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Resource allocation to kin, friends, and strangers by 3- to 6-year-old children

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ABSTRACT

Kin altruism has been widely observed across species, including humans. However, few studies have discussed the development of kin altruism or its relationship with theory of mind. In this study, 3- to 6-year-old children allocated resources between themselves and kin, a friend, or a stranger in three allocation tasks where the allocation either incurred a cost, incurred no cost, or conferred a disadvantage. The results showed that, compared with 3- and 4-year-olds, 5- and 6-year-olds acted more altruistically toward kin and that kin altruism was uncorrelated with theory of mind. These findings suggest that, within the context of resource allocation, kin altruism emerges toward the end of early childhood and probably differs from other prosocial behavior that relies solely on the understanding of others' perspectives.

Introduction

One of the most influential theoretical frameworks following and extending Darwin's natural selection and fitness theory (Darwin, 1859/1964), kin selection, and inclusive fitness theory (Hamilton, 1964), also explains the widespread phenomenon of kin altruism. However, the theoretical conceptualization and subsequent empirical investigations have been conducted with the adult population exclusively, with little knowledge generated on how and when kin altruism develops in

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children. There is literature on the development of altruism in children in general, especially in the context of resource allocation (Güroğlu, van den Bos, & Crone, 2014; House et al., 2013; Moore, 2009), but not regarding the development of kin altruism specifically. Whereas simply knowing the developmental time lines of human kin altruism is itself crucial, a deeper understanding of its human development should bring more insight into this species-general adaptation. For example, knowing the extent to which the development of kin altruism coincides with that of theory of mind (ToM; Premack & Woodruff, 1978) should reveal potential differences between kin altruism and other prosocial behaviors that rely solely on an understanding of others' perspectives. The purpose of the current study was to investigate the onset of kin altruism in children within the experimental paradigm of resource allocation and its relationship with ToM.

Ubiquity of kin altruism

Kin altruism is ubiquitous among nonhuman and human animals. When facing attacks from predators, nonhuman animals such as Siberian jays, prairie dogs, and capuchin monkeys issue more alarm signals when accompanied by kin than when accompanied by nonkin (Griesser & Ekman, 2004; Hoogland, 1996; Wheeler, 2008). In social activities, rhesus monkeys prefer to seek proximity with kin and groom them (Kapsalis & Berman, 1996). Japanese macaques assist their kin more than they do their nonkin when confronting antagonists (Chapais, Gauthier, Prud'Homme, & Vasey, 1997; Ventura, Majolo, Koyama, Hardie, & Schino, 2006). When asked to select between option 1/1, in which both the self and a partner received food, and option 1/0, in which only the self received food, capuchin monkeys most frequently selected option 1/1 when the partner was kin (de Waal, Leimgruber, & Greenberg, 2008). Similarly, macaques preferred option 0/1 (providing the recipient with food even though they themselves would not receive food) over 0/0 for recipients with whom they lived in a kin-like environment (Chang, Winecoff, & Platt, 2011). Chimpanzees also were more likely to cooperate with individuals with whom they developed a kin-like relationship; for instance, they were more tolerant of mistreatment from kin-like chimpanzees than from other group members (Brosnan, Schiff, & de Waal, 2005).

Kin altruism is equally or more common in human adults. In agricultural production, people are more likely to work with kin than with nonkin (Hames, 1987). In business, people trust kin and prefer to have their kin help in managing firms; more than half of the firms in the United States are family owned (Spranger, Colarelli, Dimotakis, Jacob, & Arvey, 2012). Furthermore, people leave higher proportions of estates to kin than to nonkin (Smith, Kish, & Crawford, 1987), migrant workers remit more money to their families (Bowles & Posel, 2005), and genetically related households share more food (Ziker & Schnegg, 2005). Labor, materials, and costly rescue behavior are more commonly provided to kin than to nonkin (Burnstein, Crandall, & Kitayama, 1994; Kruger, 2003; Madsen et al., 2007; Stewart-Williams, 2007). In experiments, adult participants preferred to trust kin (Vollan, 2011) and played investment games in a manner favoring partners who had kinship cues such as facial resemblance (Krupp, Debruine, & Barclay, 2008). In cooperation games, people generally treat kin more favorably than they do strangers; kin receive less punishment for transgressions and receive more compassion and help when they are mistreated (Lieberman & Linke, 2007; O'Gorman, Wilson, & Miller, 2005).

