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Four- and 5-Year-Olds Infer Differences in Relative Ability and Appropriately Allocate Roles to Achieve Cooperative, Competitive, and Prosocial Goals

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ABSTRACT

Preschoolers are sensitive to differences in individuals' access to external resources (e.g., tools) in division of labor tasks. However, little is known about whether children consider differences in individuals' internal resources (e.g., abilities) and whether children can flexibly allocate roles across different goal contexts. Critically, factors that are relevant to role allocation in collaborative contexts may be irrelevant in competitive and prosocial ones. In three preregistered experiments, we found that 4- and 5-year-olds (mean: 54 months; range: 42–66 months; $N = 132$) used age differences to infer relative ability and appropriately allocate the harder and easier of two tasks in a dyadic cooperative interaction (Experiment 1), and appropriately ignored relative ability in competitive (Experiment 2) and prosocial (Experiment 3) contexts, instead assigning others the harder and easier roles, respectively. Thus, 3-and-a-half- to 5-year-olds evaluate their own abilities relative to others and effectively allocate roles to achieve diverse goals.

INTRODUCTION

Cooperation is a foundation of human culture and cognition, observed in diverse activities including governing, hunting, fishing, building, and playing (Brownell, Ramani, & Zerwas, 2006; Rogoff, 1990; Tomasello, 1999). Young children begin cooperating in problem solving and social games by their first birthday, and the sophistication of their cooperative interactions increases over the first few years of life (e.g., Brownell & Carriger, 1990; Warneken, Chen, & Tomasello, 2010; for review, see Warneken, 2017). Children cooperate by sharing food and toys (Brownell, Svetlova, & Nichols, 2009; Hay, 1979), pointing to inform others (Liszkowski, Carpenter, Striano, & Tomasello, 2006; Liszkowski, Carpenter, & Tomasello, 2008), and assisting in goal-directed actions (Warneken & Tomasello, 2007). Children also appear to expect cooperation, protesting when adults disengage from cooperative interactions (Ross & Lollis, 1987).

Across species, the most sophisticated forms of cooperation involve collaboration, when individuals adjust their behavior to accomplish a goal (Boesch & Boesch, 1989). Children as young as 3-and-a-half flexibly divide labor by coordinating on tasks involving different subgoals (Ashley & Tomasello, 1998; Fletcher, Warneken, & Tomasello, 2012). Moreover, older preschoolers divide labor with respect to available resources: when the participant has both tools needed to achieve a joint goal while their partner has only one, 5-year-olds (though not

3-year-olds) appropriately delegate to their partner the task corresponding to their partner's tool (Warneken, Steinwender, Hamann, & Tomasello, 2014).

In such cases, both partners are, in principle, equally capable of performing either role. However, people differ not just with respect to the availability of external resources, but also with respect to their internal resources, including motivation, physical ability, knowledge, and intelligence.

Preschoolers are sensitive to such differences, selectively choosing to associate with and learn from more trustworthy, competent, and knowledgeable agents (e.g., Jara-Ettinger, Tenenbaum, & Schulz, 2015; Koenig, Clément, & Harris, 2004; Koenig & Jaswal, 2011; Kushnir, Vredenburgh, & Schneider, 2013) and choosing to help and instruct more naive peers (Johnson-Pynn & Nisbet, 2002; Ziv & Frye, 2004; see Corriveau, Ronfard, & Cui, 2017, for review). Three- to 5-year-olds also understand cognitive division of labor, recognizing that people specialize in different areas and may have more expertise in some areas than others (Danovitch & Keil, 2004; Lutz & Keil, 2002).

The degree to which children accurately represent their own strengths and weaknesses is more controversial. Work suggests that preschoolers are sometimes (excessively) optimistic about their abilities (Burhans & Dweck, 1995; Schneider, 1998). However, other research suggests that children as young as three engage in social comparison, evaluating their performance relative to peers' (Butler, 1998; Magid & Schulz, 2015; Rhodes & Brickman, 2008), and can accurately assess whether they are good or bad at familiar tasks (Cimpian, Mu, & Erickson, 2012; Heyman, Dweck, & Cain, 1992). To the degree that children are sensitive to relative differences in ability (even if they are poor judges of their abilities in an absolute sense), they might recognize that they should take the easier task if they believe their partner is more capable, and the harder task if they believe their partner is less capable.

