# When Boys Are More Generous Than Girls: Effects of Gender and Coordination Level on Prosocial Behavior in 4-year-old Chinese Children

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**Abstract**

Children develop a sense of joint commitment and shared intentionality during collaborative activities, which may produce prosocial effects in social coordinative activities. Past studies have found mixed results on the prosocial effect of shared intentionality. We hypothesized that it is the degree of coordination and not simply shared intentionality that facilitates social bonding. In a block-assembly task with 4-year-old children, we manipulated degree of coordination. Children in the continuous high-level coordination condition were more generous in a Dictator Game and more willing to help their partner complete a task, compared with children who engaged in a task with the same end-product that required less coordination. Surprisingly, we also found that boys shared more resources than girls, a result that we attributed to the emphasis on the importance of generosity for males in Chinese culture.

**Keywords:** joint action; prosocial behavior**;** cultural effects on cognition; cognitive development; social cognition; social development; cross-cultural gender differences

## Introduction

A growing body of literature suggests that from an early age humans form a sense of joint commitment and "we" intentionality in joint activities, which may lead them to act more helpfully and generously during collaboration (e.g. Gräfenhain, Carpenter & Tomasello, 2013; Tomasello & Carpenter, 2007). For example, three-year-old children who have made a joint commitment are more likely to help their partner in time of need during a collaborative task (Gräfenhain et al., 2013). Furthermore, when dividing up the results of the collaboration, children tend to share resources fairly even when they have the opportunity to monopolize reward (e.g. Warneken, Lohse, Melis & Tomasello, 2010). A similar study also shows that children divide up rewards more equitably after collaborative efforts than after working in parallel work or in a no-task control condition (Hamann, Warneken, Greenberg & Tomasello, 2011).

Kirschner and Tomasello (2010) proposed that the helpfulness and generosity generated by joint commitment and shared intentionality may extend beyond the original collaboration and influence children's interaction in unrelated subsequent activities. They argued that shared intentionality and joint goals might lead people to experience each other as co-active members of a group, thus increasing prosocial tendencies in later interactions. They further suggested that shared intentionality may be the mechanism underlying the well-documented prosocial effects of coordinated social behaviors such as joint music making and dancing (Huron, 2001; McNeill, 1995; Ashton-James, van Baaren, Chartrand, Decety & Karremans, 2007; Cirelli, Einarson & Trainor, 2014).

Some studies find prosocial effects of shared intentionality when it is combined with synchrony (Reddish, Fischer & Bulbulia, 2013). Others, however, find that shared goals have minimal effects on promoting social bonding (Wolf, Launay & Dunbar, 2015). One possible explanation for these discrepant findings is that some studies used tasks emphasizing a mutually desired end-product or final state (as in a game that requires maximizing the total score of two players), whereas other studies focused on more continuous coordinated behavior patterns (as in partner dancing) (Fiebich & Gallagher, 2013). These two forms of joint actions involve different levels of coordination and commitment. More continuous coordination requires participants to pay attention to shared sub-goals. Participants not only have a shared goal but also have a shared action plan, during which they must closely monitor and represent each other's tasks (Vesper, Butterfill, Knoblich & Sebanz, 2010). Indeed, the constant representation of collective goals and close interaction with partners are characteristic of coordinated social behaviors that are known to increase mutual bonding and prosocial tendencies (Kirschner & Tomasello, 2010) and subtler forms of interpersonal coordination that increase prosocial behavior, such as mimicry.

We tested the effects of level of coordination by comparing two similar block-assembly tasks where one task required only coordination on the final goal (low coordination) whereas the other task had the same end-product and equal division of workload but required more continuous (high) coordination. We measured children's prosocial behavior in two subsequent tasks. In the "envelope" task, children had the option of placing some of their stickers in an envelope for another child. This task also tests whether prosocial effects extend beyond the dyad to strangers; previous studies on generalization have found mixed results (Cirelli, Wan & Trainor, 2014; Reddish, Tong, Jong, Lanman & Whitehouse, 2016). We also used a star-arrangement task where one child needed a star sticker of a certain color that the other child had, but didn't need to use. We predicted that children in the high-coordination condition would exhibit more prosocial behavior and would subsequently be more generous.

