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The effects of collaboration and minimal-group membership on children's  
prosocial behavior, liking, affiliation, and trust

Maria Ploetner, Harriet Over, Malinda Carpenter, and Michael Tomasello

In press at *Journal of Experimental Child Psychology*

### Abstract

Recent theoretical work has highlighted potential links between interpersonal collaboration and group membership in the evolution of human sociality. Here we compared the effects of collaboration and minimal-group membership on young children's prosocial behavior (i.e., helping and resource allocation), liking, affiliation, and trust. In a design that matched as closely as possible these two ways of connecting with others, we showed that 5-year-old children's behavior was affected similarly by collaboration and minimal group membership: both increased children's preference for their partners on multiple dimensions and produced overall effects of a similar magnitude. In contrast, 3.5-year-old children did not have a strong preference for either collaborators or minimal in-group members. Thus both collaboration and minimal-group membership are similarly effective in their influence on children's prosocial behavior and social preferences.

*keywords:* collaboration; minimal groups; cooperation; prosociality; affiliation

**A comparison of the effects of collaboration and minimal-group membership on children's prosocial behavior, liking, affiliation, and trust**

In our everyday lives, we feel connected to other people in various ways. Even with a stranger, we are, in some circumstances, able to experience being a 'we', a special connection that can make us prefer this person over others and treat him or her more positively. There are at least two ways of creating this connection. One way is by collaborating with that person to achieve a shared goal (for example, jointly navigating the way to a conference hall with a stranger you just met outside). Various fields of research have shown that in adults, collaborative efforts enhance group cohesion and positive evaluations of collaborators, for example in the context of economic games (Kuwabara, 2011), virtual interactions (Park & Seo, 2013), and in therapy groups (Golden, 2000).

A second way of creating a connection with a stranger, even without any direct interaction with that person, is by recognizing that both of you belong to the same social group (for example, seeing a stranger at the conference who is wearing a t-shirt with the emblem of your university). Indeed, adults are biased towards their in-group, favoring members of groups they belong to over members of groups they do not belong to (e.g., Brewer, 2007). This is true even when the groups are novel, based on arbitrary criteria, and created in laboratory settings (Brewer & Silver, 1978; Locksley, Ortiz, & Hepburn, 1980; Tajfel, 1970; Tajfel, Billig, Bundy, & Flament, 1971). Reviews and meta-analyses show that the so-called minimal group paradigm, in which subjects are assigned to arbitrary groups randomly, for example by flipping a coin, evokes reliable preferences for strangers that belong to the in-group compared to the out-group (Brewer, 1979; Mullen, Brown, & Smith, 1992).

Theoretical work from social psychology suggests that collaboration and group membership are both ways to connect with a stranger in a special way (Lickel, Hamilton, & Sherman, 2001; Lickel et al., 2000). In addition, theoretical work from evolutionary psychology has proposed a link between collaboration and group membership in the context of human evolution. Tomasello and colleagues (2012) proposed that collaboration and group membership emerged sequentially in human evolution and have a common basis. First, early humans lived together in social units and had to hunt collaboratively in order to acquire sufficient food. The members of these units were therefore highly interdependent and were thus interested in the well-being of their fellows, as they had to ensure that they would be available for future collaboration. This resulted in prosocial acts toward collaborative partners. Later in human history, societies became too large for individuals to be familiar with all group members, although group members were still, more generally, interdependent with each other. Individuals therefore could no longer rely exclusively on personal experience when faced with potential social partners, but had to rely on observable group markers to infer who was likely to be trustworthy and able to coordinate with them. According to this perspective, both collaboration and group membership are thought to produce similar outcomes: prosociality towards and preferences for collaborative partners and in-group members, respectively, with interdependence as the common basis.

In children, the effects of collaboration and group membership have thus far been studied separately. Research on collaboration has shown that, by 14 months of age, children begin to engage in collaborative activities with adults, with more robust collaborative abilities (including with peers) appearing around two years of age (Brownell & Carriger, 1990; Brownell, Ramani, & Zerwas, 2006; Warneken, Chen, & Tomasello, 2006; Warneken & Tomasello, 2007). Several

studies have shown that 3.5-year-old children support their collaborative partners by helping and waiting for them (Gräfenhain, Carpenter, & Tomasello, 2013) and by sharing the spoils of collaborative activity equitably (Hamann, Warneken, Greenberg, & Tomasello, 2011). They also continue to collaborate to ensure that their partner obtains his or her reward, even if they themselves have already gotten theirs (Hamann, Warneken, & Tomasello, 2012). Thus there is some evidence that young children behave prosocially toward their collaborative partners, at least within the collaborative activity itself. However, it is not clear from this work whether collaboration evokes a more general preference for the collaborative partner, and whether children would also be helpful towards people they have previously collaborated with. No studies to our knowledge have shown that children's prosocial tendencies towards collaborators extend beyond the initial collaborative activity to different, unrelated situations.