However, allocating roles based on ability is only rational in collaborative tasks where both parties must succeed in order to achieve the goal. If the goal of the task is to optimize one's own chances of success, it makes sense to disregard relative differences in abilities and always assign the easier role to oneself and the harder task to one's opponent. Conversely, if the goal is prosocial—optimizing the other person's probability of success—it makes sense to assign the other person the easier of two tasks regardless of ability, especially if the decision maker can do so at no cost to themselves. Even very young children are sensitive to a diverse range of goals (Buresh & Woodward, 2007; Carpenter, Call, & Tomasello, 2002; DiYanni, Nini, & Rheel, 2011; Meltzoff, 1995), and flexibly adopt competitive, cooperative, or prosocial goals depending on the context (see Green & Rechis, 2006, and Warneken, 2015, for reviews). However, previous research has not asked whether preschoolers use differences in the goal context to make different decisions about the role other individuals should play. Critically, an adept social agent who has the power to allocate roles should consider relative abilities in collaborative contexts when maximizing each participant's chance of success is beneficial, but disregard these differences in competitive and prosocial contexts, where role assignment should be governed only by the relative difficulty of the tasks themselves. To the degree that preschoolers are sensitive to this, they should show unique patterns of role allocation depending on whether they are trying to achieve collaborative, competitive, or prosocial goals.

We tested the flexibility of children's role assignment across these different contexts by introducing participants to two carnival-style games: a ring toss and ball toss. Each game had an easy and a hard version (Figure 1). Individual participants received the easy version of one

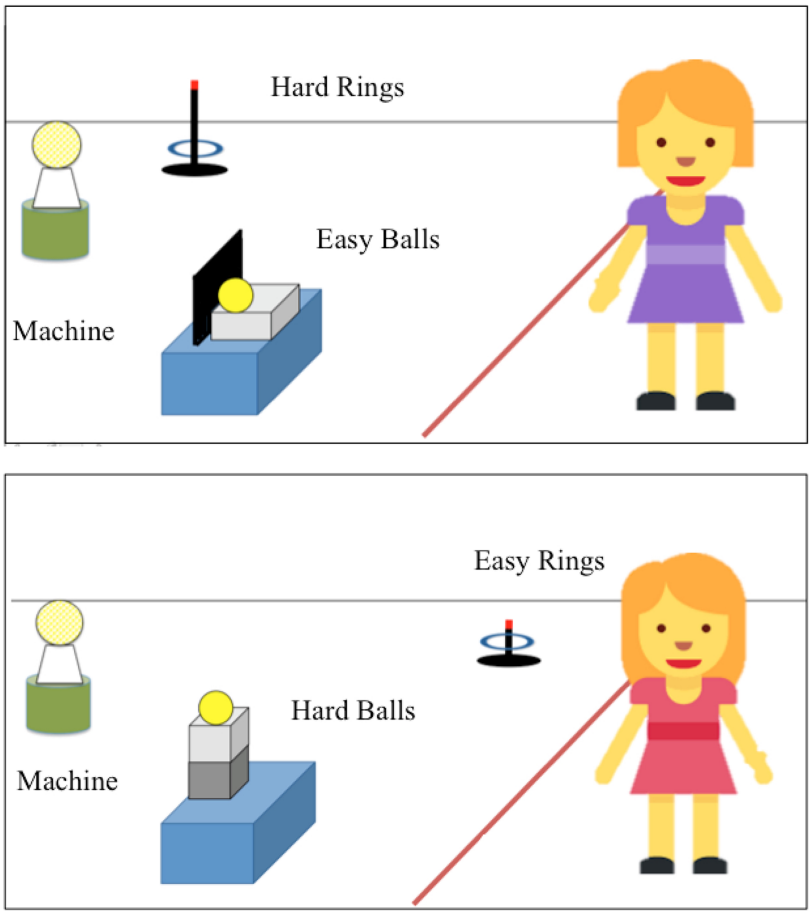

Figure 1. Each participant saw only one setup (top or bottom). Participants practiced each game before allocating roles. The hard and easy labels are for explanatory purposes; the tasks were not identified as such for the children.

game and the hard version of the other. Children were not told that one game was "easy" and the other "hard" but had the opportunity to try each game and judge for themselves. Participants were then told that another child was going to come to play with them. They were told that they had to choose one game for their partner, and one for themselves, and that if they both succeeded (i.e., getting a ring on a pole and a ball in the box) a special machine would activate.

In general, preschoolers expect that children their own age will know more than infants and less than adults (Taylor, Cartwright, & Bowden, 1991; see also Jaswal & Neely, 2006; VanderBorght & Jaswal, 2009). We do not know of any research looking at whether children can use smaller age differences to infer relative abilities, but given the anecdotal prevalence of age/ability attributions in everyday peer and sibling interactions, we assumed that they would. Thus in one condition, children were told that the partner would be younger than themselves (*Younger Other condition*); in the other condition they were told that their partner would be older (*Older Other condition*).