We also examined possible gender differences in generosity and other prosocial behavior. A large body of literature suggests females are more friendly, helpful, cooperative and generous than males (e.g. Eisenberg & Fabes, 1998, but Eagly & Crowley, 1986) and that this is the case for both adults and children (Eckel & Grossman, 1998; Maccoby, 2002). From an early age, girls tend to engage in activities that reinforce nurturance and interpersonal closeness (Kirschner & Tomasello, 2010). From an evolutionary perspective, this is often related to the fact that women are primarily responsible for child-raising in most cultures (Weisner et al., 1977; Low, 1989).

Socialization might play an important role in shaping children's prosocial behavior (Benenson, Pascoe & Radmore, 2007), through implicit imitation (Rizzolatti & Craighero, 2004), reward and punishments (e.g. Fehr & Fischbacher, 2004) and other types of social learning. To the extent that culture plays a role in shaping generosity and prosocial behavior, some gender patterns observed in Western cultures might be mitigated or even reversed in China.

In Chinese culture, the importance of generosity with resources is particularly stressed for males. Lack of generosity in women is more forgivable and sometimes even considered a virtue, as it could signal a money-saving wife who smartly manages the household's finances. Because Chinese culture emphasizes generosity more for boys, we hypothesized that boys would be more likely to give up some of their stickers than would girls.

We examined four-year-old children for two reasons. First, the first five years of life is a particularly important age range for prosocial development (Marin & Olson, 2015), and children around four-year-old have just developed the ability to collaborate relatively enduringly on problem-solving tasks. Second, children at this age are relatively sensitive to gender stereotypes and might actively match themselves to the social expectation of gender roles (Martin & Ruble, 2004).

# Methods

## Participants

138 children participated in the experiment. Some children were excluded typically because they did not follow instructions. Excluding criteria are described in the results section. The final sample for the envelope task consisted of 129 children (69 males, mean = 4 years and 6 months, range = 4.0 to 5.0 years). For the star-arrangement task, the final sample was 116 children paired in same-sex dyads (58 males, mean = 4 years and 6 months, range = 4.0 to 5.0 years). Children were paired with a familiar partner of the same gender from the same kindergarten class. The parents and school provided informed consent for all participants.

## Procedure

### Manipulation Phase

Block-assembly task. Pairs were randomly assigned to the *high-coordination* condition or the *low-coordination* condition. In both conditions, children from a pair were presented with a model that looked like two castles connected together (Fig. 1). They were told that their task was to build two castles that looked exactly like the model. For demonstration purpose, the experimenter then built the bottom two levels of the castle.

In the high-coordination condition, one child was asked to build the parts that required the green blocks, while the other used the orange blocks. In the low-coordination condition, one child was asked to build the castle on the left and the other on the right. The assignment of color and side was random. The blocks were given to children in baskets, and the number of blocks in the two baskets was similar (the actual numbers of blocks ranged from 18 to 20). The experimenter and a research assistant were present during the block-assembly task to make sure that the children understood and followed the instructions.

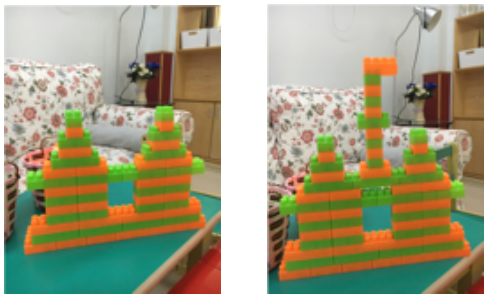

Fig. 1. The block-assembly models. In the high-coordination condition, each child in the dyad was responsible for one color of block (green or orange); in the low-coordination condition, each child in the dyad was responsible for building a single castle. The left panel shows the model for the first building task (building the castles), and the right panel shows the model for the second building task (adding the flag).

The tower-assembly task was followed by either of the two evaluation tasks: the *envelope task* which focuses on generosity or the *star-arrangement task* which assesses a wider range of behavior. After the first evaluation test, the pair completed a second assembly task, adding a flag to the towers, to reinforce the manipulation. Then they proceeded to the second evaluation task. In the high-coordination condition, each child was responsible for one block color. In the low-coordination condition, one child built the bottom six levels of the flag, and the other built the top six levels.

**Test Phase**

Envelope task: sharing stickers with an anonymous child

This task took the form of the Dictator Game, and the design was adapted from Benenson et al. (2007). Before conducting the study, pilot testing with children from other kindergartens established that all the scripts and procedures were understandable to four-year-olds.