Kin selection and inclusive fitness

According to evolutionists, the aforementioned kin altruism is the result of kin selection and inclusive fitness (Hamilton, 1964). By extending the Darwinian concept of fitness, which is defined by reproductive success, or the number of surviving offspring produced, kin selection emphasizes inclusive fitness, which is the fitness, or reproductive success, of an individual plus the effects of a particular behavior or trait of the individual on the fitness of the individual's relatives. The extent of a relative's fitness to be included in an individual's fitness is appropriated by the degree of genetic relatedness between the individual and the relative. Because altruism is by definition self-disserving, it cannot be selected through the fitness of the individual carrier of the trait. Kin altruism provides one of two mechanisms by which altruism can be selected and promulgated in a population, with the

other mechanism being reciprocal altruism (Trivers, 1971). The mechanism of kin altruism comprises two conditions. One is that there is a probability, weighted by genetic relatedness, that the receiver of altruism carries the same trait or alleles responsible for the altruistic behavior. The other is that the genetically weighted appropriation of benefit to the altruism receiver is more than the cost to the altruism provider. These two conditions ensure that altruism can be selected and spread in a population. More relevant to the current study of kin altruism, these two conditions stipulate that altruism occurs among kin and the extent of altruism relates to the closeness of kin. Kin altruism not only provides a mechanism by which altruism can spread but also dictates the means by which altruism occurs, which is through helping kin.

Kin altruism-related research in children

Whereas inclusive fitness theory explains the wide-ranging altruism among kin in human adults, no study has specifically examined kin altruism in children. Some studies have focused on kinship concepts, showing that children as young as 3 years were able to understand kinship terms (Benson & Anglin, 1987) and that 5-year-olds could explain kin relationships (Benson & Anglin, 1987; Macaskill, 1981). Other studies have investigated how preschoolers came to understand facial resemblance in cuing kinship relationships (Kaminski, Gentaz, & Mazens, 2012) and how young children identified parent–child dyads with similar physical characteristics such as height and skin color and with similar personality traits such as generosity (Springer, 1996; Williams & Smith, 2010). In general, children felt naturally and emotionally closer to kin than to nonkin because, by either socialization or cohabitation (Lieberman & Lobel, 2012), kin are known to be "part of us" (Kruger, 2003).

Numerous studies have explored the ages at which children begin to demonstrate sharing and helping behavior. Children aged 12 years favored in-group members when sharing resources in economic games (Gummerum, Takezawa, & Keller, 2009), and 6-year-olds punished free riders from out-groups more than those from in-groups (Jordan, McAuliffe, & Warneken, 2014). Children aged 12 years also favored friends over strangers in allocating resources, whereas 9-year-olds did not show such discriminative allocations (Güroğlu et al., 2014). Children aged 5 years shared more resources with friends than with strangers of the same age or with classmates they disliked (Moore, 2009; Paulus et al., 2015). Only one study examined sharing with kin. However, that study used only 3.5-year-old children and showed no allocation preference for kin (Olson & Spelke, 2008). Other studies conducted outside the sharing or resource allocation paradigm revealed helping behavior at a much earlier age. Infants as young as 1 year offered useful information by pointing to the location of an object wanted by an experimenter (Liszkowski, 2005). Toddlers aged 1.5 years spontaneously helped an experimenter to pick up an object out of his reach, open a door, and retrieve an object from a correct position (Barragan & Dweck, 2014; Warneken & Tomasello, 2006). Children aged 4 years helped an experimenter to retrieve a toy from an intricately constructed box even though they were told that they would not be given the toy (Nielsen, Gigante, & Collier-Baker, 2014).

Different experimental paradigms

These different results reflect different methods used in measuring altruism-related constructs, which include instrumental helping (e.g., Warneken & Tomasello, 2006), information provisioning (e.g., Liszkowski, 2005), and resource sharing or allocation (e.g., Evans, Athenstaedt, & Krueger, 2013; House et al., 2013). Resource sharing or allocation research often uses indicator games in which a participant, as a proposer, decides whether to share endowed resources with a recipient as well as how many resources to share (e.g., Lucas, Wagner, & Chow, 2008; Sebastián-Enesco & Warneken, 2015; Wittig, Jensen, & Tomasello, 2013) and allocation games in which a proposer selects among different types of resource divisions between a recipient and the self (e.g., Güroğlu et al., 2014; House et al., 2013; Moore, 2009). In both paradigms, the amount of sharing increased as children's age increased. Compared with 7- and 8-year-olds, children aged 9 or 10 years shared more with recipients and expressed feeling bad if they did not share fairly (Kogut, 2012); however, children aged

6 to 8 years welcomed unfair allocations favoring themselves and discounting the other party (Shaw, DeScioli, & Olson, 2012). Compared with 3-year-olds, 5-year-olds were more concerned about others and shared more stickers or candy with another child (Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010; Rochat et al., 2009). Among children aged 3 to 8 years, as age increased, the percentage of children selecting 1/1 over 2/0 or 1/0 increased in allocation tasks (Fehr, Bernhard, & Rockenbach, 2008; House, Henrich, Brosnan, & Silk, 2012), suggesting that older children were more likely to share. None of these studies involved kin or tested kin altruism.

