The Impact of Inequality on Young Children's Prosocial Behaviors

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Abstract

Inequality, especially wealth inequality, has been steadily increasing over several decades around the world. Previous studies indicated that greater inequality adversely affects adults' social behaviors and wellbeing. Yet it remains unknown whether and how the experience of inequality impacts young children's social behaviors. The present study addressed this gap by examining how 4- to 9-year-old children's experience of inequality impacts their general prosocial behaviors. Children in the U.S. (N = 236) were asked to play a distribution game with a peer and were randomly assigned to receiving half as many (Disadvantageous Inequality, DI), twice as many (Advantageous Inequality, AI), or the same number of tokens as a peer (Equality, E) or half as many as a box (Non-social DI). We then measured their sharing behavior toward a new child. The results suggested that across ages, children judged the machine as unfair when they received less than the peer (DI), whereas only older children also judged receiving more than the peer (AI) as unfair. The experience of inequality also gave rise to negative emotion. However, inequality did not undermine children's sharing behavior; rather, children shared more generously with age. Further, an exploratory analysis suggested that the experience of receiving more than the peer (AI) may promote boys' prosociality. Together, this study explored the effects of inequality on children's prosocial behavior and points to important future directions for exploring how wealth inequality may impact children's social functioning and long-term wellbeing.

The Impact of Inequality on Young Children's Prosocial Behaviors

Income inequality or wealth inequality continues to increase in the United States and across the globe (Pew Research Center, 2020). According to the World Inequality Report (2022), the global richest 0.01% shared 7% of the wealth in 1995, whereas this number increased to 11% in 2021. Similarly, within the US, the top 10% earned 9 times more than the bottom 50% in the 1980s, and this gap has now increased to 17 times (World Inequality Report, 2022). This ballooning inequality deserves public attention and concern since growing literature suggests that such inequality is strongly associated with a host of adverse health and societal problems. For instance, higher inequality is associated with higher mortality, mental illness, and obesity, and lower educational attainment and social mobility (Wilkinson & Pickett, 2009). Importantly, inequality is also associated with poorer wellbeing and social functioning, such as reduced social trust and happiness (Oishi et al., 2011). Moreover, having less than others – especially when the inequality is perceived to be unjustified – is shown to lead to greater resentment, aggression, and risk-taking, and reduced prosocial behaviors (Greitemeyer & Sagioglou, 2016, 2017; Payne et al., 2017; Callan et al., 2011, 2017).

Although these previous findings indicate an adverse impact of inequality on adults' health and social behaviors, it remains unknown whether and how inequality may influence young children's social behaviors. In 2016, around 44% of American children under the age of 9 lived in low-income families (i.e., below 200% of the federal poverty threshold), and 10% of children under age 3 years lived in deep poverty (Koball & Jiang, 2018). The child poverty rate decreased recently, yet one in seven American children still lived below the

poverty line in 2021 (OECD, 2023). Therefore, many children in the U.S. are highly likely to observe and experience inequality starting in early childhood.

Meanwhile, born in a world with such prominent wealth disparities, children can readily harness wealth information to guide their inferences and interactions with people of different economic backgrounds (e.g., Chafel & Neitzel, 2005; Dunham et al., 2014; Enright et al., 2020; Shutts et al., 2016; Elenbaas & Killen, 2016; Zhang et al., 2021). For instance, children as young as age three are sensitive to wealth status and expect the rich to possess high-value belongings (e.g., a fancy house; Olson et al., 2012). Thus, even children who are not low-income may experience advantageous or disadvantageous inequality by easily comparing their own and their family's resources to those of individuals with different wealth-status. How might these experiences of inequality impact children's social behaviors and wellbeing? Given that early life experiences not only play a critical role in childhood but extend throughout an individual's lifetime, it is vital to understand how the experience of inequality affects children's social behaviors and, ultimately, their long-term outcomes such as health and wellbeing.

Children's developing understanding of fairness and inequality

There is ample evidence that children have a strong preference for fairness and can recognize inequality from infancy and early childhood. For example, in the first year of life, infants as early as 4 months expect to see equal distribution of resources (Buyukozer Dawkins, et al., 2019). Around 16 months, infants' expectation of equal distribution is more robust (e.g., Enright et al., 2017; Schmidt & Sommerville, 2011; Sommerville, 2013) and they prefer to choose and affiliate with a distributor who allocates resources equally to the

recipients compared with an unfair distributor (e.g., Geraci & Surian, 2011; Lucca et al., 2018). Moreover, infants start to take merit into consideration, such that at around 17 months, infants expect the recipient who worked harder to receive more rewards (Sloane et al., 2012; Wang & Henderson, 2018), and by the age of 3, they begin to allocate rewards according to the recipients' contribution (Baumard et al, 2012).

At the same age, children start to object to inequality and show inequality aversion. For instance, they reject unequal distribution and share resources with their collaborative partners in order to create equal outcomes (Hamann et al., 2011). The experience of getting less than others also leads 3-year-olds to protest and show negative emotional reactions (Rakoczy et al, 2016; LoBue et al., 2009; Kim et al., 2023). However, young children's inequality aversion is not always in line with their understanding of fairness and may be biased by their self-interest. For instance, they distribute more resources to themselves than another child even though they state they should share equally (Smith et al., 2013); preschoolers reject unequal offers only when this distribution disadvantages them, but not when they get more than the other (Blake & McAuliffe, 2011; Blake et al., 2015; Sheskin et al., 2014).

With development, children's behaviors start to match their judgments. After the age of 7, children often reject unequal offers even when the inequality is advantageous for them (Blake & McAuliffe, 2011) and share equally between themselves and others (Smith et al., 2013). With age, children also view both advantageous and disadvantageous inequality as unfair (Peretz-Lange et al., 2022). Meanwhile, their perceptions of fairness become more flexible, such that they begin to consider merit as well as to balance others' needs and type of

resources, and thus to value equity (i.e., distributions based on deservingness) instead of simple equality (i.e., identical distributions) in a more sophisticated way (e.g., Rizzo et al., 2016; Schmidt et al., 2016). They also gradually become more aware of disparities in wealth status, negatively evaluate resource inequality, and are increasingly willing to rectify this inequality (Elenbaas & Killen, 2016; Elenbaas et al., 2016). For instance, while 3- to 4-year-old children prefer to distribute resources equally between a rich and a poor recipient, by age 7, children favor strategies to rectify wealth-based inequalities by allocating more resources to the poor (Rizzo & Killen, 2016).

Together, this work suggests that children gradually develop an increasingly sophisticated concept of fairness and object to inequality while valuing justice and equity. Although this existing work has focused on children's understanding, evaluation and moral reasoning of inequality and fairness, none of those studies explored how children's *own* experience of inequality impacts their subsequent social behaviors, such as prosocial behaviors. As reviewed before, with increasing inequality across the globe and children's early understanding of fairness and inequality, it is critical to examine the potential impact of the experience of inequality on children's social behaviors in order to gain a deeper understanding of how children are affected by inequality and, ultimately, to help buffer children against the adverse impacts of wealth inequality.