In a cooperative context, we could observe a number of possible results. If children are poor judges of task difficulty, they should choose at chance. If children judge the tasks accurately, but try only to maximize their own chances of success (and ignore the collaborative

nature of the task), they should choose the easy task for themselves and the hard task for their partner in both conditions. Conversely, if children tend to overestimate themselves (or underestimate their partner's ability), they should choose the hard task for themselves and the easy task for their partner in both conditions. However, if children's role allocation in cooperative tasks is sensitive to relative ability (as indexed by age), they should choose the easier game for their partner if their partner is younger, and the easier game for themselves if their partner is older.

In the competitive context, we could also observe a number of different results. In particular, young children have a strong preference for equitable distributions of resources (Baumard, Mascaro, & Chevallier, 2012; Olson & Spelke, 2008; Schmidt, Rakoczy, & Tomasello, 2012; Schmidt & Sommerville, 2011; Shaw, DeScioli, & Olson, 2012). Thus, 4-year-olds might try to "level the playing field" and assign younger children the easier game and older children the harder game in the competitive context. Some support for this comes from studies on children's sensitivity to "procedural justice," showing that 5-year-olds in triadic interactions resist the inequitable allocation of rewards given unfair, but not fair procedures (e.g., unevenly versus evenly weighted spinners; Grocke, Rossano, & Tomasello, 2015). However, 4-year-olds were unable to complete the tasks (Grocke et al., 2015), and considerable research suggests that when children themselves are advantaged and acting independently in first-person contexts, they act in accordance with self-interest rather than equity until age seven or eight (Blake & McAuliffe, 2011; Fehr, Bernhard, & Rockenbach, 2008; Shaw & Olson, 2012; Smith, Blake, & Harris, 2013; see also Schmidt, Svetlova, Johe, & Tomasello, 2015, for similarly protracted development of children's understanding of legitimate and illegitimate procedures for resource distribution). Thus, here we predict that in competitive contexts, children will act in accordance with self-interest and assign the harder game to their opponent, regardless of whether their opponent is younger or older.

Finally, considerable research suggests that very young children both act prosocially themselves and prefer those who do the same (Behne, Carpenter, Call, & Tomasello, 2005; Hamlin, 2013; Hamlin, Wynn, & Bloom, 2007; Jara-Ettinger, Tenenbaum et al., 2015; Schmidt & Sommerville, 2011; Van de Vondervoort & Hamlin, 2016; Warneken & Tomasello, 2006, 2007, 2009). To our knowledge, however, no studies have looked at role allocation as a form of prosocial behavior. Given growing evidence for young children's understanding of the costs and rewards of goal-directed actions (Jara-Ettinger, Gweon, Schulz, & Tenenbaum, 2016), we predict that when the goal is to maximize others' rewards, children will assign the easier game to the other child, independent of her relative age. To test these predictions, in Experiment 1, we look at how children allocate roles given collaborative goals; in Experiment 2, we look at how children allocate roles given competitive goals; and in Experiment 3, we look at how children allocate roles given prosocial goals.

We tested 3-and-a-half- to 5-and-a-half-year-old children because previous work has shown that by 3 and a half, children can switch from one role in a collaborative interaction to another role (Ashley & Tomasello, 1998), but only 5-year-olds, not 3-year-olds, can flexibly reason about what role to adopt in a cooperative interaction based on individuals' differential resources (Warneken et al., 2014). Thus this age range spanned a potential window of developmental change in children's understanding of role allocation. However, we expected the task in the current study would be more comparable to the role-switching task than the resource allocation task, insofar as here children do not need to integrate an understanding of role allocation with an understanding of the causal role of different tools. All children were told that the fictitious partner was a 2-year-old in the Younger Other condition and a 6-year-old

in the Older Other condition so that there would be at least a half-year gap between the age of the youngest and oldest participant and the fictitious older child.

EXPERIMENT 1

Method

Participants Procedures and our analysis plan for all experiments were preregistered on the Open Science Framework (Magid, Schulz, & DePascale, 2018). We assumed a large effect size (Cramer's $V = .50$), and a power analysis indicated that 44 participants were required to reach a power of .90. All participants were recruited from an urban children's museum and randomly assigned to one of two conditions: Younger Other or Older Other. Forty-four children (mean age = 54 months; range 43–66 months) were included in the final sample ($n = 22$ per condition). Ten additional children did not pass the inclusion criteria (see Procedure section for details). An additional five children were tested but excluded due to parental interference ($n = 3$) or failing to provide a response to the test question ($n = 2$).