Altruism and theory of mind

A lack of literature also exists regarding whether and, if so, to what extent kin altruism is related to ToM, which reflects the ability to see from the perspective of other people. Related studies have shown that preschoolers who had passed ToM tests shared resources more generously with others (Rochat et al., 2009; Takagishi, Kameshima, Schug, Koizumi, & Yamagishi, 2010; Wu & Su, 2014) and evaluated unequal sharing as less acceptable compared with children who had not passed ToM tests (Mulvey, Buchheister, & McGrath, 2016). In addition, higher levels of sympathy in 4-year-old children were associated with larger amounts of sharing in dictator games (Ongley & Malti, 2014). However, ToM was also found to be unrelated to children's performance in sharing games (Lucas et al., 2008; Mulvey et al., 2016) and was even related to less sharing because children with ToM might know there were no consequences for not sharing (Cowell, Samek, List, & Decety, 2015). Whereas ToM appears to be cognitively necessary for allocating resources to others because knowing how others feel facilitates considering their interests, kin altruism may be exercised without needing to understand other people's perspectives because one can be unilaterally benevolent toward kin (Lu & Chang, 2009). Therefore, although ToM is related to children's performance in allocation tasks, it could be independent of kin altruism because generosity toward kin may be human nature regardless of whether children understand other people's mental states.

The current study

This study represents one of the first attempts to investigate the development of kin altruism in children. We targeted 3- to 6-year-olds. Children are likely to be surrounded only by kin at early ages, when it is unnecessary to discriminate between kin and strangers (Warneken & Tomasello, 2009). After approximately 3 years of age, as children's social circle begins to expand, it is adaptive to be discriminative toward different targets in various social contexts (Martin & Olson, 2015). At approximately 5 or 6 years of age, children complete the development of basic ToM (Liu, Wellman, Tardif, & Sabbagh, 2008). Therefore, ages 3 to 6 years include developmental milestones and represent one of the earliest time periods for studying kin altruism. The current study employed the resource allocation paradigm to investigate altruism. Among the various types of altruism operations, such as instrumental helping (Warneken & Tomasello, 2006) and information provisioning (Liszkowski, 2005), resource sharing is the most explicit in incurring and calculating a cost on the part of the altruism provider (Martin & Olson, 2015), making this paradigm the most consistent with Hamilton's (1964) original theorizing of kin altruism.

We used three existing tasks to represent different cost–benefit ratios (Fehr et al., 2008). In the first task, referred to as the "costly sharing game" (Fehr et al., 2008), children are provided with a 4/0 option (four toys are allocated to the self and no toys to the target), a 3/1 option (three toys are allocated to the self and one toy to the target), and a 2/2 option (the self and target each receive two toys). This task, in which children have the option to incur a cost to benefit others (option 2/2 over 4/0 or 3/1), taps altruism or its strongest form among the three tasks. In the second task, named by Fehr et al. (2008) as the "prosocial game," children choose among 2/0, 2/1, and 2/2 options. This task, in which the giver always has two toys and can give the target zero toys, one toy, or two toys, incurs no cost on the part of the giver and is the least altruistic among the three tasks. In the final task, known as the "envy game" (Fehr et al., 2008), the three options are 2/4, 2/3, and 2/2. This task, in which the giver always has two toys and can give the target two, three, or four toys, represents a middle level of

altruism. We hypothesized that a kin altruism effect would induce children to allocate toys more generously to kin than to nonkin, that this effect would be more often or more strongly observed in older children compared with younger children, and that kin altruism would be unrelated to ToM.