Prosocial behaviors and inequality

The present work focuses on prosocial behaviors, i.e., behaviors that benefit others (e.g., Eisenberg et al., 2013), such as helping or sharing. Prosocial behaviors represent investments in one's social ties that build long-term cooperative relationships and cement

social networks. They evoke positive responses in others and thus reinforce children's positive internal working models and trust in the goodness of others. As such, they are integral to children's social bonds and the backbone of healthy families and societies (Laible et al., 2014; Padilla-Walker & Carlo, 2014). Prosocial behaviors also elicit positive emotions and are related to subjective wellbeing in both children and adults (Aknin et al., 2012; Eisenberg et al., 2006; Weinstein & Ryan, 2010). Disruptions in children's prosocial capacities can thus prove detrimental to their social development and wellbeing, both concurrently and in the long term.

Although little work has been done on how the experience of inequality impacts children's prosocial behaviors, there is a large literature exploring the relation between wealth inequality and adults' prosocial behaviors and wellbeing. For instance, wealth inequality in a society is highly associated with the rate of homicides, imprisonment, racism, and hostility (Wilkinson & Pickett, 2009) and even causally affects population health (including violence) and wellbeing (Pickett & Wilkinson, 2015).

On the one hand, having less than we need focuses our attention on ourselves and our immediate needs, leaving us less able to focus on other tasks (Mani et al., 2013). This likely undermines our capacity to focus on others' perspectives and needs, thus reducing our motivation or ability to act prosocially towards others. On the other hand, larger wealth disparities may increase social distance between individuals, thus highlighting the differences in social class or status. These gaps then give rise to less personal trust, less happiness, and more perceived unfairness (Oishi et al., 2011; Uslaner & Brown, 2005). More importantly, the accompanying social comparisons derived from differences in social class or status may

contribute to a feeling of being disadvantaged and this feeling may be followed by the experience of 'Personal Relative Deprivation' (PRD, i.e., the resentment stemming from the belief that one is worse off than similar others), which may evoke hostile emotional reactions (Smith et al., 2012). Indeed, adults with higher PRD have been shown to report more state hostility, aggression and be less prosocial than adults with lower PRD (Callan et al., 2017; Greitemeyer & Sagioglou, 2016, 2017). Thus, inequality – and especially perceived inequality – adversely affects adults' social functioning and prosociality, which can have dramatic interpersonal, psychological, physiological, and societal implications.

Correlations between inequality and children's prosocial behaviors

Previous work has documented that wealth or income inequality relates to children's and adolescents' wellbeing and health. For example, higher income inequality is significantly associated with higher rate of child maltreatment, school bullying, juvenile homicides, overweight, and mental health problems (Eckenrode et al., 2014; Elgar et al., 2009; Pickett & Wilkinson, 2007). However, it remains unclear whether the pernicious impact of inequality extending to children's prosocial behaviors.

Some limited research has examined the impact of socioeconomic status (SES) on children's prosocial behaviors, though this has produced mixed evidence. For instance, one line of work suggested that children with low SES background are more aggressive and less prosocial (Dodge et al., 1994; Malti et al., 2013). However, other work shows the opposite: children of lower SES are more altruistic than children of higher SES (Miller et al., 2015; Chen et al., 2013). The link between SES and children's prosocial behaviors remains unclear. More importantly, the work on SES makes it hard to tease apart the specific role of inequality

from that of other factors that tend to be related to SES such as social support, educational background, and access to health. Therefore, we still need work to speak to the direct casual relation that may exist between the experience of inequality and children's prosocial behavior.

Another bigger concern is that this work has not accounted for children's perception of inequality since children's SES background is not necessarily in line with or linearly related to their perceived inequality. As mentioned before, different social hierarchy derived from wealth inequality gives rise to the relative deprivation that may lead to resentment and hostility (Smith et al., 2012). Some studies among adolescents thus partially addressed this concern from the perspective of relative deprivation: moving to a more affluent neighborhood (i.e., experiencing relatively disadvantaged standing) is associated with increased externalizing (e.g., aggression) and internalizing problems (e.g., depression) (Nieuwenhuis et al., 2017). However, this work was also correlational, thus still leaving unknown the potential causal impact of the perception of inequality.

Experimental evidence between inequality and children's prosocial behaviors

To our knowledge, there is only one recent line of research that has addressed a closely-related question, namely, children's responses to environmental inequality, i.e., the degree to which children are in a generally equal or unequal social setting (Kirkland et al., 2020). In this work, 4-year-old children played a game against six puppets for rewards. During the game, children received a medium number of rewards compared with other puppets (three puppets received more rewards than the participant and the other three puppets received fewer rewards than the participant). Some children were exposed to a high

inequality situation, where other puppets received *far more or fewer* rewards (e.g., 8 or 10 more/less) than the participant, whereas other children were exposed to a low inequality situation, where other puppets received *little more or fewer* rewards (e.g., 1 or 3 more/less) than the participant. The researchers measured children's donation behavior towards an unknown sick child and found that 4-year-old children were less generous when assigned to a high inequality condition compared to a low inequality condition (Kirkland et al., 2020). However, this finding was not replicated in their later work, in which both younger (4- to 6-year-old) and older children (7- to 9-year-old) shared similar amounts of stickers regardless of which inequality condition they were assigned to (Kirkland et al., 2021a). The impact of environmental inequality on children's sharing behavior thus remains unclear.

More importantly for the present study, although Kirkland et al. (2020; 2021a) created an experimental setting to explore the impact of inequality on children's prosocial behaviors, it focused on *environmental inequality*. Though environmental inequality is certainly one pertinent form of inequality in the real world, it does not necessarily speak to one's own direct experience or perception of inequality derived from social comparison with others, which is also a common form of inequality. In other words, the prior studies manipulated the degree of inequality in the child's environment but, as children were always the middle earners across the two inequality situations, the studies did not manipulate children's perception of their own unequal situation in comparison with others. Indeed, in Kirkland et al.'s studies, children's evaluations of the fairness of the distributions did not vary across conditions, indicating that children's perceived inequality did not differ in their paradigm. Yet as previous work among adults and adolescents shows, the perceived inequality is more

likely to exert a stronger effect on psychosocial behaviors compared with the objective environmental inequality (e.g., Callan et al., 2017; Nieuwenhuis et al., 2017).

Kirkland and colleagues' recent work partially addressed this concern (Kirkland et al., 2021b). They assigned children as high earners or low earners in a distribution game against six puppets, then they measured how children 1) donated stickers to an unknown child and 2) distributed an extra token to one of the puppets. They found that 4- to 6-year-old children donated similar number of stickers to an unknown child regardless of their earning, suggesting that their relative earning status may not impact their general prosociality to unknown others. However, for the resource redistribution task, children who were low earners were more likely to give the extra resource to the high earning puppet instead of rectifying the current inequality by distributing the extra resource to a low earning puppet. Conversely, the majority of high earners chose to give the extra resource to the low earning puppet (see Kirkland et al., 2021b, Experiment 1). These findings may suggest that children who experienced disadvantageous inequality were less likely than children who experienced advantageous inequality to rectify unequal distribution, indicating that disadvantageous inequality may undermine prosociality.