Materials A felt mat was placed on the floor for game play. Children played two games: a ring toss and a ball toss. Each game had two versions—one easier (Easy Rings, Easy Balls) and one harder (Hard Rings, Hard Balls). See the Supplemental Materials (Magid, DePascale, & Schulz, 2018) for details.

Half the participants played the Easy Rings and Hard Balls, half the Hard Rings and Easy Balls. Laminated cards showed photographs of an Older Other (a 6-year-old) or Younger Other (a 2-year-old) child. A laminated card with the word "You" printed in the center was used to represent the participant. A remote-controlled LED light machine ($12 \times 13 \times 12$ cm) was used for the joint task.

Procedure This study was approved by the Institutional Review Board. All children were tested individually in a quiet room at a children's museum. Children were shown two games (either Easy Rings and Hard Balls, or Hard Rings and Easy Balls) and given the chance to practice each game four times. The game played first (rings or balls), the location of each game (right or left), and the version of each game (easy or hard) were counterbalanced across participants. After children practiced, the experimenter introduced the light machine and explained that players of the two games could work together to achieve a single joint goal: if the ball went in the box and a ring went on the pole at the same time, then the machine would light up. The experimenter introduced the participant to the fictional other child, named Jamie, by explaining that she had talked with the other child earlier that day and that he or she wanted to come play the games together with the participant. The experimenter then showed children a card with a picture of the other child and said that they were either a toddler (Younger Other) or a first-grader (Older Other). The experimenter then asked children their own age, so that they could specify that the other child was younger or older, by condition. The other child was matched by gender to the participant. For each category (Younger boy, Older boy, Younger girl, Older girl) one of two pictures was used to reduce the possibility that ancillary features of any picture might influence children's perceptions of the other child's abilities. The photographs represented a diversity of races and ethnicities.

The experimenter then asked children to allocate roles by choosing which game the other child should play, placing the other child's picture next to the game chosen for them and the card with "You" next to the game the participant chose for themselves. While one game

was designed to be easier than the other, differences in motor skills or experience might lead different children to different conclusions. To ensure that the role allocation matched children's judgment of the relative difficulty of the two games, we asked children, "Which game was easier?" Children were then asked why they chose the game they picked for the other child. Finally, as a comprehension and memory check, we asked children if the other child was older or younger. This last question was used as an inclusion criterion: children who did not answer correctly were not included in the analysis. Following these questions, the experimenter left the room briefly (15–30 s) and returned saying that she couldn't find the other child, and then played the games with the participant.

Preregistered Analyses and Results

All data were coded from videotape by the second author. A naïve coder blind to condition and hypotheses recoded a randomly selected sample of 25% of the data for the three outcome measures: the question about role allocation, the question about game difficulty, and the question about Jamie's age. Coders agreed 100% of the time (Cohen's kappa = 1).

In response to, "Which game was easier?" 37 of the 44 children (84%) responded that the game designed to be easier was easier for them. Children's self-reported judgment was used in all analyses (consistent with the preregistered design). We expected that there might be some differences in children's perception of the relative difficulty of the two games due to differences in children's motor skill development and their prior experience with throwing balls or tossing rings. We did, however, expect that children would use their own assessment of the difficulty of the tasks as proxies for how easy or hard they would be for other children (Gweon, Asaba, & Bennett-Pierre, 2017).

As predicted, children's role assignments differed by condition [$\chi^2(1) = 7.615$, $p = .006$, $V = .462$]. In the Younger Other condition, 14 children (63%) children assigned their partner the Easy Game. By contrast, in the Older Other condition, only 4 children (18%) assigned their partner the Easy Game (Figure 2). Collapsing across conditions, 72.72% of children assigned roles in a way corresponding to the difficulty of fulfilling each role in the joint task, $p = .004$ by binomial test (two-sided). Thus, children allocated roles in a way most likely to lead to their joint success and there was no significant difference in children's ability to allocate roles effectively in each condition [$\chi^2(1) = 1.031$, $p = .310$, $V = .204$].

Given evidence that even 3-and-a-half-year-olds flexibly switch roles in collaborative tasks (Ashley & Tomasello, 1998), we did not predict an effect of age on children's role allocation. Nonetheless, because previous work has found that 5-year-olds, but not 3-year-olds, allocate roles based on available resources (Warneken et al., 2014), we looked at whether the likelihood of participants allocating roles based on ability increased with age. As predicted, there was no effect of age in a logistic regression model using chronological age to predict role assignment, $\beta = -.004$, $p = .995$. This suggests that children ages 3 and a half to 5 and a half years can allocate roles in a cooperative interaction given inferred differences in ability.

