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The shadow of the future: 5-Year-olds, but not 3-year-olds, adjust their sharing in anticipation of reciprocation

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ABSTRACT

Cooperation can be maintained if individuals reciprocate favors over repeated interactions. However, it is not known when during development the psychological capacities to engage in contingent reciprocation emerge. Therefore, we tested when children begin to differentiate between reciprocal and nonreciprocal interactions in their resource sharing. We compared the sharing behavior of 3- and 5-year-olds in two situations. In an experimental condition, the child and a puppet partner alternated the roles of donor and recipient. In a control condition, the puppet had no opportunity to reciprocate. Results showed that 5-year-olds, but not 3-year-olds, increased their sharing toward a potential reciprocator. In addition, we found that children's ability to delay gratification was positively related to their tendency to share in both conditions. These findings show that reciprocity in anticipation of repeated interactions emerges during middle childhood. Moreover, our results highlight the importance of the ability to delay gratification as a prerequisite for children's sharing. We discuss how children's emerging cognitive abilities enable reciprocal sharing in situations where a child must react to or anticipate a partner's behavior.

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Introduction

Reciprocity provides a powerful mechanism for sustaining cooperation because current costs can be outweighed by long-term benefits. For example, when two individuals interact repeatedly and give away resources in response to prior sharing (tit-for-tat), both individuals are better off in the long term than if they had never given up a resource in the first place. However, although apparently simple, such acts of contingent reciprocity require that individuals possess several psychological capacities (Trivers, 1971). In fact, these psychological constraints are important to explain the presence or absence of contingent reciprocity across species (Schino & Aureli, 2009; Stevens, Cushman, & Hauser, 2005) and can elucidate when during ontogeny children become able to cooperate reciprocally (Warneken & Tomasello, 2013). Therefore, we first review what psychological capacities have been proposed as necessary prerequisites for contingent reciprocity and then assess when these capacities are predicted to emerge during development.

One prerequisite is to discriminate between cooperators and defectors. Cooperative interaction is vulnerable to defectors who reap the benefits while paying a lower cost or no cost at all (Axelrod & Hamilton, 1981; Trivers, 1971). Therefore, a key cognitive requirement to avoid cheaters is to discriminate between different individuals and evaluate their social behavior. The basic components of this ability appear to be early emerging; face recognition and discriminating between individuals are already in place during the first months of life (e.g., Di Giorgio, Leo, Pascalis, & Simion, 2012). Moreover, children as young as 7 months might already be able to discriminate between cooperative and uncooperative agents (Hamlin, Wynn, & Bloom, 2007). Several studies show that, at least by 2 or 3 years of age, children begin to apply this ability when choosing with whom to cooperate (Dunfield & Kuhlmeier, 2010; Vaish, Carpenter, & Tomasello, 2010). Therefore, children display the basic capacity to discriminate between individuals and evaluate their social behaviors during infancy and apply them to cooperative behaviors during early childhood.

A second prerequisite is the numerical ability to track the amount of resources exchanged (Schino & Aureli, 2009; Stevens & Hauser, 2004). The basic numerical abilities required seem to be early emerging as well. Several studies have pointed out that even infants could discriminate between large sets of objects based on their quantity (e.g., Xu, Spelke, & Goddard, 2005). Thus, by the age at which children are able to engage in cooperative interactions with others, they are able to at least track the approximate amount of resources shared beyond a simple assessment of whether sharing occurred or not.

Although these first two prerequisites concern the ability to track prior or current interactions, a third prerequisite is that individuals are able to determine whether one will likely interact with a given partner again in the future (Axelrod & Hamilton, 1981; Trivers, 1971). Adults adjust their cooperative behaviors depending on whether interactants will meet again—the so-called shadow of the future (Axelrod & Hamilton, 1988). More concretely, individuals are less likely to make sacrifices in one-shot interactions than in repeated interactions (Palfrey & Rosenthal, 1994). Similarly, if the number of interactions is fixed in advance, humans decrease their contributions markedly as they approach the end of the sequence (Bó, 2005). Concerning children, we know of no study that has assessed at what age children begin to differentiate between one-shot and repeated interactions.

A fourth prerequisite is the ability to delay gratification. Once individuals have identified how current costs could be recouped through future reciprocity, they still need to overcome the temptation to choose the immediate benefit (Rachlin, 2000). This is particularly challenging because even adults have a strong tendency to prefer instant gratification over delayed benefits. In fact, delay of gratification has been proposed to be the major constraint for several animal species, making reciprocity very limited or even nonexistent among nonhuman animals (Stevens & Hauser, 2004). In humans, the ability to delay gratification and make decisions that benefit their future selves progressively develops as children mature. Several studies reveal major changes between 3 and 5 years of age. For example, 3-year-olds typically decide to keep a smaller immediate reward, forgoing the opportunity to obtain a larger reward only minutes later. In contrast, 4- and 5-year-olds prudently choose the larger delayed reward over a smaller but immediate one (e.g., Lemmon & Moore, 2007). This age trend points to a more general ability to make decisions based on future needs, such as to select the correct tool to

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