Again, although this work did go some way towards addressing our questions, the causal impact of inequality on children's prosociality is still unclear. First, the findings in Kirkand et al. (2021b) resource redistribution task can be alternatively explained by children giving the extra resource to the puppet who cannot threaten their relative status, since children in both conditions distributed the extra resource to the puppet who was in a contrasting position. If so, two ways of inequality may both diminish prosociality since

children in both conditions reacted in their own interest. Alternative explanations make it hard to tease apart the effects of disadvantageous inequality and advantageous inequality, especially when there is no baseline condition (i.e., children's reactions under an equal distribution). Additionally, Kirkand et al. (2021b) resource redistribution task assessed children's prosocial behavior within the distribution game and towards one of the individuals with whom they had played and experienced inequality, leaving open whether the impact of inequality extends to children's general prosocial behaviors beyond the specific inequality situation and interactants. More generally, children's varying prosocial responses across studies (Kirkland et al., 2020, 2021a, 2021b) do not provide a clear picture of how inequality may impact children's prosocial behaviors.

Present work

Despite the vital importance of understanding the implications of wealth inequality on social development and outcomes, little research has systematically addressed this question. The limited research that does exist is almost entirely correlational in nature, has typically employed measures of SES (or proxies thereof) rather than inequality as such, or has addressed children's understanding of inequality but not the impact of inequality on children's social behaviors, or has focused on environmental inequality but not children's own experience of inequality. In contrast, the present work addressed these concerns by examining the impact of inequality on children's social behaviors using well-controlled procedures to experimentally manipulate children's experience of inequality. This innovation will permit us to isolate the causal impact of inequality on children's behavior, which will allow for far firmer conclusions than prior work has done.

The present work thus investigated the impact of inequality on young children's prosocial behaviors. We experimentally created disadvantageous and advantageous inequality of resources among children aged 4 to 9 years in the U.S. and examined whether this experience of inequality impacted children's subsequent prosocial behavior (sharing) towards a new individual. We also added an equal distribution and nonsocial-disadvantageous inequality as comparison. We focused on children in this age range since over this range, children are increasingly capable of understanding inequality and fairness and showing sensitivity to wealth status and accompanying inequality (e.g., Blake et al., 2015; Elenbaas & Killen, 2016; Yang & Dunham, 2022; Zhang et al., 2021). Additionally, we measured children's prosociality to an unknown peer as the first step to detect the potential causal impact of inequality on children's *general* prosocial behaviors instead of their specific reactions towards an individual who interacted with them before.

Based on prior work with adults, as well as limited evidence of the negative relation between environmental inequality and prosocial behavior (Kirkland et al., 2020, 2021b), we hypothesized that the experience of inequality would impact children's prosocial behaviors. Specifically, we predicted that children who experienced disadvantageous inequality (receiving less than their peer) would show less prosocial behavior than children who experienced equality or children who experienced advantageous inequality (receiving more than their peer).

The current work also aimed to explore the developmental trajectory of children's perception of inequality as well as the impact of inequality. We did not have strong predictions regarding developmental changes but considered two plausible hypotheses. On

the one hand, given that with age, children increasingly recognize and attempt to rectify unfair distributions (e.g., Elenbaas & Killen, 2016; Rizzo & Killen, 2016), we may expect that with age, children in our study will be more impacted by inequality and will thus be less prosocial after experiencing disadvantageous inequality. On the other hand, given that by the early school years, children have strongly internalized norms of fairness (Blake & McAuliffe, 2011), we may expect that with age, children's sharing behavior will more clearly follow norms of equal distribution and thus be less impacted by their prior experience of inequality.

Meanwhile, we also measured children's fairness evaluation of the distribution and their emotional changes during the game to deeply understand how inequality impacts children's fairness perception, happiness and how these processes may relate to their behaviors. Since children's understanding of inequality or fairness become sophisticated with age (e.g., Blake & McAuliffe, 2011; Blake et al., 2015), we hypothesized that children would show different developmental trajectories of understanding fairness of distributions. Specifically, we predicted that both younger and older children would regard disadvantageous inequality as unfair, however only older children would view advantageous inequality as unfair as well. And according to children's aversion to inequality at young age (e.g., LoBue et al., 2009), we expected that children over this age range who experienced inequality would report more negative emotional reactions.

Methods

Power analysis

We conducted a priori power analysis (G*Power 3.1; Faul et al., 2007). Based on a preliminary study using a similar paradigm with 6- to 9-year-old children, a sample size of 35

children in each of four conditions is sufficient to achieve 97% power with an alpha score of 0.5. Since we decided to explore a wider age range from 4 to 9, we increased the sample size to 60 participants in each of four conditions (i.e., 240 total participants) to fully counterbalance all aspects of the design. The sample size, procedures, and analysis plan for this study were pre-registered on AsPredicted (https://aspredicted.org/5G8_R1N).

Participants

A total of 247 children between 4 and 9 years participated in the current study. Participants were recruited from a database of families living in a medium-size mid-Atlantic town as well as from diverse locations in the U.S through Facebook advertisement. Eleven participants were excluded: 3 due to experimenter error, 5 because they did not complete the whole testing session and 3 because they did not pass comprehension questions. The final sample thus consisted of 236 (planned 240) U.S. children between the ages of 4 and 9 (M_{age} = 6.99, SD = 1.70, 119 girls).

Geographic information was available for 98% of the sample; this subset came from 35 different U.S. states: 40% were from the Southeast (e.g., VA, GA), 21% were from the Northeast (e.g., NY, PA), 17% from the West (e.g., CA, UT), 18% from the Midwest (e.g., OH, IL), and 5% from the Southwest (e.g., TX). Demographic information was available for 96% of the sample. Of this subset, 62% identified as White, 15% as Asian, 4% as Hispanic, 3% as Black, and 16% as more than one race or other. Finally, 96% of families reported income and education. The median household income level was $100,001-$150,000, and 93% of the participants had at least one parent with a bachelor's degree or higher.

Materials and procedure

Participants were tested online via Zoom due to the COVID-19 pandemic. Participants' parents were asked to help participants set up the Zoom meeting and let their children answer all the questions by themselves. The experimenter then briefly explained the study to children to make sure they felt comfortable and provided assent before starting the study. Next, the experimenter shared their screen to present study slides with participants. The testing sessions were recorded using the 'record' function on Zoom.

The study consisted of two main phases: manipulation of inequality followed by the prosocial task.

Manipulation of inequality

In the first phase, children were asked to play a resource distribution game online with a gender-matched peer. The peer was not in fact playing with them live; however, to make sure children believed there was really another child playing with them, a prerecorded video of a real child was presented. In this video, the gender-matched child introduced themselves by name and let the participants know that they were ready for the game. The participants were then presented with a novel virtual machine that appeared to randomly give out tokens to participants and the peer (see Figure 1). To make the resources valuable for participants, they were told that at the end of the game, they could exchange the tokens for real gifts (i.e., scratch papers, that allow for colorful artwork) that the experimenter would mail to them after the game.