Discussion

These results suggest that children consider their own and their partner's relative abilities when allocating roles in a cooperative interaction. However, they leave open the question about the extent to which preschoolers simply assign harder games to older children and easier games to younger children without regard for the context, and more generally, whether children will allocate roles differently in different contexts. In Experiment 2, we look at how children allocate

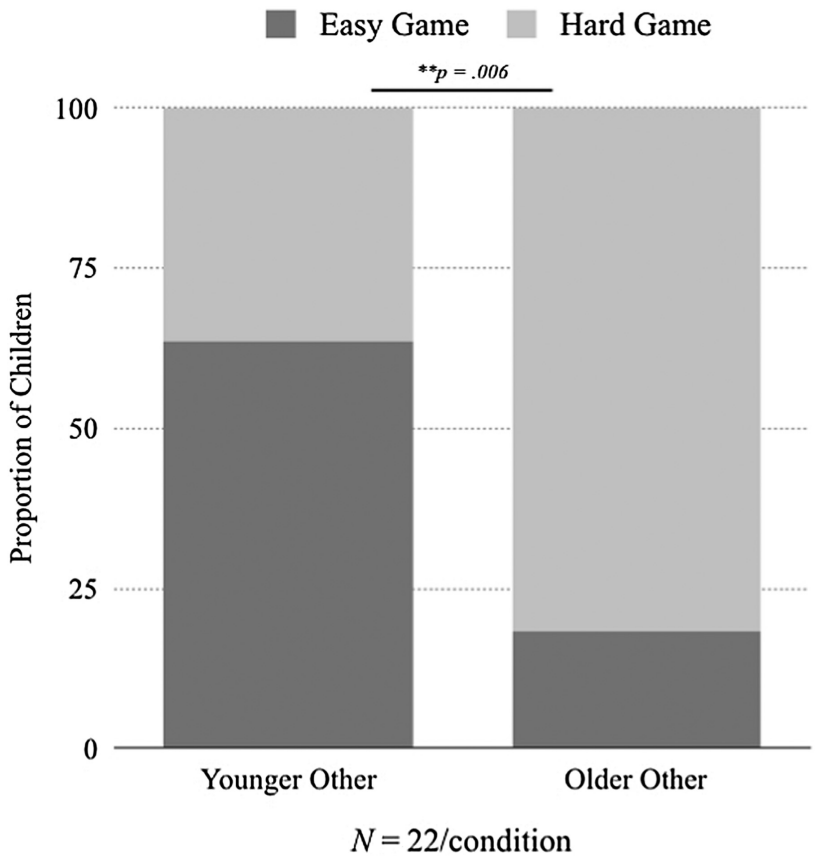

Figure 2. Proportion of children who chose the Easy Game or Hard Game for their partner by condition in Experiment 1—Cooperative Context.

roles when their goal is to compete with another child. Although in principle, children might resist taking an unfair advantage (Grocke et al., 2015), as noted above, the vast majority of work suggests that preschoolers will act in self-interested ways in first-person interactions (Blake & McAuliffe, 2011; Fehr et al., 2008; Shaw & Olson, 2012; Smith et al., 2013). Thus in Experiment 2, we predict that preschoolers should ignore relative ability and assign roles based on the relative difficulty of the tasks: assigning the easier game to themselves and the harder one to their opponents.

EXPERIMENT 2

Method

As in Experiment 1, all participants were recruited from an urban children's museum and randomly assigned to one of two conditions: Younger Other or Older Other. Forty-four children (mean age = 54 months; range 42–65 months) were included in the final sample ($n = 22$ per condition). Seven additional children did not pass the inclusion criteria (see Experiment 1 for details). Two additional children were tested but excluded due to parental interference. The materials were the same as in Experiment 1.

Children were introduced to and practiced the two games as in Experiment 1. After children practiced each game, the experimenter introduced the light machine and explained that the person who got a ball in the box or a ring on the pole first would win and get to turn on the machine. All other procedures were identical to those in Experiment 1.

Preregistered Analyses and Results

Data were coded as in Experiment 1. Intercoder agreement was 100% (Cohen's kappa = 1). In response to, "Which game was easier?" 33 of the 44 children (75%) responded that the game we had designed to be easier was easier for them.