There has been far more research on children's preferences for group members. Many studies have shown that preschool children prefer members of their language (Kinzler, Dupoux, & Spelke, 2007; Kinzler, Shutts, DeJesus, & Spelke, 2009), gender (Martin, Fabes, Evans, & Wyman, 1999; Shutts, Kinzler, McKee, & Spelke, 2009), and, to some extent, racial in-groups over out-groups (Kinzler et al., 2009; Kinzler & Spelke, 2011). While it is possible that the findings in those studies can be explained by children's greater familiarity with the in-group (Ziv & Banaji, 2012), other research has shown that preferences for in-group members are apparent in novel groups as well (Bigler, Jones, & Lobliner, 1997; Patterson & Bigler, 2006), and even in minimal groups created within the laboratory. So far, for minimal groups, the strongest preferences for in-group members have been shown with implicit attitudes rather than explicit behavior. Dunham and colleagues have shown that 5- and 6-year-olds, but not 3-year-olds, favored children wearing a same-color group shirt on tasks of implicit attitudes, behavioral

attribution, and expectation of reciprocity, while findings for resource allocation and explicit liking tasks were rather inconsistent (Baron & Dunham, in press; Dunham, Baron, & Carey, 2011; Dunham & Emory, 2014). These findings are methodologically important as they show a preference for in-group members even when children are equally familiar with the in-group and the out-group and when they have no previous experience with the groups on which to base their judgment. Minimal groups also provide an interesting comparison to collaboration because both concern ways in which children can form new relationships with others on the basis of relatively transient interactions.

From previous research, we thus know that young children support their collaborative partners within collaborative activities, and prefer various different types of in-group members. However, it is not yet clear whether children create more enduring preferences for social partners based on collaboration, and whether collaboration and group membership have a similar effect on children's behavior. Furthermore, we do not yet know whether preferences for collaborators and in-group members emerge developmentally at the same time, or one earlier than the other. It is not possible to compare the effects of collaboration and group membership across existing studies, as the nature of the manipulations in these studies varies widely, for example sometimes the target individuals that children are responding to are peers (Hamann et al., 2011; Hamann et al., 2012; Patterson & Bigler, 2006), and sometimes puppets (Gräfenhain et al., 2013), or photos of individuals presented on a computer (Dunham et al., 2011). Dependent variables have also varied, sometimes emphasizing sharing and helping (Gräfenhain et al., 2013; Hamann et al., 2011), and sometimes preferences, attributions, and attitudes (Bigler et al., 1997; Dunham et al., 2011; Patterson & Bigler, 2006). While previous minimal group studies have investigated preferences for in- over out-group members (Dunham et al., 2011; Dunham & Emory, 2014), no

previous studies on collaboration have investigated young children's preferences for collaborators over non-collaborators directly. In addition, whereas the effects of minimal group manipulations are always measured after the manipulation (i.e., group assignment is completed first, tests are conducted afterwards; e.g., Bigler et al., 1997; Dunham et al., 2011), the prosocial effects of collaboration have only been shown to occur within the context of the collaborative activity itself (Gräfenhain et al., 2013; Hamann et al., 2011; Hamann et al., 2012).

In the current study we therefore investigated the effects of previous collaboration and shared minimal-group membership in 3.5- and 5-year-old children in comparison to each other, matching the two as closely as possible. In a between-subjects design, participants and a puppet either collaborated together or were allocated to the same minimal group. That is, in the collaboration condition, children were asked to solve a collaborative task with one puppet (collaborator) while another puppet (non-collaborator) was said to be collaborating with someone else. In the minimal-group condition, children were assigned to one of two minimal groups based on color, and then were presented with one puppet wearing the same (in-group) and one puppet wearing different (out-group) group markers. To investigate children's general tendency to prefer collaborators (versus non-collaborators) and minimal in-group members (versus out-group members), children in both conditions were presented with five forced-choice tests which comprised a broad selection of positive, prosocial behaviors and social preferences: helping, resource allocation, trust, liking, and affiliation.

The study had three main aims. First, we aimed to explore whether children would show favoritism for their social partners both in collaboration and in minimal group settings. In so doing, we wished to extend previous findings in both areas, a) by investigating whether children show a more general preferential treatment of previous collaboration partners (i.e., in situations



unrelated to the collaborative activity itself), and b) by adding a variety of novel measures, which allowed us to further investigate whether favoritism in minimal groups extends to preferential and prosocial behaviors, rather than just attitudes. Second, we aimed to investigate the relative strength of these effects, by asking whether collaboration would lead, overall, to effects similar in magnitude to those observed with minimal groups. Third, we aimed to provide a more systematic picture of when in development children's sensitivity to these two ways of connecting with others emerges, to see whether one emerges earlier than the other or whether they emerge around the same age. We chose to test 3.5- and 5-year-old children, as the earliest evidence of prosocial behavior toward collaborative partners has been found around 3.5 years (e.g., Gräfenhain et al., 2013; Hamann et al., 2011), and minimal group effects been shown from 5 years (Dunham et al., 2011, Dunham & Emory, 2014).