The experimenter first asked the children if they would do her a favor. All of the children happily agreed. She then emptied a bag of 20 stickers in front of each child and asked the child to select 10 that he/she liked the best. All children of both genders or conditions selected their stickers with great care and confirmed that they liked their choices. Observation suggested that boys and girls were equally engaged in choosing their stickers.

The experimenter then told the children that she also planned to give stickers to other children in the kindergarten classes. Because she did not have time to go to every class, she would need help with dividing stickers. Children were told that they could keep all 10 stickers for themselves or could give some to the children in the other classes. The experimenter gave each child two envelopes and drew a smiley face on one of them. The children were told to put all of the stickers they wanted to keep in the envelope with the smiley face and to put any they wanted to share in the envelope without the smiley face. The experimenter then showed the children how to seal the envelopes, and instructed them to seal both envelopes after dividing the stickers. She then showed the children a basket full of sealed envelopes, explaining that the envelope without the smiley face would go into this basket and eventually be handed out by another teacher to kids in another class. She made sure the children understood that their choice was completely anonymous. The two children were then brought to separate rooms. After explaining the procedure again, the experimenter left the room, leaving the child to divide the stickers. Children called out for the experimenter when he/she was finished.

Star-arrangement task: contributing to the partner's project

Each child was asked to finish a decoration pattern on a transparent card with some stickers (Fig. 2). The pattern was composed of one sun-shaped sticker and five star-shaped stickers of different colors. The experimenter first showed both children two finished models of the patterns that used different colors of stars and asked the children for the names of all the colors used in the patterns. After making sure that both children could recognize the colors and count the numbers of stickers used, each child was given a model.

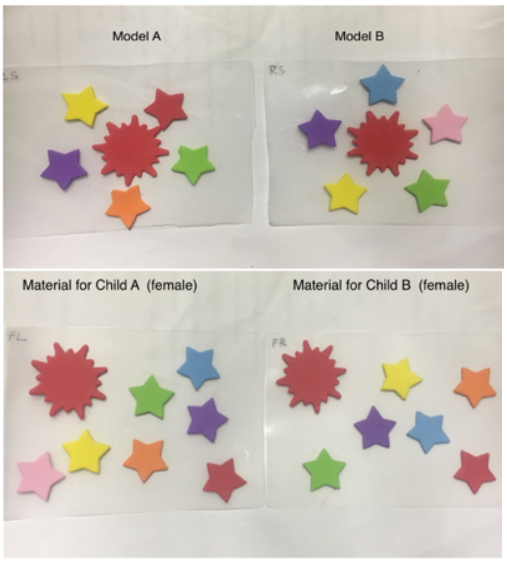


Figure 2: Star-arrangement task materials. Top Panel (Model A) is given to Child A: the five stars are yellow, red, green, orange and purple. Top Panel (Model B) is given to Child B: the five stars are purple, blue, pink, green and yellow. Bottom Panel shows the stickers given to Child A and B, respectively. Note that Child B does not have a pink sticker which she would need to complete the pattern, while Child A has a pink sticker that she does not need. For girls the missing sticker is pink; for boys it is blue.

Each child was given a transparent card approximately 27cm by 9cm with some stickers attached to the left side of the card; the stickers given to each child are shown on the bottom panel below the models (Fig. 2). The child was told to use the stickers on the left side of the card to complete a decoration pattern on the right side that looked exactly like the model assigned to him or her. The experimenter told the children that there might be additional stickers, and they could do whatever they wanted to with them, such as further decorating the pattern or putting the stickers on themselves, which was particularly popular among children in this kindergarten. Finally, the children were told that whoever finished the pattern could keep the decoration card as a gift. All children showed great interest in this gift. After demonstrating with the sun-shaped sticker, the experimenter left the room and let the children finish the task.

The two children sat parallel to each other and started the task. Child B would notice that he/she was missing a star-shaped sticker of a particular color (blue for boys and pink for girls). Child A had a sticker of that color and it was not needed to complete his or her Model A. On all trials, Child B reported missing a color. The trial ended when both children had stopped working on their projects for 10 seconds.

The entire session lasted around 20 minutes. The order of the two tasks, the star-arrangement task and the envelope task, was counterbalanced across pairs and was balanced across trials. The experimenter (YW) conducted the experiment with the help of a research assistant.