As in Experiment 1, children's own judgments were used for all analyses. In the Younger Other condition, 13 children (59%) assigned their partner the Hard Game (Figure 3). In the Older Other condition, 18 children (82%) assigned their partner the Hard Game. As predicted, in Experiment 2 children's role assignments did not differ by condition $\chi^2(1) = 1.747$, $p = .186$, $V = .249$. Collapsing across conditions, 70.45% of children assigned the harder game to the Other child, $p = .010$ by binomial test (two-sided).

Discussion

These results suggest that preschoolers' flexible allocation of roles in Experiment 1 was not due merely to a tendency to assign younger children easier games and older children harder games. In the competitive context of Experiment 2, preschoolers assigned harder games to their opponent regardless of inferred ability. Interestingly, although in the Older Other condition, children chose the harder game for their partner significantly above chance, children chose at chance in the Younger Other game. This is consistent with the possibility that at least

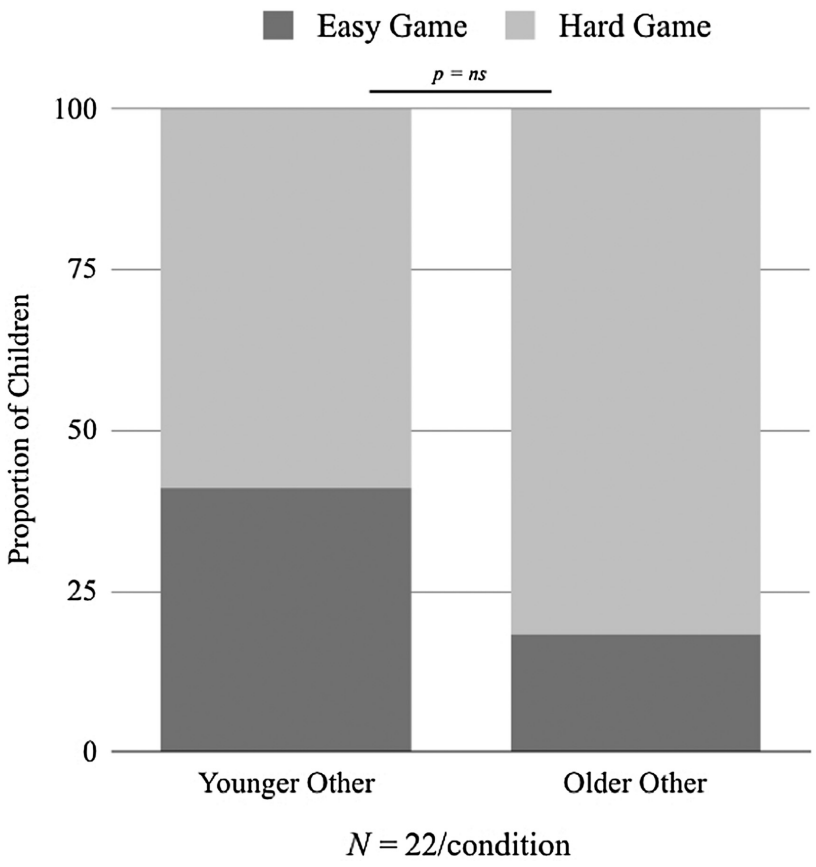

Figure 3. Proportion of children who chose the Easy Game or Hard Game for their partner by condition in Experiment 2—Competitive Context.

some of the children may have been resistant to an unfair procedure (Grocke et al., 2015) and preferred to level the playing field by assigning the 2-year-old the easier game. Future research might look in more detail at the development of children's sensitivity to procedural justice in competitive contexts. Overall however, children distinguished between cooperative and competitive goals, assigning roles according to relative ability in the collaborative context and according to self-advantage in the competitive context. In Experiment 3, we further investigate children's role allocation by looking at whether they assign all children the easier task in prosocial contexts.

EXPERIMENT 3

Method

Children were recruited and assigned to conditions as in Experiments 1 and 2. Forty-four children (mean age = 55 months; range 43–66 months) were included in the final sample (n = 22 per condition). Ten additional children did not pass the inclusion criteria. (See Experiment 1 for details.) Five additional children were tested but excluded due to parental interference. Materials were the same as in previous experiments.

The procedure was identical to Experiments 1 and 2 except that the experimenter explained that the children would get a sticker for the number of rings and balls they scored at the end of the game. After children practiced the games and were given the stickers, they were introduced to Jamie, who would come and play after the participant. Children were told that Jamie would only have time to play one of the two games. Children were asked which game Jamie should play.

Preregistered Analyses and Results

Data were coded as in Experiment 1. Intercoder agreement was 97.22% (Cohen's kappa = 1). In response to, "Which game was easier?" 32 of the 44 children (73%) responded that the game we had designed to be easier was easier for them.