Over 10 rounds, the machine was pre-set to sometimes dispense equal amounts to the participant and peer, sometimes more to the participant, and sometimes less to the participant. At the end of the 10 rounds, the participant either had the same number of tokens as the peer

(Equality condition, E), twice that of the peer (Advantageous Inequality condition, AI), or half that of the peer (Disadvantageous Inequality condition, DI). We controlled the number of tokens participants received across conditions and only changed the number of tokens the peer received to achieve these allocations. Thus, at the end of the distribution game, every participant received 24 tokens and could exchange those tokens for 2 scratch papers. The peer either received 24 tokens as well (2 scratch papers: E condition), 12 tokens (1 scratch paper: AI condition as the participant received more than the peer) or 48 tokens (4 scratch papers: DI condition as the participant received less than the peer). To ensure any effects of inequality arose from social comparisons instead of mere frustration about receiving less, we also conducted a Nonsocial-Disadvantage (NS-D) condition in which the machine distributed tokens between the participant and a box. Participants were told that the tokens that went to the box would be put into the box, and no one would get those tokens. Children were randomly assigned to one of the four conditions (E, AI, DI, or NS-D). To ensure comprehension, on each of the 10 distribution rounds, children were asked how many tokens they received and whether they received more or less than the peer. If they failed to answer them correctly, the experimenter helped participants count tokens together and made sure they knew the correct number of tokens and understood who received more or less. After recounting, if they still got wrong answers, the experimenter told the correct number of tokens and let them know who got more. Children who got wrong in recounting for 3 or more rounds ($N = 3$) were excluded from data analyses.

Sharing task

In the second phase we measured children's prosocial behavior by measuring their sharing towards a new child. We first told children that since they helped us so much, in addition to the scratch papers we would also mail out 5 stickers to them. To maximize the likelihood that children would be interested in stickers, we offered three types of stickers (star stickers, happy face stickers and heart stickers) and asked participants to pick the kind that they preferred. Participants were then presented with a picture of a sick child (White, gender-matched) and told that if they wanted, they could share some of their stickers with the sick child to make him/her happy. And the experimenter presented pictures of two envelopes, one for the participant and another one for the sick child. They were told that the stickers that they wanted to share would go into the sick child's envelope and the rest of them would leave in their own envelope, and the experimenter would mail envelopes to them after the game. Previous work indicated that at the age of 5, children are concerned about their reputation (Engelmann et al., 2012). Thus, to avoid the impact of reputation management on children's sharing behavior, the experimenter told children that she would leave and only the computer would know their decision. The experimenter then stepped out of participants' view and played a prerecorded audio with a female AI voice to make it appear as though the computer alone was conducting the sharing task. On the screen, children were presented with 6 choices of sharing options ranging from sharing none of the stickers to sharing all 5 stickers, and the AI voice asked children to say their decision out loud. After children said their decision, the experimenter (off screen) selected the corresponding slide to show children's choice. On this slide, the AI voice double-checked children's decision by asking whether the number of stickers that they want to share was correct. If children declined, the experimenter would

return to the slide that presented 6 choices of sharing options and repeat all the steps. After double-checking, the stickers on the screen then went into the appropriate envelopes and covered (i.e., the shared stickers went to the sick child's envelope, the rest of them went to the participant's envelope). Thus, from the perspective of participants, the experimenter would not know what the child had selected. Then the experimenter returned and continued the remaining sessions. We used the number of stickers that participants shared as the main dependent variable, ranging from 0 to 5.

Other measures

In addition to the main measure of children's prosocial behavior, we also measured children's other responses that may be influenced by the experience of inequality.

Emotional changes. To explore children's emotional changes while playing the distribution game, we measured children's emotional reactions before they played the distribution game and after the distribution game. Children were presented with a child-friendly 5-point scale of faces changing from a very sad face to a very happy face, and asked to point to the face to show their current feeling. Children's responses were coded as numbers from 1 to 5 (1 = "very sad", 5 = "very happy"). We computed the difference score using the post-test emotional reaction score minus the pre-test emotional reaction score as the emotional change of each participant, ranging from -4 to 4. Negative emotional change scores indicated children were sadder after playing the distribution game, positive emotional change scores indicated children were happier after playing the game, and 0 indicated no change.

Sympathy. After the prosocial task, we also measured children's sympathy toward the sick child by asking them how sorry they feel for the child on a 3-point scale (1 = "not at all

sorry", 3 = "really sorry"). This measure was included as sympathy is an important motivator of children's sharing behavior (see, e.g., Vaish et al., 2009) and we wanted to account for this additional motivator.

Fairness evaluation. After the sympathy measurement, we asked children to evaluate the fairness of the virtual machine in two steps. We first asked a force-choice question (i.e., "Do you think the machine is fair or not fair?"). Depending on children's response to this question, we then asked an additional question to measure how fair/ unfair they thought the machine was on a 3-point scale changing from "a little bit (not) fair" to "really (not) fair". We coded children's fairness evaluation of the virtual machine as numbers ranging from 1 to 6 (1 = "really not fair", 6 = "really fair")

Debriefing

After the entire testing session, the experimenter told children in the DI condition that the machine had malfunctioned today and that she would give them 2 more scratch papers; thus, children in the DI condition ultimately received the same number of scratch papers as the peer. After the study, the scratch papers and stickers were mailed to all participants.

Results

Analytic strategy

As per our pre-registered analyses, we performed a linear regression model on the number of stickers participants shared as a function of condition (AI, DI, E or NS-D), age (continuous), and their interactions in R (Version 4.1.2, R Core Team, 2021). For the other measures of interest (emotional changes, sympathy and fairness evaluation), we conducted similar linear regression models. Since there were four conditions, to better interpret the

regression models, we ran the *Anova* function in *car* package on all models that included condition and report corresponding statistics. For our main measurement (i.e., prosocial behaviors), we also conduced pre-registered exploratory analyses of participants' gender and socioeconomic status on children's prosocial behavior.

Prosocial behavior

The linear regression model revealed a significant main effect of age, $F(1,228) = 19.53$, $p < .001$, suggesting that with age, children were more likely to share their stickers with the sick child. This pattern is in line with previous findings that older children are more generous and willing to sharing their own resources with others (e.g., Benenson et al., 2007; Kirkland et al., 2021). However, contrary to predictions, there was no main effect of condition, $F(3, 228) = 1.19$, $p = .31$. There was also no interaction between condition and age, $F(3, 228) = 0.92$, $p = .43$ (Figure 2), indicating that children's sharing behavior toward a new, unknown peer was not impacted by their experience of inequality/equality in our manipulation.

Exploratory analyses

We performed two exploratory analyses to explore how (1) participant gender and (2) family socioeconomic status may moderate children's prosocial behavior after experiencing inequality.