Method

Participants

A total of 165 Chinese children (93 boys and 72 girls) were recruited from four kindergartens in a government-subsidized housing area in Hong Kong. The children all came from working-class families. Most of their parents had secondary educations. Of the children, 46 were 3 years old ($M = 44.0$ months, $SD = 2.4$), 49 were 4 years old ($M = 54.5$ months, $SD = 3.4$), 46 were 5 years old ($M = 65.8$ months, $SD = 3.3$), and 24 were 6 years old ($M = 75.8$ months, $SD = 1.8$). The children completed all tasks individually in a quiet room with a female experimenter and were given stickers as a reward after participating in the study.

Design

This study adopted a 3×4 mixed-model design with target (kin, friend, or stranger) as the within-participant variable and age (3-, 4-, 5-, or 6-year-olds) as the between-participant variable. In each trial, the children decided how they would allocate resources between a specific target and themselves. There were three types of allocation tasks: costly sharing, prosocial, and envy games. In each type of allocation task, the children completed 6 trials: 2 trials with a sibling or cousin as the target, 2 trials with a friend as the target, and 2 trials with a stranger as the target. In total, 18 trials were presented to the children in random order.

Procedure

After building rapport with a participating child, the experimenter asked the participant whether he or she had a sibling or cousin with whom the participant lived or frequently met. When given an affirmative answer, the experimenter presented a puppet to the participant and asked him or her to pretend that the puppet was the sibling or cousin. Previous studies have demonstrated the validity of employing puppets to investigate children's responses in sharing games (e.g., McCrink, Bloom, & Santos, 2010; Paulus, 2014). The participant was also shown a second puppet and a third puppet representing a friend with whom the participant liked to play and a stranger or another child of the same age, respectively. The allocation tasks began only after the participant passed a quiz on the identity of each puppet. At the beginning of each allocation trial, the target puppet was placed facing the participant across a table. To reinforce the identity of the puppet, the participants needed to correctly identify the puppet every time before they selected an option for allocation.

In each allocation trial, three pairs of dishes were also placed on the table. Each pair of dishes was connected by a belt so that the pairing was obvious. In each pair, one dish was on the participant's side and the other dish was on the target's side. The following is an example of one costly sharing allocation task in which the experimenter provided the following instructions verbatim:

> "Now you can choose how to share the toys between you and him/her [the target]. You have three options. If you choose this option [pointing to one pair of dishes], then you will have two toys and he/she will have two toys [two toys were placed on the participant's dish and two toys were placed on the target's dish]. If you choose this option [pointing to another pair of dishes], then you will have three toys and he/she will have one toy [three toys were placed on the participant's dish and one toy was placed on the target's dish]. If you choose this option [pointing to the third pair of dishes], then you will have four toys and he/she will have no toy [four toys were placed on the participant's dish and none was placed on the target's dish]. Which option will you choose?

After the participant responded, the toys from the selected pair of dishes were allocated to the participant and target accordingly and the experimenter said, "See, now you have X [number] toys and he/she has X toys." After the completion of each trial, all of the toys and the target were removed from the table, and the target of the next trial was then presented to begin the next trial. In each trial, the toys were either colorful heart-shaped erasers or colorful stamps. Both were favored by the children.

ToM was tested using two false-belief tasks. In the mistaken location task (Wimmer & Perner, 1983), a toy placed in a box by a puppet was transferred to another box by another puppet while the first puppet was absent. The participant was asked whether the first puppet knew the current location of the toy and where the first puppet would look for the toy. In the unexpected content task (Hogrefe, Wimmer, & Perner, 1986), the participant was shown the real content (train tickets) of a colored pencil container that depicts colored pencils on the outside and was then asked whether another child who had never looked into the container would know what was inside the container and what the other child would think was inside the container. Each correct answer was scored as 1. Thus, the combined scores in ToM for both tasks ranged from 0 to 4.

Results

The numbers 2, 1, and 0 were coded for options 2/2, 3/1, and 4/0, respectively, in the costly sharing task, for options 2/2, 2/1, and 2/0, respectively, in the prosocial task, and for options 2/4, 2/3, and 2/2, respectively, in the envy task. Thus, scores ranged from 0 (*least altruistic toward recipient*) to 2 (*most altruistic toward recipient*). Mean scores calculated by averaging the scores over all of the trials within each of the three tasks under the same target condition served as the dependent variable. Using the dependent variables of all three tasks, we conducted a 3 (kin, friend, or stranger; within participants) × 4 (3-, 4-, 5-, or 6-year-olds; between participants) mixed-model multivariate analysis of variance (ANOVA). The results revealed a main effect of target, $F(6, 156) = 4.22$, $p < .001$, $\eta^2 = .14$, a main effect of age, $F(9, 483) = 3.91$, $p < .001$, $\eta^2 = .07$, and an interaction effect, $F(18, 474) = 1.96$, $p < .05$, $\eta^2 = .07$.