## Results

**Envelope task**

The number of donated stickers was our measure of generosity. We first examined the video recording to exclude children who did not understand the task. Nine children were excluded for this reason. For children who understood the task, we recorded the number of stickers that each child placed in the envelope.

As shown in Table 1, there are effects of coordination and gender. There were more donated stickers in the high-coordination condition compared to the low-coordination condition. Boys donated more stickers than girls. We evaluated the results using a regression analysis on the number of stickers donated which included the effect of both gender and coordination level. It yielded significant effects of both gender ($\beta = 1.12$, $t = 3.17$, $p = 0.002$, 95% CI [0.42, 1.81]) and coordination level ($\beta = 1.07$, $t = 3.03$, $p = 0.003$, 95% CI [0.37, 1.77]). There was no interaction, suggesting the effect of the block-assembly task was similar for boys and girls.

Table 1: Mean number of stickers donated for Envelope Task (standard deviations are in parenthesis).

| Gender/Coordination | High | Low | Both conditions |
|---|---|---|---|
| Female | 2.64 (2.19) | 1.44 (1.89) | 2.10 (2.13) |
| Male | 3.65 (1.81) | 2.69 (2.10) | 3.20 (2.00) |
| Both genders | 3.17 (2.05) | 2.12 (2.09) | |

Figure 3 presents a histogram showing how many children donated each number of stickers, ranging from 0-10, and the number of boys and girls contributing to each score. As the figure shows the overall numbers do not appear to be normally distributed. We therefore used a Dirichlet Process to infer the number of components of a Gaussian mixture model.

The best fitting model, as shown in Figure 4, has two distributions (Distribution A: mean = 0.197, SD = 0.614, weight = 0.351; Distribution B: mean = 4.022, SD = 1.255, weight = 0.649). By including 1.5 SDs around the means into the distribution, we coded the cases of donating 0 and 1 sticker as falling into Distribution A and donating 2 or more stickers as falling into Distribution B. We used a logistic regression to test the effects of coordination level and gender on which distribution that a child was assigned to. There were significant effects for both (gender: $\beta = 1.21$, $z = 3.03$, $p = 0.002$, 95% CI [0.44, 2.01]; coordination level: $\beta = 0.98$, $z = 2.48$, $p = 0.013$, 95% CI [0.22, 1.78]). Boys are more likely to fall into Distribution B, whereas girls are more likely to fall into Distribution A; children in the high-coordination condition are more likely to fall into Distribution B, whereas children in the low-coordination condition are more likely to fall into Distribution A (Fig 5).

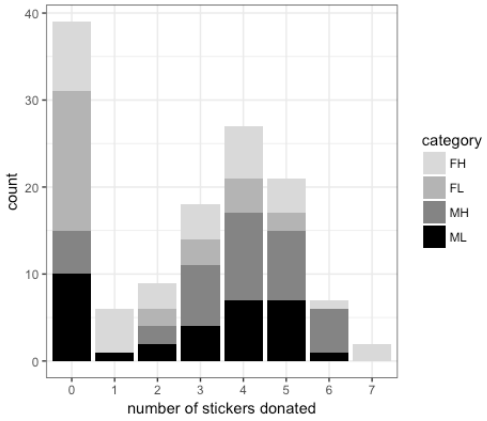


Figure 3: Histogram of numbers of stickers donated. FH stands for Female/High-coordination, FL Female/Low-coordination, MH Male/High-coordination, ML Male/Low-coordination. Note that the number of participants in each category is not equal, with n(FH) = 33, n(FL) = 27, n(MH) = 37, n(ML) = 32.

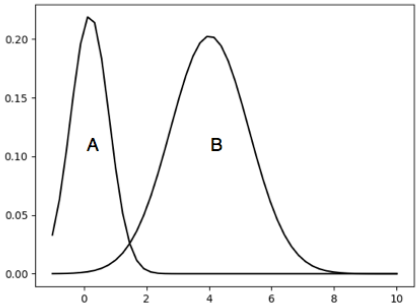


Figure 4: Gaussian components of the Gaussian Mixture Model.