## Method

### Participants

Participants included in the analyses were 72 3.5-year-olds (*mean*= 3 years, 5 months, 24 days, *range*= 3 years, 1 month, 28 days - 3 years, 8 months, 0 days) and 72 5-year-olds (*mean*= 4 years, 11 months, 24 days, *range*= 4 years, 9 months, 28 days - 5 years, 2 months, 3 days). The sample size of 36 children per condition was determined prior to data collection based on typical sample sizes in the field. Half of the participants at each age were female. All children were from a medium-sized city in [blinded country] and were recruited from a database of parents who had agreed to participate in studies on child development. Additional children were tested but excluded from analyses due to experimenter error (3 3.5-year-olds/3 5-year-olds), uncooperativeness (4/2), inability to operate the collaboration apparatus correctly (4/3), or unwillingness to put on the minimal-group markers (5/1). Eleven further 3.5-year-olds were

tested but excluded because after the test session, they could not recall with which puppet they had previously collaborated or which puppet was in the same minimal group.

### **Design**

Children were randomly assigned to either the collaboration condition or the minimal-group condition. Subsequently, all children participated in five forced-choice tests examining helping, resource allocation, trust, liking, and affiliation towards a collaborator versus a non-collaborator or a minimal in-group versus a minimal out-group member puppet. To make the minimal group membership condition comparable to the collaboration condition, groups were represented by one other group member only, with one puppet representing each group (collaborator versus non-collaborator, minimal in-group member versus out-group member). We counterbalanced which puppet was used as the collaborator or the minimal in-group member and the side of the target puppet. The order of the first four tasks was also counterbalanced. Because the affiliation test was operationalized as children's willingness to hug the puppets goodbye, this test was always conducted last.

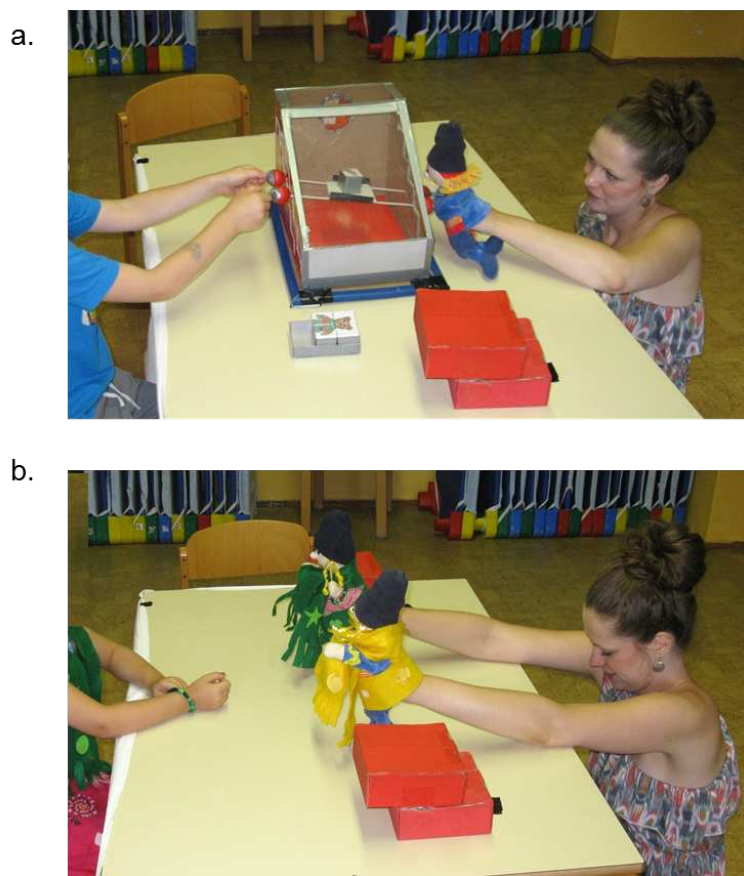
### **Materials**

We used two different-looking hand puppets which previously had been pilot-tested and shown to evoke no significant puppet preference among 3- to 5-year-old children (total N=19). Both puppets were operated by one puppeteer. The puppets' gender was matched to that of the participants by labeling the puppets as male or female and by attaching long hair to the puppets for female participants.