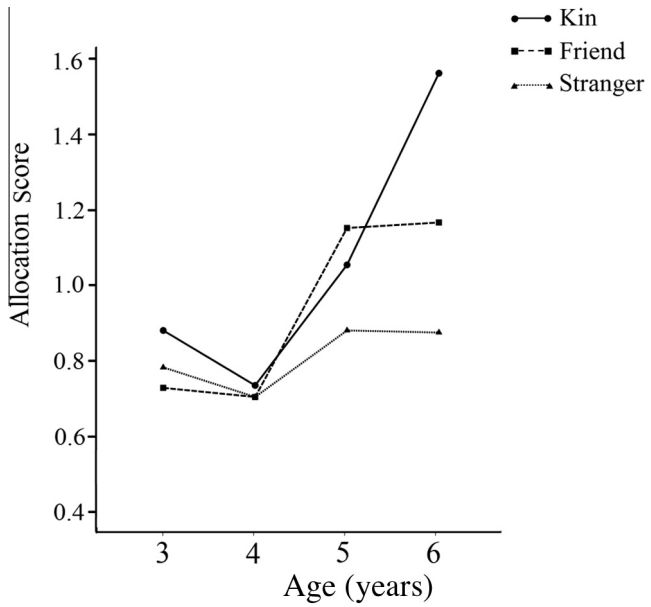

Fig. 1. Allocations to different targets by children of different ages in the costly sharing task. The scores range from 0 (*least altruistic*) to 2 (*most altruistic*).

Target and age effects in costly sharing task

We then conducted univariate tests for each of the three tasks. For the costly sharing task (Fig. 1), a 3 × 4 mixed-model ANOVA revealed a main effect of target, $F(2,160) = 9.19$, $p < .001$, $\eta^2 = .10$, a main effect of age, $F(3,161) = 4.35$, $p < .01$, $\eta^2 = .08$, and an interaction effect, $F(6, 322) = 3.69$, $p < .01$, $\eta^2 = .06$. Regarding the target effect, the children were more willing to allocate resources to kin ($M = 1.06$, $SE = 0.06$) than to friends ($M = 0.93$, $SE = 0.06$, $p = .05$) and strangers ($M = 0.81$, $SE = 0.06$, $p < .001$). The difference between allocation to friends and that to strangers was marginal ($p = .09$). Regarding the age effect, no difference was observed between the ages of 3 years ($M = 0.79$, $SE = 0.09$) and 4 years ($M = 0.72$, $SE = 0.09$, $p = .52$) or between the ages of 5 years ($M = 1.03$, $SE = 0.09$) and 6 years ($M = 1.20$, $SE = 0.13$, $p = .28$), but the 4-year-olds acted less altruistically than the 5-year-olds ($p < .05$) and 6-year-olds ($p < .01$). Regarding the interaction effect, the 3- and 4-year-olds did not act differently when allocating resources to kin, friends, or strangers, whereas the 5- and 6-year-olds treated the targets differently: 5-year-olds, $F(2, 44) = 3.34$, $p < .05$, $\eta^2 = .13$; 6-year-olds, $F(2, 22) = 8.05$, $p < .01$, $\eta^2 = .42$. The 5-year-olds were more altruistic and less selfish toward kin than toward strangers ($MD = 0.17$, $SE = 0.09$), $t(45) = 1.77$, $p = .08$, $d' = 0.20$, and were more altruistic and less selfish toward friends than toward strangers ($MD = 0.27$, $SE = 0.10$), $t(45) = 2.62$, $p < .05$, $d' = 0.33$, but they did not act differently when allocating resources to kin ($M = 1.05$, $SD = 0.84$) and to friends ($M = 1.15$, $SD = 0.81$), $t(45) = 1.18$, $p = .25$, $d' = 0.12$. The 6-year-olds were more altruistic toward kin ($M = 1.56$, $SD = 0.68$) than toward friends ($M = 1.17$, $SD = 0.73$), $t(23) = 2.87$, $p < .01$, $d' = 0.55$, or toward strangers ($M = 0.89$, $SD = 0.84$), $t(23) = 4.05$, $p < .001$, $d' = 0.88$, and they were more altruistic toward friends than toward strangers, $t(23) = 2.02$, $p = .05$, $d' = 0.35$. These results suggest that the 3- and 4-year-olds exhibited no kin altruism, the 5-year-olds exhibited some kin altruism, and the 6-year-olds exhibited the most kin altruism when allocating resources that incurred personal cost.