We first added participant gender as an additional fixed factor into the original model. The analysis revealed the interaction between condition and participant age was moderated by participant gender, $F(3, 220) = 2.79$, $p = .042$. To untangle the three-way interaction, we assessed boys' and girls' prosocial behavior by performing two linear regression models as a

function of condition and age and their interactions. The interaction between condition and participant age was significant for boys' prosocial behavior, $F(3, 109) = 3.02$, $p = .033$, but not for girls', $F(3, 111) = 0.78$, $p = .51$ (Figure 3). The simple slope tests indicated that with age, boys in NS-D condition and AI condition shared more stickers (NS-D: $B = 0.66$, $SE = 0.13$, $t = 4.77$, $p < .001$; AI: $B = 0.35$, $SE = 0.14$, $t = 2.61$, $p = .010$). However, boys in E condition and DI condition shared similar number of stickers across the age range (E: $B = 0.11$, $SE = 0.14$, $t = 0.77$, $p = .44$; DI: $B = 0.21$, $SE = 0.16$, $t = 1.32$, $p = .19$). The fact that boys showed a similar pattern in the DI condition as the E condition suggests that experiencing disadvantageous inequality did not reduce boys' prosociality. Instead, the increasing pattern with age in the AI condition hints that with age, getting more than others may increase boys' generosity. Interestingly, boys showed a similar increase in generosity with age in the NS-D condition, in which they received less than a box (a non-social comparison). For girls, neither the main effect of condition nor age reached significance, suggesting that girls' prosocial behavior kept constant across conditions and the age range. We caution that we did not predict these gender differences and these analyses were exploratory; more research is needed to understand these findings.

To explore how children's SES level impacts the original model, we only used the subset of participants who reported their family income and parent's education background ($N = 229$) and created a composite SES measure by (1) standardizing the average education level of the parent(s) (which had been converted to years of education prior to standardizing) and the total income of the household, and then (2) averaging these two scores (education and income) into a composite SES variable. This subset included 29 participants (12.66%) with

high-SES level (+1 *SD*), 35 participants (15.28%) with low-SES level and 165 participants (72.05%) with middle-SES level. The analysis only revealed a significant effect of age, $F(1, 213) = 16.56$, $p < .001$, and this effect was not moderated by participant SES level or condition, $F(3, 213) = 1.03$, $p = .38$. We also ran separate linear regression models for family household income and average education level. The two models did not detect significant effects of household income level or education on children's prosocial behavior, ps > .41. The exploratory analyses suggested that children's SES background may not impact their prosocial behavior. Since SES background was not our main measurement, however, more work is needed to examine the relation between SES and prosociality systematically in the future to draw clearer conclusions.

Other measures

Emotional Changes

We submitted children's difference score of their emotional responses to a linear regression model as a function of condition, participant age and their interaction. Only the main effect of condition reached significance, $F(1, 226) = 7.62$, $p < .001$ (Figure 4). Pairwise comparison tests indicated that, when children received fewer resources than the peer (DI condition), they became less happy after the game ($M = -0.61$, $SD = 1.09$) compared with children who received more resources than the peer (AI: $M = 0.08$, $SD = 0.97$, $p < .001$), or received the same number of resources as the peer (E: $M = 0.10$, $SD = 0.86$, $p < .001$). Further, children in the non-social condition (NS-D: $M = -0.37$, $SD = 0.90$) also reported reduced happiness compared with E condition, $p = .042$ and marginally less happiness than in AI condition, $p = .06$. These analyses suggested that the experience of receiving less

significantly influenced children's emotion in both social and non-social condition and that children became unhappy when they received less than the peer or the box.

Sympathy

The similar linear regression model on children's sympathy toward the sick child suggested that there was no significant effect of participant age ($F(1, 226) = 1.21$, $p = .27$), condition ($F(3, 226) = 0.52$, $p = .67$) or their interaction ($F(3, 226) = 0.39$, $p = .76$) on their sympathy. Instead, children across this age range and conditions felt '*really sorry*' for the sick child (AI: $M = 2.64$, $SD = 0.58$; DI: $M = 2.54$, $SD = 0.60$; E: $M = 2.52$, $SD = 0.65$; NS-D: $M = 2.53$, $SD = 0.65$), suggesting a ceiling effect.

Fairness evaluation

A linear regression model on children's fairness evaluation as a function of condition, participant age and their interaction revealed significant main effects of condition and age (condition: $F(3, 225) = 14.82$, $p < .001$; age: $F(1, 225) = 14.12$, $p < .001$). These main effects were moderated by their interaction, $F(3, 225) = 4.71$, $p = .003$ (Figure 5). Simple slopes tests suggested that children across this age range all viewed E condition as fair, $B = 0.13$, $SE = 0.14$, $t = 0.90$, $p = .37$, and DI condition as unfair, $B = -0.18$, $SE = 0.15$, $t = -1.26$, $p = .21$. However, only with age, children gradually evaluated receiving more than others (AI condition) as unfair, $B = -0.58$, $SE = 0.13$, $t = -4.41$, $p < .001$. These results replicated previous findings that with age children gradually view advantageous inequality as unfair (Blake et al., 2015; Peretz-Lang et al., 2022). Children's fairness evaluation in the NS-D condition showed a similar pattern as the AI condition: children increasingly viewed receiving less than a box as unfair with age, $B = -0.36$, $SE = 0.14$, $t = -2.53$, $p = .012$,

suggesting that only older children understood that the system of distribution (the machine) was unfair no matter whether the recipient was a human or a non-social entity. This is in line with previous findings that children are gradually more concerned about the fairness of the process than the outcomes of distributions (Dunham et al., 2018).

Supplementary analyses

Children's emotional responses and fairness evaluation were significantly impacted by condition in our setting, suggesting that children could recognize and felt the justice/injustice of distribution in our manipulation. Compared with the experience of inequality across condition, these responses may also or even better represent children's *perceived* inequality. Therefore, we performed two additional exploratory analyses to explore whether (1) children's emotional responses and (2) children's fairness evaluation of the machine were related to children's prosociality.

We first submitted children's prosociality to a linear regression model as a function of children's difference score of emotional responses, participant age (mean-centered) and their interaction. The model revealed a significant effect of age, $B = 0.24$, $SE = 0.05$, $t(230) = 4.49$, $p < .001$; as reported above, with age, children were more likely to share stickers with the sick child. This model also revealed a marginally significant effect of emotional changes, $B = -0.18$, $SE = 0.09$, $t(230) = -1.93$, $p = .054$, such that children who reported more reduced happiness shared somewhat more stickers with the sick child. Since most children who reported reduced happiness were in DI condition or NS-D condition, it is possible that children who experienced disadvantaged standing (either in social or non-social situation) were more likely to take others' perspectives and thus share more with others. In line with

this explanation, in prior work, children who were assigned to a disadvantaged condition were more likely to pass a theory of mind task than children who experienced advantage (Rizzo & Killen, 2018). However, since boys in NS-D condition showed more prosociality with age, it is possible that the removal of a social comparison in NS-D condition offset or even overrode the impact of disadvantage and thus promoted boys' prosocial behaviors. Since the effect was marginal and the analysis was exploratory, however, we still need more systematic work to further explore the relation between children's emotions and their prosociality.

The next linear regression model on children's prosociality as a function of children's fairness evaluation, participant age (mean-centered), and their interaction only revealed a significant effect of age, $B = 0.33$, $SE = 0.11$, $t(229) = 2.97$, $p = .003$. Neither the main effect of fairness evaluation nor its interaction with participant age reached significance, ps $> .51$, suggesting that children's fairness evaluations were not related to their sharing behavior.

General Discussion

The present work manipulated the experience of inequality to examine how this experience may impact prosocial behaviors among 4- to 9-year-old children. This study was the first experimental study to systematically explore the potential causal relation between inequality and children's prosocial behaviors. Although children regarded disadvantageous inequality as unfair, which successfully replicated previous work (e.g., Blake et al., 2015; Peretz-Lange et al., 2022), and children showed more negative emotional reaction when they experienced disadvantageous inequality, we did not find evidence supporting our hypothesis that the experience of disadvantageous inequality undermines children's prosocial behaviors.