As previously, children's own judgments were used for all analyses. In the Younger Other condition, 17 children (77%) assigned their partner the Easy Game. In the Older Other condition, 13 children (59%) assigned their partner the Easy Game (see Figure 4). As predicted, children's role assignments did not differ by condition [$\chi^2(1) = .943$, $p = .332$, $V = .195$]. Collapsing across conditions, 30 of the 44 children (68%) assigned the Easy game to the Other child ($p = .023$ by binomial test). See the Supplemental Materials (Magid et al., 2018) for exploratory analyses evaluating whether the age difference between participants and the Other child affect role allocation.

Discussion

The results from Experiment 3 provide further evidence that children's role assignment is sensitive to the goal context. Consistent with previous work (e.g., Buttelmann, Carpenter, & Tomasello, 2009; Knudsen & Liszkowski, 2012; Martin & Olson, 2013), this suggests that young children can go beyond others' explicit requests in providing assistance to others. Preschoolers are sensitive to the difficulty of components of a task, and their helping behavior is sensitive to these dimensions of difficulty (e.g., Bridgers, Jara-Ettinger, & Gweon, 2016, for similar results in selective teaching).

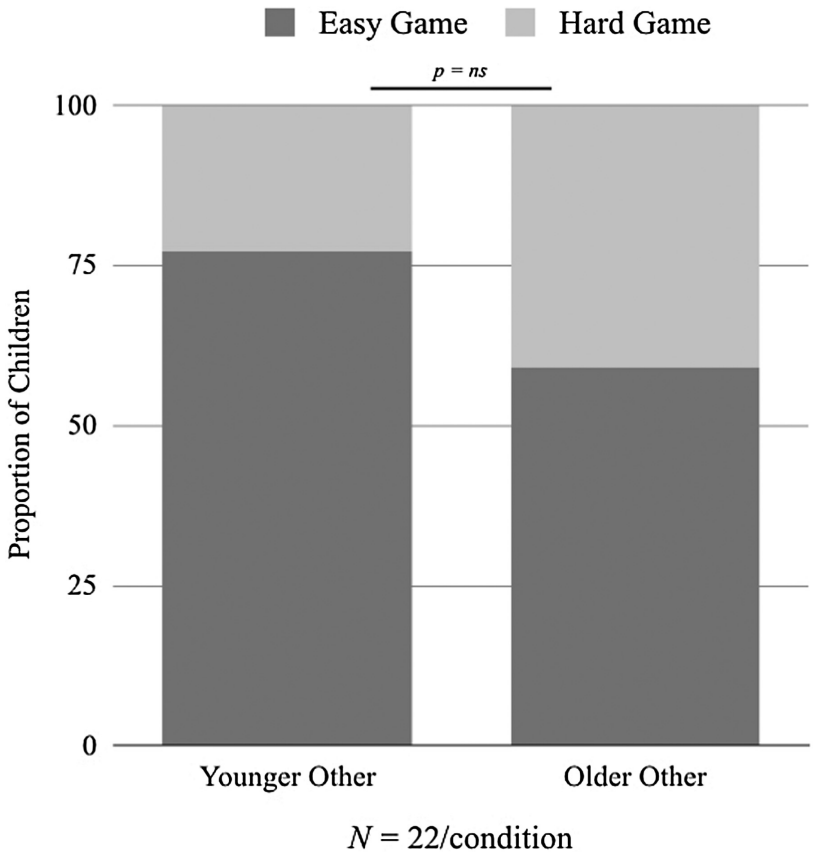

Figure 4. Proportion of children who chose the Easy Game or Hard Game for their partner by condition in Experiment 3—Prosocial Context.

GENERAL DISCUSSION

In the current study, children effectively allocated roles in cooperative, competitive, and prosocial interactions. Although preschoolers might simply choose which game to play based on level of enjoyment or choose a single strategy for role allocation independent of contexts (e.g., always assigning hard games to older children and easier games to others), instead we found patterns of role allocation that aligned with the way most likely to achieve the desired outcome. Preschoolers considered differences in relative ability to effectively allocate roles to achieve a collaborative goal; they were also able to ignore differences in relative ability to allocate roles in competitive and prosocial contexts.