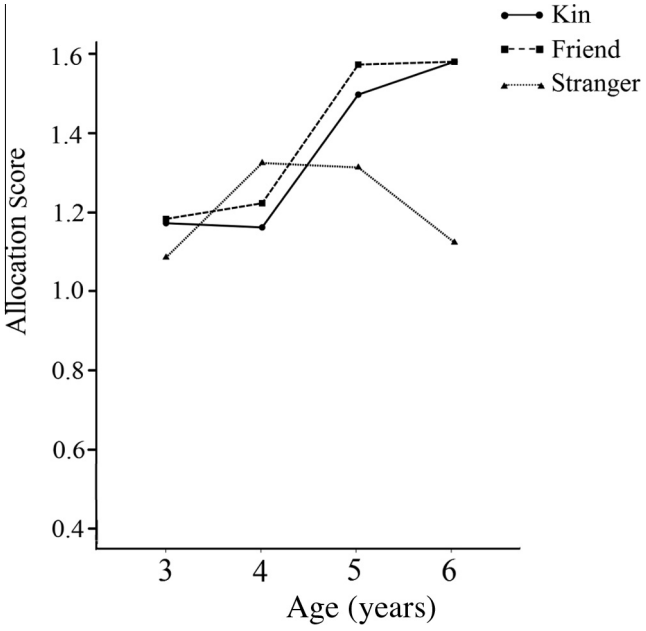

Fig. 2. Allocations to different targets by children of different ages in the prosocial task. The scores range from 0 (*least altruistic*) to 2 (*most altruistic*).

Target and age effects in prosocial task

In the prosocial task (Fig. 2), a 3 × 4 mixed-model ANOVA revealed a main effect of target, $F(2, 160) = 4.66$, $p < .05$, $\eta^2 = .06$, a main effect of age, $F(3, 161) = 4.40$, $p < .01$, $\eta^2 = .08$, and an interaction effect, $F(6, 322) = 2.68$, $p < .05$, $\eta^2 = .05$. Regarding the target effect, the children were less willing to allocate resources to strangers ($M = 1.21$, $SE = 0.06$) than to kin ($M = 1.36$, $SE = 0.05$, $p = .07$) or friends ($M = 1.39$, $SE = 0.05$, $p < .05$). In contrast to the costly sharing task, in which the children generally treated kin more favorably than they did friends, in this task they treated kin and friends similarly when allocating resources. Regarding age, no difference was observed between the children aged 3 years ($M = 1.15$, $SE = 0.07$) and 4 years ($M = 1.23$, $SE = 0.07$, $p = .35$) or between children aged 5 years ($M = 1.46$, $SE = 0.07$) and 6 years ($M = 1.43$, $SE = 0.09$, $p = .78$), but the 3-year-olds were not as altruistic as the 5-year-olds ($p < .01$) or the 6-year-olds ($p < .05$). Whereas there were no differences in resource allocation to different targets between the 3- and 4-year-olds, an equal target effect was observed for the 5-year-olds, $F(2, 44) = 2.98$, $p = .06$, $\eta^2 = .12$, and the 6-year-olds, $F(2, 22) = 5.73$, $p < .05$, $\eta^2 = .34$. The children aged 5 and 6 years responded similarly to kin ($M = 1.53$, $SD = 0.58$) and friends ($M = 1.58$, $SD = 0.60$), $t(69) = 0.76$, $p = .45$, $d' = 0.09$; they allocated fewer toys to strangers ($M = 1.25$, $SD = 0.74$) than they did to relatives, $t(69) = 3.41$, $p < .01$, $d' = 0.42$, or friends, $t(69) = 3.84$, $p < .001$, $d' = 0.47$. These results indicate that the 3- and 4-year-olds exhibited no kin altruism, whereas the 5- and 6-year-olds exhibited kin altruism when allocating resources that incurred no personal cost.

Age effect in envy task

In the envy task (Fig. 3), a 3 × 4 mixed-model ANOVA revealed a main effect of age, $F(3, 161) = 6.38$, $p < .001$, $\eta^2 = .11$, but no main effect of target or interaction effect. Post hoc analysis revealed that regardless of the target, the 6-year-olds ($M = 0.66$, $SD = 0.62$) were more altruistic, but also fairer, than the 3-year-olds ($M = 1.25$, $SD = 0.48$, $p < .001$), the 4-year-olds ($M = 1.19$, $SD = 0.55$, $p < .001$), and the 5-year-olds ($M = 0.96$, $SD = 0.74$, $p = .05$). In addition, the 5-year-olds were more altruistic than the 3-year-olds ($p < .05$) and the 4-year-olds ($p = .06$).