In the collaboration condition, materials were a cardboard stairs apparatus (modified from Hamann et al., 2012) and six wooden blocks painted such that, when placed together, they depicted a teddy bear. Blocks could be retrieved from the cardboard apparatus through

collaborative effort (see Figure 1a). The blocks needed to complete the puzzle were out of reach, resting on a tray inside the cardboard box. The tray's handles stretched across both sides of the apparatus. If two individuals grasped these handles with both hands and lifted the tray up the stairs at the same time, the block could be lifted up. At the highest step, there was a small hole covered by a curtain. From here it was possible to remove the block from the apparatus.

In the minimal-group condition, materials were a set of yellow and green group markers consisting of scarves, belts, and armbands (see Figure 1b). There were a child-size and a puppet-size version of each set of group markers. To assign children to one of the color groups, two green and one yellow plastic coin were used.



*Figure 1.* Manipulation phases. Child (left) and collaborator puppet operating the collaboration

apparatus in the collaboration condition (a) and child (left) meeting minimal in-group and out-group member in the minimal group condition (b).

For the helping test, two identical red boxes were attached to the table, with a soft blue block resting on the top of each box. In the resource allocation test, materials were five blue star stickers on a small black tray, and two empty plates. In the trust test, materials were two small, identical cardboard boxes containing either a blue or a red plastic frog.

### **Procedure**

Testing took place in children's kindergartens. The child first met the experimenter (E), who led her to a quiet testing room. An assistant, who would be the puppeteer later, already sat there at a small table, and appeared to be tidying something up. E and the child said hello to the assistant and then played together until the child seemed comfortable. The child was then asked to sit at the table opposite the puppeteer, with E on the child's left.

In the manipulation phase of the collaboration condition, the assistant brought out two hand puppets who introduced themselves by name. E suggested that one puppet could play with the child. To make sure that the non-collaborator puppet was also perceived as collaborative, E also suggested that the other puppet could play with somebody called Max (or Maxi, for female subjects) underneath the table. Both puppets agreed happily and the non-collaborator disappeared underneath the table. E then placed the unsolved block puzzle with two blocks missing and the cardboard box containing one of the missing blocks between the child and the remaining puppet (the collaborator). E explained that in order to complete the puzzle, the child and the puppet needed to work together to retrieve the puzzle pieces from inside the box. E then demonstrated

that if one person operated the handles on her own, they would get stuck and then she encouraged the child and the collaborator puppet to start. In order to ensure that children understood that they could not operate the apparatus on their own, during the collaboration the collaborator puppet pretended that her handle got stuck and asked the child to wait for her on one occasion. After they had successfully retrieved the puzzle piece and put it into the puzzle, E refilled the box with the second missing puzzle piece and a second trial started. After this trial, E put the apparatus away (out of sight) and told the child and the collaborator that they would do something else now and that they could finish the puzzle later. Then the non-collaborator puppet reappeared. To ensure that children would pay equal attention to both puppets before the test phase, E reminded the child again which puppet had played with the child and which one had played with Max. Subsequently, the test phase began.

In the manipulation phase of the minimal-group condition, E brought out two sets of green and yellow items and explained to the child that there were two groups: the green group and the yellow group. Children were told that to determine which group they were in, they could choose one of E's hands, which held, in closed fists, a yellow and a green coin. Although the group allocation appeared to be random, in reality E had a green coin in both hands and thus all children were assigned to the green group. (Previous studies from our lab have shown that no significant differences have been found between children assigned to one color group versus the other. Thus for ease of counterbalancing, we held this factor constant). With the help of E, children put on a green scarf, belt, and armband. Afterwards, the assistant brought out two hand puppets, one wearing green group markers and the other wearing yellow group markers, and they chatted briefly with E, and stated which group they were in. To ensure that children would pay

equal attention to both puppets before the test phase, E repeated again which puppet was in the same and different group as the child. Subsequently, the test phase began.

In the test phase, children in both conditions were confronted with five different situations in which they had to direct their behavior towards one of the two puppets in a forced-choice scenario. During this time, the experimenter looked directly into participants' eyes when asking the test questions and did not look at either puppet. The puppeteer always looked down during the test phases. In the test phases, E never referred to the previous collaborative activity, nor did she refer to the child or puppets using the minimal group labels (green/yellow).

In the helping test, E said that she had some other things she wanted to show everyone, but before doing so, the puppets should put away their building blocks, which were lying on the two boxes attached to the table, approximately one meter away from each other. Each puppet then climbed up one box, trying to reach for the block, and they simultaneously accidentally dropped their block off the box. The puppets each leaned over their box and tried to reach for their block. E, who was standing behind the puppeteer (and holding a large package such that she was unable to help the puppets herself), encouraged the child to help the puppets by saying, "Oh, look, they have dropped their blocks! Maybe you can help them!"

In the resource allocation test, E placed a tray with five stickers in front of the child and put a little plate in front of each of the puppets, who were waiting opposite the child. The child was told that these stickers were for the puppets and that the puppets could take them home afterwards. E then said, "You can divide the stickers up between their plates."