Instead, children's prosociality increased with age and was not affected by their experience of inequality, sense of fairness or emotional reactions during the game.

Contrary to our expectations and previous work in adults, the present work points to the possibility that the experience of inequality may not negatively affect children's prosocial behaviors. However, it is important to consider other possible explanations for this null finding. One such explanation is that the current method did not successfully manipulate children's experience of inequality, thus it did not evoke a sense of inequality or deprivation and in turn did not impact children's sharing behavior. However, the variance and predicted patterns in the fairness evaluation and emotional changes across conditions suggests that the non-significant effect of inequality on children's prosocial behaviors cannot be attributed to this concern.

Specifically, in the current manipulation, children in the four conditions rated the fairness of the machine differently and showed different developmental trajectories of understanding advantageous and disadvantageous inequality. These developmental changes are in line with previous work that children are sensitive to disadvantageous inequality and object to it at an early age, whereas only older children regard advantageous inequality as unfair and decline offers that advantage them (e.g., Blake & McAuliffe, 2011; Blake et al., 2015; Peretz-Lange et al., 2022). In terms of emotional reactions, children at all ages reported significantly reduced happiness after experiencing disadvantageous inequality (DI or NS-D), which was not found when they experienced equality or received an advantageous offer, replicating previous work among young children and adults (e.g., Kim et al., 2023; LoBue et al., 2009; Oishi et al., 2011). These consistent findings suggest that the present manipulation

did produce clearly distinct experiences of equality or inequality and children reacted to them differently in their fairness evaluation and emotional reaction. However, these experiences did not go on to influence children's general sharing behavior to unknown others. Similarly, some recent work found that inequality in an experimental environment did not reliably reduce children's general donation behavior (Kirkland et al., 2020, 2021a, 2021b) or their third-party punishment to unfair distributors (Lee & Warneken, 2022). Together, the present work suggests that children negatively evaluate disadvantageous inequality across the preschool and early school ages and the experience of inequality undermines their happiness, however it may not extend to their general prosocial behaviors.

This is of course a tentative conclusion that will require more exploration in the future, as there are certainly alternative explanations for our findings. One possibility is that though children in our study did recognize inequality, negatively rated it and were less happy after experiencing disadvantageous inequality, this manipulation may not be able to evoke a strong sense of unfair disadvantage or deprivation, which as reviewed before, is a better predictor of psychological outcomes than objective wealth distribution (e.g., Greitemeyer & Sagioglou, 2016; Oshio & Urakawa, 2014). In other words, the current manipulation does not permit us to know the real impact of the perceived inequality on children's prosocial behaviors.

One piece of evidence to support this consideration is that some participants commented that "It's just a random game" when we asked why they viewed the machine as fair/unfair, suggesting that they may not be heavily impacted by the inequality in this setting and instead try to attribute the distributions to a random system. Similarly, the current task used a non-social agent (i.e., a novel virtual machine) to distribute resources, which may let children

regard the distribution as more random instead of norm-based or biased as it might be from a social agent. Accordingly, children in this age range can differentiate the agent type of distributors and expect a similar distribution in a third-party scenario only after they interact with a social agent but not a non-social agent (Lee & Warneken, 2022). Thus, the unequal allocation from a non-social agent may be justified as random and not evoke a strong sense of unfair disadvantage, deprivation, or resentment and thus not impact children's prosocial behavior. Indeed, when adults perceive inequality as justified or surmountable, their wellbeing is not as adversely impacted as when they perceive it as unjustified (Alesina et al., 2004; Schneider, 2012). Thus, further work should focus on how to manipulate children's perceived inequality and strengthen the effect of inequality to precisely explore its effect on their prosociality. For instance, the next step could manipulate the experience of inequality as justified or unjustified, and thus weaken the sense of randomization while amplifying the perception of inequality.

Additionally, although the current work contributed to the potential causal relation between the experience of inequality and children's prosocial behaviors, being exposed to inequality in an experimental manipulation may not offer an extreme and long-term effect on children's prosociality compared with being exposed to real-world inequality. Indeed, although the experimental manipulation in Kirkland et al. (2021) did not affect children's donations, their exploratory analyses suggested that the inequality in their home suburb (i.e., Gini coefficient) was negatively related to children's donations. It is possible that the persistent inequality in their actual environments may induce a more pervasive and stronger effect on children's development and their subsequent prosociality than a one-time

experimental manipulation. Besides, previous work among adults suggested that their perceptions of wealth distribution, and justification of wealth inequality in the real world are associated with confounding factors such as their SES status, cultural views, political attitudes, etc. (e.g., Brown-Iannuzzi et al., 2015; Kraus et al., 2017; Waldfogel et al., 2021; Wu, 2021). And these complex relations are also increasingly detected among adolescents and children (e.g., Elenbaas & Mistry, 2021; Flanagan & Kornbluh, 2019; Wang & Roberts, 2023). Thus, children's perceptions of inequality in a lab and the real world may be different and only experimental manipulations may not fully shed light on the impact of inequality on children's behaviors both quantitively and qualitatively. Though this discrepancy deserves future concerns, experimental manipulations are still necessary to untangle the sophisticated relations and provide implications on possible causal effects and the underlying mechanism. Future work could address this discrepancy and consider a way to explore inequality in the real-world and in the lab together to provide more informative and practical implications.

Another consideration to explain our findings concerns the nature of the prosocial task, such that children's prosociality may in fact be impacted by inequality but did not emerge in the specific task used in our study. First, the current prosocial task measured whether children would share some of their stickers with an unknown sick child who was in hospital for many days. This scenario may have aroused substantial sympathy which, in turn, may have motivated children to be prosocial regardless of the experimental condition they had experienced. Sympathy for those in need has been shown to emerge in early infancy and childhood and to motivate prosocial behavior to assist the person in need (e.g., Batson, 1991; Eisenberg & Miller, 1987; Sagi & Hoffman, 1976; Vaish et al., 2009). Indeed, our analysis

indicated that children across the age range and condition showed high sympathy towards the sick child (M = 2.56, SD = 0.62 on a scale of 1 to 3). Therefore, the strong sympathy may overpower the adverse impact of being disadvantaged and thus encourage more prosocial behaviors to the other who is suffering. Future work can consider balancing the impact of sympathy by using a more neutral scenario sharing.

Another concern to note is that the recipient of the current prosocial task was an unknown child who did not participate in the previous distribution game. Therefore, we can only say that children's prosociality to general others may not be impacted by the experience of inequality, however we do not shed light on how children's prosociality may differ within the inequality situation itself. In line with this, adults who experience relative deprivation and are thus in a disadvantaged standing are only more aggressive toward the target who is the source of their disadvantage but not toward a neutral target (Greitemeyer & Sagioglou, 2017). Even though the present work made the first step to explore the impact of inequality on children's general prosociality, it will be worthwhile to examine how children's prosocial behaviors varies in the specific social contexts in the future.