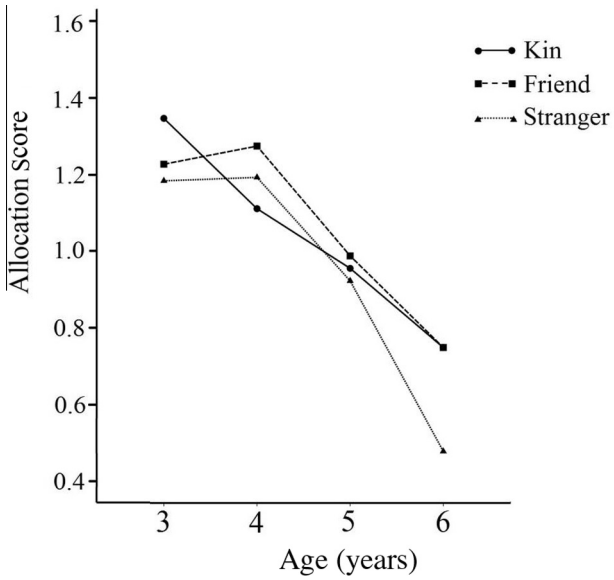

Fig. 3. Allocations to different targets by children of different ages in the envy task. The scores range from 0 (*least altruistic*) to 2 (*most altruistic*).

Table 1
Partial correlations of age and theory of mind with allocation scores and allocation contrast scores (final two columns).

	Allocation scores			Allocation contrast scores	
	Age controlled for ToM	ToM controlled for age		Age controlled for ToM	ToM controlled for age
Costly sharing task					
Kin	.21**	.00	Kin–stranger	.17*	.00
Friend	.23**	.04	Friend–stranger	.18*	–.04
Stranger	.05	.00	Kin–friend	.00	.05
Prosocial task					
Kin	.16*	.09	Kin–stranger	.10	.04
Friend	.22**	–.01	Friend–stranger	.16*	–.04
Stranger	.02	.03	Kin–friend	.06	.08
Envy task					
Kin	–.26**	.10	Kin–stranger	.03	–.01
Friend	–.29***	.18*	Friend–stranger	.02	.08
Stranger	–.31***	.12	Kin–friend	.02	–.09

Note. Higher allocation scores indicate more generous allocations.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

ToM and allocation toward different targets

Table 1 lists partial correlations of age (controlled for ToM) and ToM (controlled for age) with allocation and contrast scores. The contrast scores were calculated by subtracting scores obtained from allocations to one target from scores obtained from allocations to another target. Higher contrast scores suggest greater disparity in altruism exhibited toward two targets. The results suggest that a generous allocation toward kin and friends was related to age rather than ToM and that the discrimination among kin, friends, and strangers was accounted for by age but not by ToM.

Discussion

In all of the tasks, the 3- and 4-year-olds allocated resources indiscriminately. In the costly sharing and prosocial tasks, when sharing incurred no cost, the 5- and 6-year-olds treated kin and friends more favorably than they did strangers, whereas only the 6-year-olds favored kin over friends when sharing incurred cost. ToM was related neither to altruistic sharing nor to the kinship effect of sharing.

These findings suggest that the effect of kinship on costly resource allocation emerges at 5 years of age and becomes clear kin altruism by 6 years. Although previous studies have shown that 3- and 4-year-old children understand kinship terms (Benson & Anglin, 1987) and act more prosocially toward kin than toward nonkin in daily life (de Guzman, Carlo, & Edwards, 2008), children aged 3 and 4 years who were able to match a kinship term with a particular person did not exhibit kin altruism when allocating resources in the current experimental setting. In daily life, children may share more with kin because they are asked to do so by a particular relative such as a parent or sibling. However, in the experimental tasks, the target did not make any request and the children could choose freely among the options. Because 3- and 4-year-olds are likely to be egocentric and focused on the objects to be shared (Gummerum et al., 2010; Rochat et al., 2009), the lack of explicit expectation from the target nullified any kin altruism.