These findings support a large literature showing that children are adept at cooperating with others, in that they can take on complementary as well as parallel roles (Warneken et al., 2006), and they can divide labor and flexibly change roles within a task (Fletcher et al., 2012). The current study extends these findings to demonstrate that children are able to cooperate in a way that is based on something intrinsic about their collaborative partner. In addition, we found that children are able to use themselves as a reference point when collaborating. Rather than always taking on the easier or harder task in Experiment 1, children's role allocation differed based on the age of the partner relative to the participant. Critically, when the goal was competitive, children were also able to take a purely self-interested perspective, and when the goal was prosocial, children were able to take themselves out of the picture and consider only

the interests of the other. Thus, although differences in children's own ability relative to others were present in all three contexts, children were able to both consider and disregard these differences as appropriate. In an exploratory analysis across experiments, we find that context and condition together affected children's role allocation (see the Supplemental Materials [Magid et al., 2018]).

Our study considered three goal contexts, but there are a few other goal contexts that would be interesting to investigate. In our version of a competitive context, the goal was to score first. However, in competitive sports, the goal is usually to see who prevails in a fair match, and sometimes handicaps are introduced on more able players (e.g., as in horse racing) to make the game more compelling. In a competitive context where the goal is not winning at all costs but winning at a fair match, previous work on children's preference for procedural justice (e.g., Grocke et al., 2015) would support the idea that children would allocate roles in a way that would mirror the role allocation in Experiment 1: assigning the easier task to a younger player and the harder task to an older one. Indeed, across experiments, children were more likely to assign the Younger Other the easier game and the Older Other the harder game ($p < .001$), suggesting they integrate the notion of procedural justice or appropriateness with goal context when assigning roles (see the Supplemental Materials [Magid et al., 2018]). Future work would be necessary to understand the precise way in which children combine notions of fairness with other goals.

Similarly, a general desire to be prosocial could manifest itself in a number of different ways. In Experiment 3 (when the other child could accrue stickers for succeeding) the prosocial decision was to help the other individual succeed on the task; in this context, the children, as predicted, assigned the other child the easier game. However, one could also be prosocial by helping an individual develop her skills. In line with this, there is extensive evidence for children's motivation and ability to teach others (Bass et al., 2017; Bridgers et al., 2016; Clegg & Legare, 2016; Gweon & Schulz, 2018; Liszkowski et al., 2008; Ronfard, Was, & Harris, 2016; Strauss, Calero, & Sigman, 2014; Ziv & Frye, 2004). In contexts where teaching is the intended goal, there might be good reasons for assigning the hard task, even to the younger children. In an analysis of children's verbal explanations for their role assignments, we found that children invoked explanations of the other child over 40% of the time in prosocial contexts, suggesting they are considering features and goals of the other child (Supplemental Materials [Magid et al., 2018], Table S3). Future research might look at children's sensitivity to these more nuanced goal contexts. Future work might also look at how children's ability to allocate roles extends beyond dyadic interactions to third-party contexts and larger social groups.

The current study also suggests that children can use relatively fine-grained differences in age (2 years) to infer relative ability. However, age is a coarse proxy for ability: younger individuals are sometimes more skilled, or skilled in different respects, than older ones. Research suggests that preschoolers are sensitive to these factors (Jaswal & Neely, 2006; Koenig & Jaswal, 2011; Kushnir et al., 2013; Lutz & Keil, 2002; VanderBorght & Jaswal, 2009). Future work might investigate whether children can use more nuanced indices of ability differences to allocate roles.

Additionally, the current study focused on individuals' relative competence to complete a task. However, other factors both internal to the individual (e.g., motivation, trustworthiness, energy level, informational access, etc.) and external (access to tools, relative proximity, etc.) affect someone's ability to complete a goal, influencing the costs of goal-directed actions and the probability of success. Previous research suggests that children evaluate the costs and rewards of others' goal-directed actions (Jara-Ettinger, Gweon, Tenenbaum,

& Schulz, 2015; Jara-Ettinger, Tenenbaum, et al., 2015; Liu, Ullman, Tenenbaum, & Spelke, 2017); future research might look quantitatively at whether children's role assignment varies with calculations of expected utility (Jara-Ettinger et al., 2016). For the present, this study suggests that well before children have much, if any, experience delegating responsibility they appropriately invoke and ignore ability differences in assigning roles to achieve diverse goals.

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AUTHOR CONTRIBUTIONS

RWM: Conceptualization: Lead; Data curation: Supporting; Formal analysis: Lead; Funding acquisition: Equal; Investigation: Equal; Methodology: Equal; Project administration: Equal; Writing—original draft: Equal; Writing—review & editing: Equal. MD: Conceptualization: Equal; Data curation: Lead; Investigation: Equal; Methodology: Equal; Project administration: Equal; Writing—review & editing: Supporting. LES: Conceptualization: Equal; Funding acquisition: Lead; Investigation: Equal; Methodology: Equal; Supervision: Lead; Writing—original draft: Equal.

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