We also cannot generalize our findings to other prosocial behaviors beyond sharing. Although we did not find evidence that children's prosociality in a *sharing* task is negatively influenced by the experience of disadvantage, it remains unknown whether other prosocial behaviors such as helping, donation, or cooperation can be undermined, especially when these interactions happen face-to-face instead of virtually via games online. For example, even though previous work has documented that wealth inequality is highly related to population health and wellbeing (Wilkinson & Pickett, 2009), and individuals who

experienced unfair disadvantage show more hostility and aggression compared with those who did not experience it (Callan et al., 2017; Greitemeyer & Sagioglou, 2016, 2017), other work suggested that individuals from low social class may show more prosociality. Specifically, they were more generous to strangers in the dictator game, endorsed more generous donation to charity (Pitt et al., 2010), displayed more attention to others (Dietze & Knowles, 2016), viewed inequality as more unfair and were more likely to support redistribution (Brown-Iannuzzi et al., 2015). One way to explain this discrepancy may be that some behaviors such as redistribution or supporting others in suffering may be a way that can eventually rectify inequality, and thus those behaviors may be more likely to be produced by disadvantaged groups (see Pitt & Robinson, 2017 for review). However, other behaviors that do not rectify inequalities may not be impacted by the experience of inequality. Our current findings may add one piece of evidence to support this explanation: since sharing with an unknown child cannot rectify inequality neither in the current game or later, this behavior may not be influenced by the experience of inequality. Similarly, in Kirkland et al. (2021b), children's general sharing with unknown others was not impacted by their experience of disadvantage, whereas their redistribution of resources among puppets in the distribution game was affected. Therefore, future work should be cautious when generalizing findings to multiple prosocial behaviors and be aware of the nuance of motivations underlying different prosocial behaviors.

We would like to address some interesting findings in our exploratory analyses. First, we found that with age, boys shared more stickers to the unknown sick child after they got more than the peer (AI condition) and after they got less than the box (NS-D) compared with

E and DI conditions. However, girls' prosocaility stayed constant across age for all conditions. One major implication of these findings is that the experience of receiving more than others may promote boys' but not girls' generosity. The gender gap in the present work may be attributed to various, admittedly speculative explanations. One possibility is that boys are more likely than girls to regard the distribution game as a competition than girls and thus view receiving more than the peer as a win. And this accomplishment may promote happiness and make them more willing to share their additional stickers with others. Indeed, previous work suggested that there is gender gap in terms of the outcomes of competition (e.g., Lowes, 2021; Niederle & Vesterlund, 2010; Ors et al., 2013), such that men prefer competition more than women and a competitive environment benefits men but not affects women's performance (Gneezy et al., 2003). However, since most children in our sample reported high levels of happiness (M = 4.46, SD = 0.83 on a scale of 1 to 5) before playing the distribution game, we cannot know whether boys truly became happier after receiving advantageous inequality. Another possibility is that AI or NS-D may also promote girls' prosociality, however, girls may keep valuing stickers with age more than boys, and this consistent preference may hold back older girls' sticker sharing, thus may wash out any positive effect of AI on girls' prosocial behaviors. Future work can systematically explore the gender difference in children's prosocial behaviors under inequality.

Another interesting finding was the discrepancy between NS-D and DI conditions: even though we did not see the expected impact of disadvantageous inequality on children's prosocial behaviors, this variance may at least suggest that social comparison during a distribution game plays a role in affecting children's (especially for boys) prosocial

behaviors. Specifically, it might be that the removal of social comparison mitigates the resentment of receiving less or the pressure of comparison and thus encourages more prosociality (at least among boys). Certainly, more evidence should be provided in the next step to detect the critical role of social comparison in creating a sense of inequality and the subsequent social behaviors.

Additionally, although in our exploratory analyses, participants' SES did not impact their prosocial behaviors, we are not sure whether this finding can extend to other SES groups due to the skewed family income in our sample. Indeed, previous findings among adults and children have documented the impact of SES on prosocial behaviors though with mixed findings (e.g., Andreoni et al., 2021; Chen et al., 2013; Miller et al., 2015; Pitt et al., 2010; Pitt & Robinson, 2017; Safra et al., 2016). Meanwhile, more and more recent work indicated that children's own subjective or objective SES impact their social behaviors such as their fairness evaluation of allocations (Peretz-Lange et al., 2022) and risk-taking behaviors (Harvey & Blake, 2022) differently. Therefore, future work should return to this concern by systematically measuring children's subjective and objective SES and explore the potential causal relations.

In summary, the present work manipulated 4- to 9-year-old children's experience of inequality and suggested that this experience of inequality affected children's fairness evaluation of the distribution and happiness. Particularly, they were increasingly aware of the unfairness of inequality and their affect was negatively influenced by it. However, this adverse impact did not extend to children's general sharing behavior to an unknown child. Instead, children were overall more generous with age. This current work serves as the first

experimental study to explore the potential causal relation between children's own experience of inequality and their general prosocial behaviors. More generally, this project promises to provide insights into the earliest effects of inequality on children's development and to lay the foundation for a novel and important area of research on the near- and long-term impact of inequality on children's social development and wellbeing.

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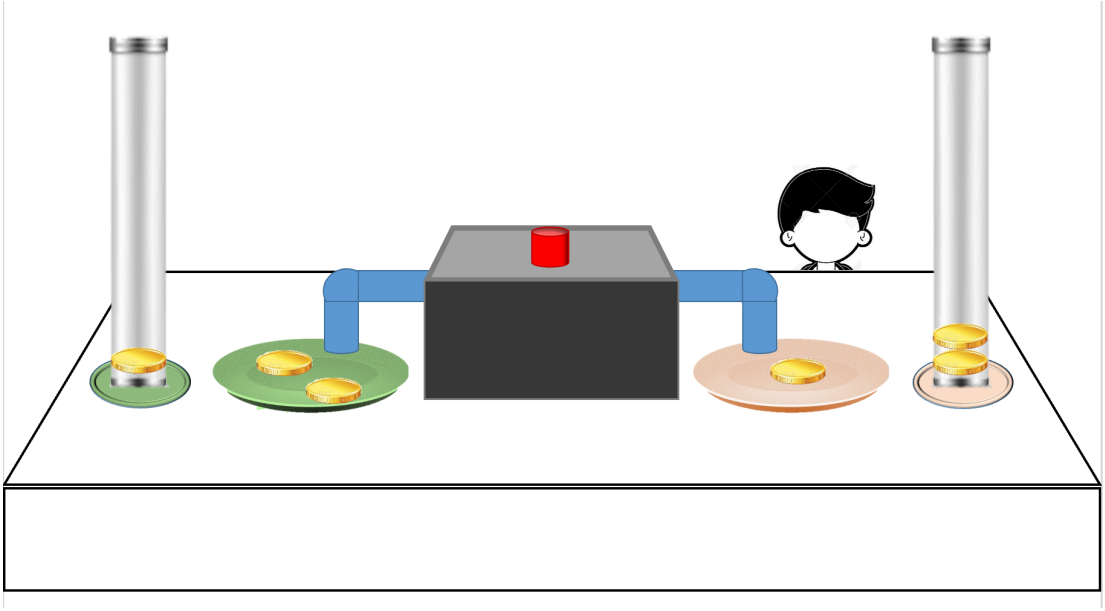
Figure 1

