goals. In this paradigm infants are habituated to an experimenter repeatedly reaching for and touching one of two objects (e.g. a ball over a bear). On the critical test trials that follow, the two objects switch locations and the experimenter reaches again, either for the same target (the ball contacted during habituation, which is now in a new location) or for the same location (the bear that the experimenter had never before touched, now sitting in the location where the experimenter had formerly reached). Infants dishabituate to a reach to the new object in the old location, but not to a reach for the old object in a new location. This paradigm has been extended to displays where the agent picks up the object (Phillips, Wellman, & Spelke, 2002; Sodian & Thoermer, 2004), and ones where the entire agent approaches the object rather than reaching for it (Hernik & Southgate, 2012; Lakusta, Wagner, O'Hearn, & Landau,

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2007). In all of these cases, experimenters concluded that infants' intentional construal of the event was of the agent fulfilling its goal to contact the object. More recently, these and other manipulations have also been interpreted as providing information to the child that the agent has a positive disposition toward the approached object, which in turn leads to the prediction that the agent will approach the object in the future (Baillargeon et al., 2014).

There is, however, another possibility. When an agent consistently chooses a ball over a bear, this action is consistent not only with the agent having a goal to obtain the ball, but also with the agent *not* having a goal to obtain the bear, or with a goal to avoid it. Either of these representations alone would be sufficient to explain dishabituation in the Woodward paradigm, and neither is mutually exclusive with the standard interpretation: Infants might represent goals alongside non-goals, or approach alongside avoidance. This ambiguity is present in the account where infants represent agents as having a particular disposition toward an object as well. Not only is the Woodward paradigm ambiguous with respect to the evidence the child uses to establish the agent's disposition (approach to one object or avoidance of the other), it is also ambiguous with respect to which attributed disposition underlies the child's attention to the unexpected event (attributing to the agent a positive disposition toward the approached object or a negative disposition toward the avoided object).

Although these alternative possibilities have not received much attention, a number of considerations lend them some plausibility. From an evolutionary perspective, avoiding is often more critical for survival than approaching – a single encounter with a predator could well be deadly. Representing, noticing and learning from others' avoidance goals are therefore likely to be important for young humans, as for other animals. Furthermore, recent work on a negativity bias in both adults' and infants' processing of valenced information suggests infants do attend to negative information. Three-month-old infants prefer neutral over antisocial agents, but not prosocial over neutral agents (Hamlin, Wynn, & Bloom, 2010). Studies of social referencing show that infants generally modify their own behavior more in response to negative than to positive affective information from their caregivers (see Vaish, Grossmann, & Woodward, 2008, for a review). Twelve-month-old infants faced with an ambiguous new toy play with it less if their caregiver looks disgusted rather than neutral, but do not play with it more if the caregiver emotes positively, rather than neutrally, toward the toy (Hornik, Risenhoover, & Gunnar, 1987).

Additionally, a number of other studies test infants' sensitivity to others' positive and negative emotions and preferences, by providing both kinds of information within the same condition. These studies indicate infants' sensitivity to valenced intentional information, even if they do not allow us to compare positive to negative directly. Thus, by 18 months, infants will give an agent an object she emoted positively rather than negatively toward, (Egyed, Király, & Gergely, 2013), match the food preference of a prosocial or novel agent who indicated liking one food and disliking another (but not of an antisocial agent; Hamlin & Wynn, 2012), and override their own preference to give an agent a food that the agent has shown a preference rather than a dispreference for (Repacholi & Gopnik, 1997). This literature suggests that infants in the Woodward paradigm might indeed attend to the consistent avoidance, and perhaps even attend to it preferentially over a consistent approach, and might indeed attribute a negative disposition toward that object to the agent.

Most studies using the Woodward paradigm are ambiguous on this point, because every trial with a persistently reached-for object has always included a persistently not-reached for object. Some relevant evidence comes from studies where the habituation display involves only one object that is consistently approached. If an agent simply approaches a single object along a straight path, as in the Woodward paradigm, infants do not expect the agent to continue approaching that object (Luo & Baillargeon, 2005). However, when the agent approaches the object by taking an efficient path around an obstacle, infants successfully predict an approach to the same object during test (e.g. Biro, Verschoor, & Coenen, 2011; Hernik & Southgate, 2012). These studies indicate that infants can represent a consistent approach, since there is no consistent avoidance during habituation. However, they do not bear on the question of whether infants also represent avoidance given evidence consistent with both avoidance and approach, as in the canonical and widely-used Woodward paradigm.

The present study addresses this ambiguity through a modification of the original Woodward paradigm. As in the original, two objects are present during habituation. But, while one of the objects stays the same across all trials, the other object's identity changes on every trial. Infants see one of two habituation displays: either a consistent reach to the same fixed object (the Approach condition), or a consistent reach to the always-novel, variable object and, therefore, a consistent avoidance of the fixed object (the Avoidance condition). The Approach and Avoidance conditions each provide equivalent evidence for an approach goal or an avoidance goal, as well as for a positive or a negative disposition toward the fixed object, respectively.

If infants only require that one fixed reached-for object be paired with a foil in order to establish that the agent has the goal of contacting that fixed object, then they should succeed at the Approach condition. Similarly, if infants need only one *unreached-for* fixed object and a foil to establish that the agent has the goal of avoiding or of not picking up the fixed object, they should succeed at the Avoidance condition. If infants succeed in both of these conditions, that would suggest that imputing positive and negative valences, goals to approach and goals to avoid, are equally available to young infants as they make sense of the events in the basic Woodward paradigm. We begin our investigation with 7-month-old infants, who have been shown to succeed robustly in multiple versions of the basic Woodward paradigm (Luo & Baillargeon, 2005; Luo & Johnson, 2009; Woodward, 1998).