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Young children co-represent a partner's task: Evidence for a joint Simon effect in five-year-olds

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ABSTRACT

We examined five-year-olds' ability to co-represent a partner's role during a shared activity. In adults, one indicator of such co-representation is the joint Simon effect, a spatial compatibility effect that is present when a two-choice reaction time task (a Simon task) is divided between two participants but is not present when an individual carries performs the task in isolation. We provide evidence for a joint Simon effect in five-year-old children, although its magnitude was unaffected by the priming of interdependence or independence in a preceding activity. Appearance of the joint Simon effect in young children suggests that when carrying out a joint task, young children can form integrated task representations involving both their own role and their partner's role, thus serving as a potential cognitive mechanism that may facilitate the emergence of early joint action abilities.

1. Introduction

Recent years have seen a significant increase in research on joint action, which refers to the ways that two or more people work together toward a common goal (Bekkering et al., 2009; Obhi & Sebanz, 2011). The capacity to act jointly with another person shows distinct developmental changes during

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early childhood (Brownell, 2011; Tomasello & Hamann, 2012). By their second birthday, children are able to complete simple joint tasks with an adult or a peer (Brownell, Ramani, & Zerwas, 2006; Warneken, Chen, & Tomasello, 2006), and by three years of age children show increased coordination and faster responses on more complex joint action tasks (Ashley & Tomasello, 1998; Meyer, Bekkering, Paulus, & Hunnius, 2010). By age four, children reliably adopt and coordinate roles and actions with a partner in joint play and problem solving: They negotiate and share goals and they support each other's activity with respect to those shared goals (Hamann, Warneken, & Tomasello, 2012).

These developments in the capacity for joint action during early childhood are thought to be related to co-occurring developments in various social-cognitive skills such as attention sharing (Brownell et al., 2006), action monitoring (Brownell & Carriger, 1991; Carpenter, Tomasello, & Striano, 2005; Gauvain, 2001), and perspective taking (Moll, Meltzoff, Merzsch, & Tomasello, 2013; Tomasello & Hamann, 2012). A related explanation draws on the notion of shared task representations, or developments in the ability to cognitively represent information about a partner's role in a joint activity, alongside information about one's own responsibilities (Barresi & Moore, 1996; Tomasello & Hamann, 2012). Knowledge regarding the origins of the ability to simultaneously represent the roles of self and other in a joint task comes from studies that have explored children's ability to reverse roles with a joint action partner when called on to do so. This ability appears in the second year of life (Carpenter et al., 2005; Warneken et al., 2006) and becomes more robust by age five (Fletcher, Warneken, & Tomasello, 2012).

Although such work has informed our understanding of the developing capacity to represent a partner's role during an ongoing joint activity, specifically how children represent their partner's role is only now beginning to be addressed (Milward, Kita, & Apperly, 2014). While developmental research in this area is at a very early stage, related work in adults has suggested that when two individuals complete a joint task, each person represents their partner's task in essentially the same way as they represent their own task. Specifically, adults appear to represent a partner's task in a similar way as they would if they were completing the entire activity alone (for a review, see Knoblich & Sebanz, 2006). Such "co-representation" of a partner's role is thought to facilitate temporal coordination on joint tasks by enabling individuals to prepare their actions in anticipation of their partner's actions (Sebanz, Bekkering, & Knoblich, 2006a).

This research with adults raises the question of whether developments in the ability to co-represent a partner's task may be one mechanism through which young children become more proficient in coordinating their actions with others on joint tasks. As an investigation addressing this question, here we adapt a paradigm commonly used to examine task co-representation in adults, the joint Simon task, for use with preschool children. This task, first described by Sebanz, Knoblich, and Prinz (2003), is a two-person version of the standard Simon task (Simon & Rudell, 1967)—a two-choice reaction time task in which an individual is seated in front of a display and presented with two response buttons, one on the left and one on the right. He or she is then instructed to press the left button when a certain visual stimulus (e.g., a blue square) is presented on the display and to press the right button when a second type of stimulus (e.g., a green square) is presented. During the task, the two stimuli appear one at a time on the left or right of the display. Although stimulus location is irrelevant to the task, participants are faster to respond when a stimulus is presented on the same side as its assigned response button (compatible trials) compared to when a stimulus and the assigned response button are on opposite sides (incompatible trials).

The spatial compatibility effect induced in the standard Simon task is a highly replicable phenomenon referred to as the "Simon effect." The relative slowing of reaction times on trials in which the stimulus and response are spatially incompatible (i.e., on opposite sides) is thought to be due to a conflict between two activated responses, one generated by the prepotent tendency to press the button on the same side of the stimulus and another generated based on the task instructions (De Jong, Liang, & Lauber, 1994; Lu & Proctor, 1995; Simon, 1969).

The joint Simon task has the same physical configuration of stimuli and response buttons as the standard Simon Task but is completed by two individuals simultaneously. The two individuals usually sit side-by-side, one in front of the left response button and one in front of the right response button. Each individual is instructed to use the single button in front of them to respond to only one of the stimulus types that will appear on the display. Thus, the task responsibilities are now divided between