The trust test was a modified version of that used by Over, Carpenter, Spears, and Gattis (2013). E brought out two identical small boxes which she said contained different toys. She asked the puppets to look inside the boxes and choose the one they liked most. The puppets did

so, without ever letting the child see what was in the boxes. While one puppet expressed a preference for box A, the other puppet expressed a preference for box B. Then E asked the child, “Ok, now it’s your turn. Which box do you like most?”

In the liking test, E asked the child (with a lowered voice), “So, [child’s name], tell me, which of these two do you like most?” pointing at the two puppets opposite the child.

Finally, in the affiliation test, the child was told the game was over and E said, “If you want to, you can hug the puppets goodbye.” If children were reluctant to do so, they were told that they could shake the puppets’ hands if they wanted to instead.

For the 3.5-year-olds only, piloting had revealed that some children had trouble remembering which puppet had been the collaborative partner or which minimal group they themselves had been in. Therefore, after the tests were complete, we showed children the two puppets again, and asked which one they had previously played the puzzle game with together (collaboration condition) or which one was in the same group as them (minimal-group condition).

After the test phase, children in the collaboration condition completed the puzzle together with both the collaborator and the non-collaborator. In the minimal group condition, E told the child, as well as the in-group and the out-group member, that the group game was over, and that they were all in the same group again.

### **Coding and Reliability**

Children’s responses were coded from videotape. For each test, we coded which puppet the child favored. Since our main interest was in comparing the overall strength of children’s preference for collaborators and minimal in-group members, the main analyses were conducted on an overall preference score which consisted of the percentage of tests in which participants

chose the collaborator or the minimal in-group member. In the helping test, we coded to which puppet children gave the dropped block back first (although it is worth noting that most children eventually helped both puppets). In the resource allocation test, we coded to which puppet children gave more stickers. In the trust test, we coded whose preferred box children chose. In the liking test, we coded which puppet children explicitly preferred. In the affiliation test, we coded who children hugged or shook hands with first.

Twenty-five percent of the videotapes at each age and in each condition (36 children) were randomly chosen to be independently coded by a second rater who was unaware of the hypotheses of the study. Agreement between the two coders was excellent (all Cohen's  $k$ 's > .856).

## Results

### Preliminary Analyses

Preliminary analyses revealed that there were no significant differences between performance in the first and last counterbalanced trials (separated for the two ages and conditions: all Chi-square  $p$ 's > .11). As a result, we collapsed across order of tests and do not consider it further. All reported  $p$  values are two tailed.

### Main Analyses

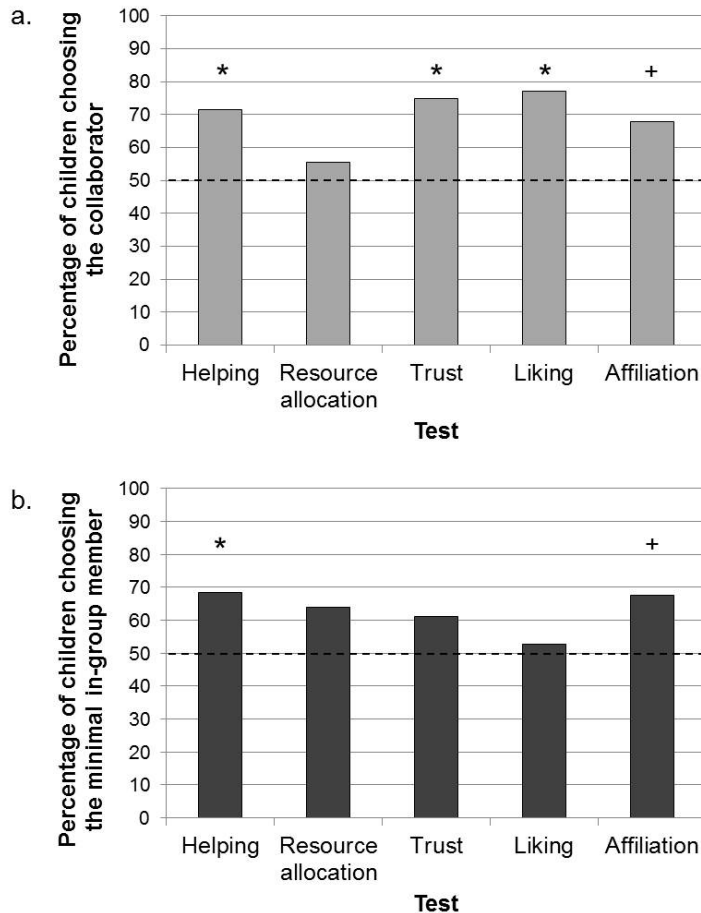
First, to investigate whether children showed a reliable preference for collaborators over non-collaborators and minimal in-group over out-group members, we tested children's overall preference scores against the chance level of 50%. Five-year-olds showed overall preferences for both collaborators and minimal in-group members, on average favoring the collaborator over the non-collaborator in 69.4% of tests ( $t(35) = 4.47, p < .01, d = 0.745$ ) and the minimal in-group over the out-group member in 62.7% of tests ( $t(35) = 2.83, p < .01, d = 0.471$ ). In contrast, 3.5-



year-olds showed a trend towards favoring the collaborator (57.1% of tests,  $t(35) = 1.73$ ,  $p = .093$ ,  $d = 0.288$ ) but not the minimal in-group member (55.8% of tests,  $t(35) = 1.44$ ,  $p = .159$ ,  $d = 0.240$ ).