When the allocation incurred personal cost, the 6-year-old children showed altruism toward kin but not toward friends or strangers. When sharing was costless, the 5- and 6-year-olds treated kin and friends more altruistically than they did strangers. These results are consistent with previous findings on adult helping behaviors; people exhibit greater willingness to help kin than to help friends when the help is very costly such as donating a kidney or risking injury or death to rescue someone

(Kruger, 2003; Stewart-Williams, 2007). By contrast, when the help incurs a low cost, such as providing care or moderate financial assistance, adults help kin and friends equally. These results can be explained by kin selection theory, which posits that the cost of fitness that one pays in costly situations can be compensated by the fitness gained by the relative who shares common genes with the helper (Hamilton, 1964). Although the allocation tasks of this study were not as costly, we found that 6-year-old children exhibited kin altruism only in the costly sharing task, which is consistent with the adult findings. In the envy task, where the altruistic allocation put participants in a seemingly disadvantaged position compared with the recipient, children aged 3 to 6 years treated different targets equally and older children were less altruistic, but fairer, than younger children. The concern for altruism may have been less salient than the concern for fairness, especially for the older children. Similar observations have been reported in the literature (Fehr et al., 2008; Wittig et al., 2013), and children have shown an aversion toward inequity, particularly when it represents a disadvantage to them (Blake & McAuliffe, 2011; McAuliffe, Blake, & Warneken, 2014).

Finally, the results show that ToM was unrelated to kin altruism. Being altruistic and benevolent toward kin derives from genetically graded emotional and psychological closeness rather than merely requiring an understanding of others' perspectives. Therefore, the development of sharing in favor of kin may be more a matter of cognitive development related to the understanding of kinship concepts than a matter of social development related to the understanding of how others feel. Previous studies have shown a similar lack of correlation between ToM and sharing, although the findings are mixed. In one study, a negative correlation between ToM and sharing was exhibited by 3- to 5-year-olds playing a dictator game in which the children freely decided whether to share an endowment and, if so, how much (Cowell et al., 2015). However, other studies have reported marginally positive to positive correlations among children of a similar age range playing the same game (Rochat et al., 2009; Wu & Su, 2014). If a recipient was entitled to accept or reject the shared portion of an endowment, ToM seemed to facilitate sharing in 4- to 6-year-olds (Takagishi et al., 2010) but not in 4- and 5-year-olds (Lucas et al., 2008). However, none of these studies included kin. We speculate that sharing with kin can evoke kin altruism that may be stronger than the fluctuating effect of ToM.

There are several limitations of this study. First, the operationalization of kinship as siblings or cousins might not capture enough coresidence experience, especially for younger children and those with a younger sibling rather than an older sibling. An alternative approach is to define kinship only as parents who can then be compared with other adult figures as friends and strangers. Future studies may also maintain the current operationalization of kin but record the length of coresidence between siblings, which can then be investigated for its own effect (Lieberman, Tooby, & Cosmides, 2007). We also did not separate siblings from cousins as the kin target of the resource allocation task because more than 80% of the participants had siblings and used siblings as the kin target and subsequent analysis showed no difference between those who used siblings and those who used cousins as the target. Future studies can deliberately compare children who have siblings with children who do not have siblings or cousins to further understand the development of kin altruism and other kinship concepts. Second, we designed the allocation task so that the participants themselves were involved in the allocation. This approach captures a deeper or stronger kinship effect that may incur a cost on the self but precludes direct comparisons among kin, friends, and strangers. Future studies may employ multiple allocation paradigms to investigate the kinship effect in different contexts. Third, this study employed toys rather than food as the items to be allocated. The attractiveness to children of having multiple toys may be lower than that of having multiple food items (e.g., pieces of candy) because the joy of eating different food items at different times is additive, whereas the joy derived from playing with similar toys might not differ considerably from that of playing with a single toy. The lower attractiveness of toys compared with food might skew the results in a direction where children appear to be more generous to others. Nonetheless, toys were demonstrated as equally attractive as food (Gummerum et al., 2010), and food and toys have been used interchangeably in allocation games (Rochat et al., 2009). We did not use food as the allocation items because food was not approved by the research sites. In addition, the toys adopted in this study were similar to the stickers that were used as rewards, and the children in the research sites exhibited pride in having many stickers.

Conclusions

Kin altruism was exhibited by the 5-year-old children and appeared to be fully developed in the 6-year-olds only in the context of costly resource allocation tasks. In noncostly resource allocation, the 5- and 6-year-olds were equally altruistic toward kin and friends but not toward strangers. In tasks that put the children in a comparatively disadvantaged position, children in none of the age groups exhibited altruism or kin altruism. Analyzing the results for all three tasks suggests that kin altruism was uncorrelated with ToM.

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