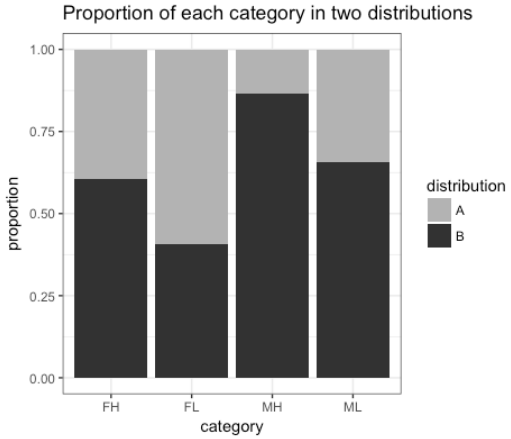


Figure 5: Proportion of each category that falls into Distribution A or Distribution B.

**Star-arrangement task**

For the star-arrangement task, coding was done from video by (YW) and a research assistant blind to the hypotheses. Nearly all of the children who were missing a star reported it to the partner (e.g., "I'm missing a pink star!"). After excluding the pairs who could not follow instructions, we coded the interaction between the dyad as falling into one of the following four categories: (1) active giving (one child offered the spare sticker before the other child asked), (2) sharing after being asked (one child handed over the spare sticker after the other requested), (3) taking (the other child took the sticker without getting permission), and (4) refusing to share (one child refused to share after the other child requested sharing or made an attempt to take the sticker). Since active giving and sharing after being asked both showed clear willingness to share, we coded both as "willing to share." Inter-rater agreement ($\kappa$) was 0.97.

We also coded aggressive behavior. Behavior was considered to be aggressive if a child made an attempt, whether successful or not, to take the sticker before asking for permission (e.g., reaching out and placing fingers on the desired sticker). Inter-rater agreement ($\kappa$) was 0.98.

We computed two dependent measures: willingness to share and aggression, using logistic regression analyses.

Aggression. The logistic aggression analysis yielded a significant effect of gender on aggression ($\beta = 1.35$, $z = 2.36$, $p = 0.018$, 95% CI [0.26, 2.53]), with boys attempting to take the sticker in 55% of the trials and girls 24%. There was no effect of coordination level or interaction between level of coordination and gender.

Sharing behavior. We found a significant effect of coordination level on willingness to share ($\beta = 1.62$, $z = 2.80$, $p = 0.005$. 95% CI [0.52, 2.82]). Children in the high-coordination condition were more likely to contribute to their partners' projects (77% of the trials) compared to those in the low-coordination condition (39% of the trials).

There were no significant effects of gender nor an interaction between gender and coordination. While this might seem inconsistent with what we reported for the envelope task, the numerical trends are consistent with boys being more generous. Girls were more likely to refuse to share when asked (31% of the trials) than boys (17% of the trials) (Category 4), and after being asked (Categories 2 and 4 combined), boys are more likely to say yes (67% of the trials) than girls (40% of the trials).

## Discussion

The current study provided clear evidence that level of coordination affects prosocial behavior above and beyond having a shared final goal, with higher levels of coordination leading to more prosocial behavior than lower levels of coordination. These effects held across all measures and for both boys and girls. A possible explanation is that children engaging in high-level coordination are likely to pay more attention to each other and have a stronger feeling of sharing the experience and acting as a unit (Kirschner & Tomasello, 2010). In addition, the set of sub-goals could create a stronger sense of achievement as children complete each step (Reddish et al., 2013). This might also explain why tasks with continuous goals, such as mimicry or moving in synchrony, produce prosocial effects. Interestingly, the emphasis on goal-setting and task-assignment coincides with that of the long-established goal-setting theory of group work in industrial/organizational psychology (Tosi, Locke & Latham, 1991), which states that specific and challenging goals along with appropriate feedback contribute to better task performance, a prediction supported by a large body of research (Locke & Latham, 2006).

We also found the expected pattern of more aggressive behavior in boys than girls. Most interestingly, and perhaps most surprising given the received view that girls are more generous than boys, boys shared more stickers in the envelope task which measures generosity. There were similar patterns in the star-arrangement task in which generosity is a component of more complex behaviors. While unexpected in light of previous findings, greater generosity for boys likely reflects a particular aspect of socialization and gender stereotyping that differs in the values emphasized for boys in China. Clearly, further research is needed to document and isolate the degree to which these effects generalize to other tasks and age groups. Nonetheless the current results provide striking support for the positive effects of coordinated behaviors on prosocial behavior and the impact that the emphasis on generosity for males has on behavior in kindergarten-age children.

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