Next, we compared the overall preference scores of the two conditions to each other, 1) to test whether preferences for collaborators were similar in strength to preferences for minimal in-group members and 2) to examine whether the pattern of performance between the conditions varied with age. A two-way ANOVA revealed a marginal main effect of age suggesting that older children have a stronger tendency than younger children to favor both collaborators and minimal in-group members, ( $F(1,144) = 3.75$ ,  $p = .055$ ), but no significant main effect of condition ( $F(1,144) = .035$ ,  $p = .53$ ) and no interaction between age and condition ( $F(1,144) = .031$ ,  $p = .50$ ).

Although our main interest was in the overall effects, we also investigated children's performance in each of the different tests separately. For 5-year-olds (see Figure 2), in the collaboration condition, binomial tests revealed that children favored the collaborator in the helping test ( $p = .018$ ), the trust test ( $p = .005$ ), and the liking test ( $p = .002$ ) and showed a trend to do so in the affiliation test ( $p = .072$ ). They showed no preference in the resource allocation test ( $p = .70$ ). In the minimal-group condition, binomial tests revealed that children favored the minimal in-group member in the helping test ( $p = .043$ ) and showed a trend to do so in the affiliation test ( $p = .059$ ). None of the other tests revealed a significant preference for the minimal in-group member (all  $p$ 's > .13).



*Figure 2.* Results for the 5-year-olds. Percentage of children choosing the collaborator over the non-collaborator in the collaboration condition (a) and the minimal in-group member over the minimal out-group member in the minimal group condition (b). Dashed lines represent chance level. \* $p < .05$ ; + $p < .10$

We also investigated 3-year-olds' performance in each test separately (see Figure 3). Binomial tests revealed that children showed a trend to favor the collaborator in the trust test ( $p = .067$ ). There was no significant preference for the collaborator in the other tests (all  $p$ 's  $> .13$ ). In the minimal-group condition, binomial tests revealed that children favored the minimal in-group member in the liking test ( $p = .043$ ), but not in any of the other tests (all  $p$ 's  $> .13$ ).

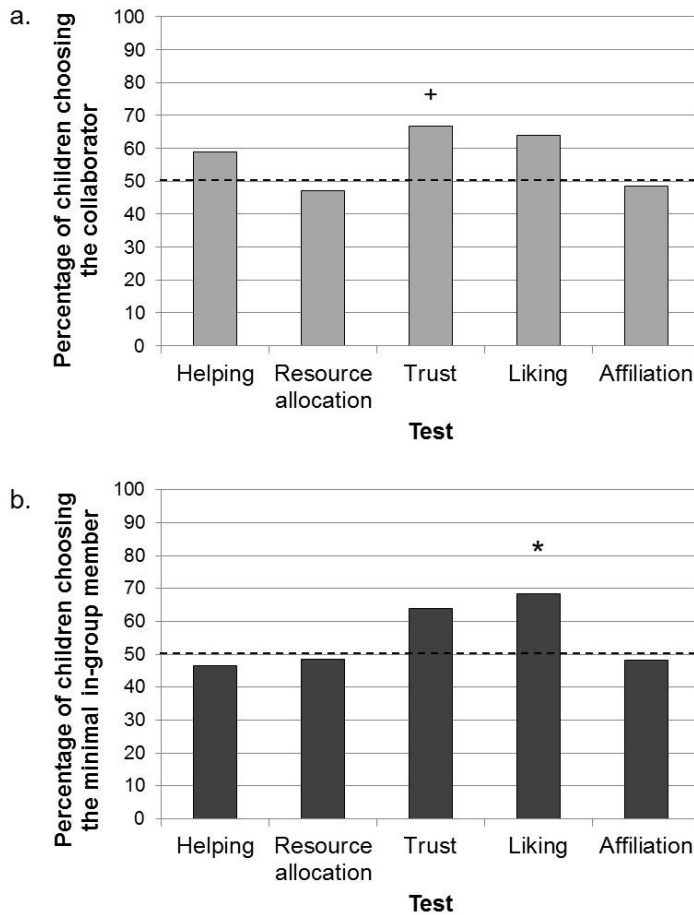


Figure 3. Results for the 3.5-year-olds. Percentage of children choosing the collaborator over the non-collaborator in the collaboration condition (a) and the minimal in-group member over the minimal out-group member in the minimal group condition (b). Dashed lines represent chance level. \* $p < .05$ ; + $p < .10$

### Discussion

This study investigated the effects of having participated in a collaborative activity and having been allocated to the same minimal group on the prosocial behavior and social preferences of 3.5- and 5-year-old children. We found that, whereas 5-year-old children showed preferences for both collaborators and minimal in-group members on multiple dimensions, and showed overall effects of a similar magnitude in both cases, 3.5-year-old children did not have a

strong preference for either collaborators or minimal in-group members. Thus both collaboration and minimal-group membership are similarly effective in their influence on children's prosocial behavior and social preferences and emerge at a similar time.

More specifically, 5-year-olds preferentially helped, trusted, and liked their collaborators, and they showed a tendency to affiliate more with them. This finding extends previous research on children's collaboration in several ways. For example, it shows that the positive effects of a brief collaboration are not restricted to supporting the partner (for example by helping or sharing with her) but also extend to other aspects of the relationship, such as trust, liking, and, to some extent, affiliation. Furthermore, and in contrast to previous findings, the behaviors measured in our study were not tested during the actual collaborative activity itself (i.e., the puzzle activity), but rather took place in situations unrelated to that activity. Therefore we showed that preferences evoked by collaboration can extend to situations outside of the immediate collaborative interaction and thus are of a more general nature. There are at least two possible explanations for how this more general positivity might have come about. First, it could be that, as intended, children understood that the collaborative activity was over but still retained a lasting preference for their former collaborative partner. Alternatively, it is possible that, because the experimenter had said that they would finish the puzzle later, children 'kept open' their collaborative relationship with their partner during the different activities that followed in anticipation of a further collaborative interaction with him/her. Either way, this finding supports the idea that collaborative partners are not merely important to us at the moment of the collaborative interaction but also more generally (as we are dependent on those individuals as potential collaborative partners in the future, too; Tomasello et al., 2012).

The 5-year-olds also preferred minimal in-group members to minimal out-group members overall, and in particular they helped in-group members more and showed a tendency to affiliate more with them. These findings extend previous minimal group research, which has shown a bias for minimal in-group members mainly on the level of implicit attitudes (Dunham et al., 2011, Dunham & Emory, 2014), to two behavioral measures (helping and a new measure of affiliation). It also demonstrates minimal group preferences in a new situation (i.e., when the in- and out-group members are physically present instead of represented by pictures). An important contribution of this study, therefore, is the finding that minimal group manipulations affect children's actual behavior toward minimal group members, in particular their prosocial behavior (and, to some extent, their affiliative behavior as well). This finding supports the idea the in-group biases might go beyond preferences and attitudes, and extend to more positive behaviors towards in-group members (Hammond & Axelrod, 2006; Tomasello et al., 2012).

This study also contributes the interesting finding that, in 5-year-old children, the minimal-group manipulation resulted in an overall preference of similar magnitude to collaboration. Thus minimal markers indicating group membership (without any further interaction taking place) are sufficient to create a connection similar to those created by a direct, collaborative interaction. This demonstrates just how powerful the impacts of minimal group cues are. At least at times, they are just as powerful as having worked together for a joint goal.

Turning to the question of developmental change, overall 3.5-year-olds did not show a strong preference for minimal in-group members, and only showed a trend to prefer collaborators. This fits with previous studies suggesting that minimal group effects might not occur in children younger than 5 (Dunham & Emory, 2014). It is perhaps surprising that 3.5-year-olds do not favor collaborators over non-collaborators more convincingly, given that

previous studies have found prosocial tendencies towards collaborators at this age (Gräfenhain et al., 2013; Hamann et al., 2011; Hamann et al., 2012). However, as noted above, a crucial difference in this study was that our test phases were unrelated to the collaborative activity. It thus appears that 3.5-year-olds show prosocial tendencies only within the immediate context of the collaboration, whereas 5-year-olds extend their prosocial tendencies (and preferences) beyond that particular activity and develop more general preferences for collaborative partners.

It is interesting to consider why 5-year-olds, but not 3.5-year-olds, showed a clear preference for both collaborators and minimal-group members. All the 3.5-year-olds included in the final sample were able to identify the former collaborator or the minimal in-group member after the test phase; thus task demands like difficulty in remembering the collaborative activity or group manipulation were unlikely to have contributed substantially to this age difference. One possible factor contributing to this difference may be experience in kindergartens. While children around 3 years of age often have only just started attending preschool, 5-year-olds often have a couple years of experience with both kinds of connections to their peers. These years of experience collaborating in various ways with peers on the one hand, and being exposed to group markers and class labels that structure their daily lives (Bigler et al., 1997; Patterson & Bigler, 2006) on the other hand, could enhance children's sensitivity to both ways of forming connections with others. Dunham and Emory (2014) have suggested that between the ages of 3 and 6 years, children undergo a sociocentric shift (see also Aboud, 1988). They proposed that although by around 3 years of age children are able to encode group membership correctly, only older children are more sensitive to the importance of group membership due to their increasing awareness of real-world group distinctions, and, as a result, are more likely to see groups as socially meaningful.

By comparing the effects of collaboration and minimal group membership in children, we open up a number of avenues for future research. First, it would be interesting to further investigate the different patterns of results we found in each condition at each age. Informally, we noticed while coding that children often acted spontaneously towards the puppets in the helping and affiliation test. In contrast, when answering the explicit questions about their preferences (in the trust and liking tests), and when distributing the final sticker in the resource allocation test, children often paused for a moment and appeared to give more thought to their responses. Thus, it is possible that different processes were involved in these two types of tests. Through this lens, the pattern of results for the 5-year-olds in the minimal group condition (helping, and to some extent, affiliating more with in-group members) would fit well with previous work suggesting stronger results for implicit than explicit preferences (Dunham et al., 2011; Dunham & Emory, 2014). However, the 3.5-year-olds in our study showed a preference for the minimal in-group member in the explicit liking test – a finding which is somewhat difficult to explain in this context. Since implicit and explicit group-based preferences have been shown to follow distinct developmental courses throughout childhood (Dunham, Baron, & Banaji, 2008), further research, using a wider variety of tests, should investigate whether there are reliable differences between implicit and explicit measures in the development of preferences for both collaborators and minimal in-group members. Relatedly, it would also be interesting to investigate whether children's responses to collaborators differ from their responses to minimal in-group members in other meaningful ways, for example to see whether the effects of one condition last longer than those of the other. Future research could also explore whether the patterns of effects differ depending on whether or not the collaborative and the minimal groups are marked with explicit labels during the test phase, as previous work has shown that biases are

more pronounced when group labels are used (Baron & Dunham, in press; Baron, Dunham, Banaji, & Carey, 2014; Diesendruck & haLevi, 2006; Patterson & Bigler, 2006).

Another important question for future research involves the underlying mechanisms of these effects, that is, do collaboration and the minimal group manipulation trigger similar feelings of connection or were the similar preferences we observed driven by two separate processes? For example, it is possible that minimal group markers serve as a proxy or a short-cut for collaborative interaction. This would fit with evolutionary arguments suggesting that, since relying on personal interaction with every group member is not possible in bigger groups, group markers are necessary to recognize in-group members (e.g., Tomasello et al., 2012). Thus, in-group markers could serve as cues to detect potential collaborators (e.g., Axelrod, Hammond, & Grafen, 2004; Cohen, 2012; Hammond & Axelrod, 2006). Alternatively, children might view collaboration as a behavioral cue to novel group membership (much like the color clothing serves as a cue). In that case positivity towards collaborators could be driven by the same mechanisms underlying minimal group biases. However, social psychological research showing that people have different expectations about collaborative groups and social categories with group markers (Lickel et al., 2001; Lickel et al., 2000) might suggest there could be different mechanisms underlying positivity towards collaborators and towards in-group members. Notwithstanding, in the current study, both ways to connect evoked effects of similar strength, showing that whether or not the same mechanisms underlie them, they result in comparable final outcomes. Longitudinal investigations at more time points between the ages of 3 and 5 years, using a within-subjects design to compare the effects of collaboration and minimal group manipulations, could help shed light on whether the same mechanisms are driving positivity toward collaborators and minimal in-group members.



Finally, in this study, we explored whether children's responses to in- versus out-group members differ for collaborative and minimal groups. This is an important question because, from an evolutionary perspective, it is critical to be able to distinguish in-group members from out-group members. In future work, it would also be interesting to pit children's preferences for both types of social partners against each other, to see whether children have a preference for one type of in-group member over the other. This could be done either 1) by forcing children to choose between a minimal in-group member and a collaborator or 2) by crossing the two factors and forcing them to choose between a collaborative minimal out-group member and a non-collaborative minimal in-group member (the way Kinzler et al., 2009, did when contrasting language and race as cues to group membership).

In summary, this study links two fields that, until now, have always been considered separately in developmental psychology. In doing so, it contributes to the current literature in several ways. It adds to the growing body of research on children's selectivity in responding to social partners (e.g., Kinzler et al., 2007; Kuhlmeier, Dunfield, & O'Neill, 2014; Olson & Spelke, 2008; Vaish, Carpenter, & Tomasello, 2009) and it extends previous work on both collaboration and minimal groups in important ways. Becoming connected to others is a crucial part of human social life. We show here that, by 5 years of age, children are well on their way to forming the variety of positive connections to their group members that will increasingly structure their social relationships.

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