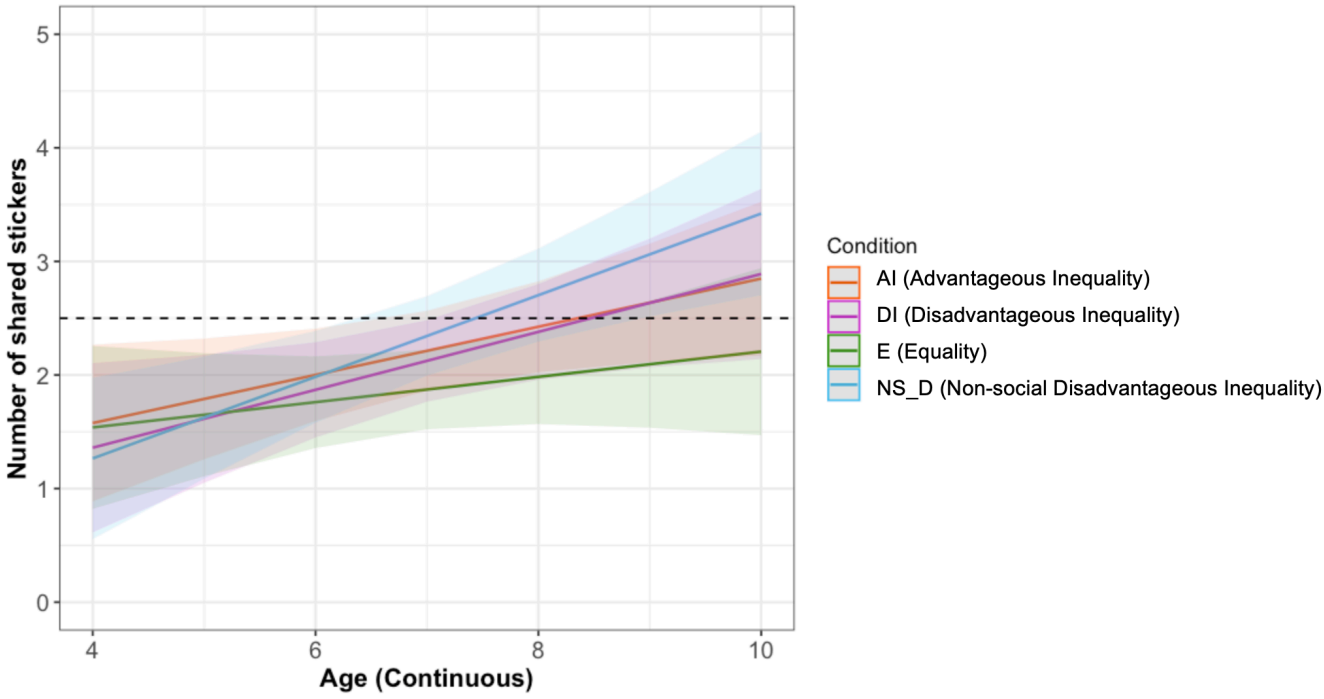
The Novel Virtual Machine in the Distribution Game



Note. The novel virtual machine used in the current study, which distributed tokens to the participant and the gender-matched peer. The experimenter would use the mouse to click the red button of the machine, then the machine would work with 3 seconds of sound effect (i.e., a sound mimicking a roiling coin). After this, the tokens would show on the plates. Here is an example version for boy participants. The tokens on the green plate are the participant's. The tokens on the orange plate are the gender-matched peer's. The tokens on the plates would then go to the corresponding tubes. Once the participant fills one full tube, they would exchange the full tube for a scratch paper that would mail out to them later.

Figure 2

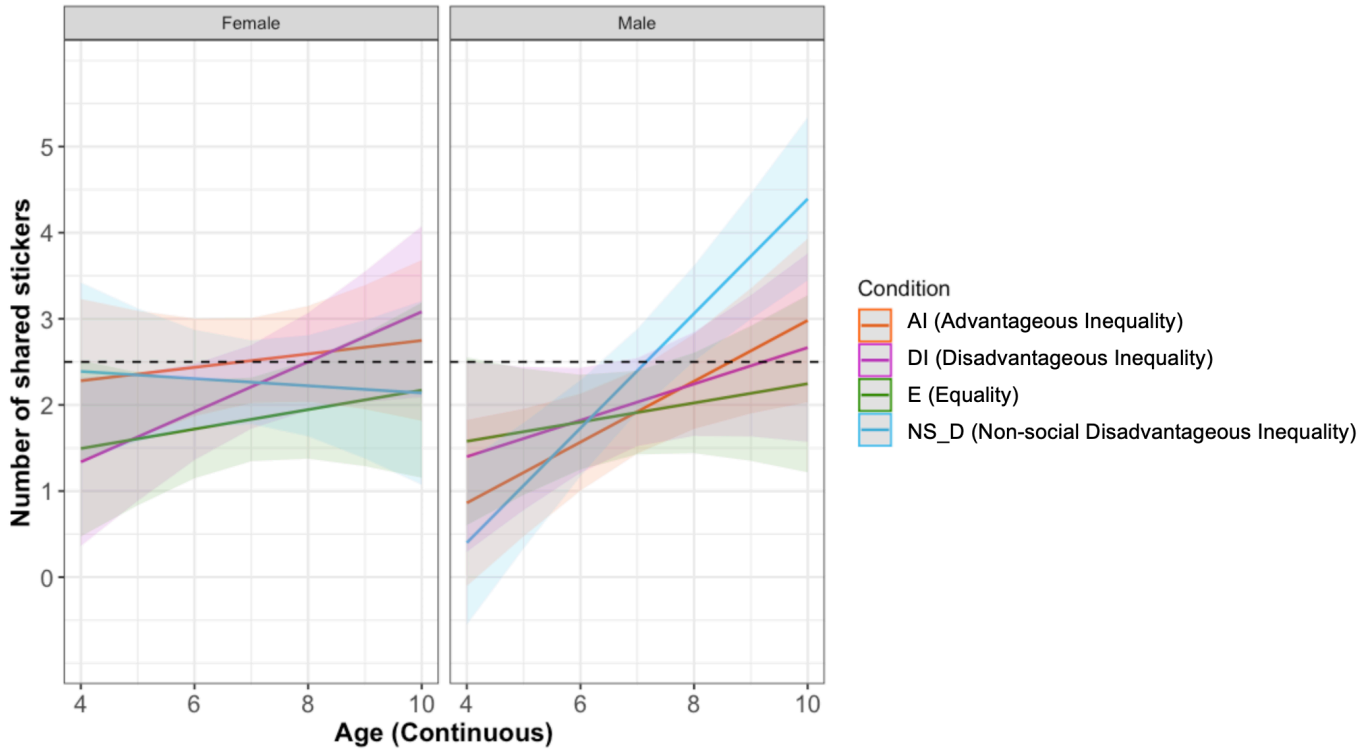
Sharing Task by Participant Age and Condition



Note. The number of stickers that children shared across age and condition. Shaded areas represent 95% confidence intervals.

Figure 3

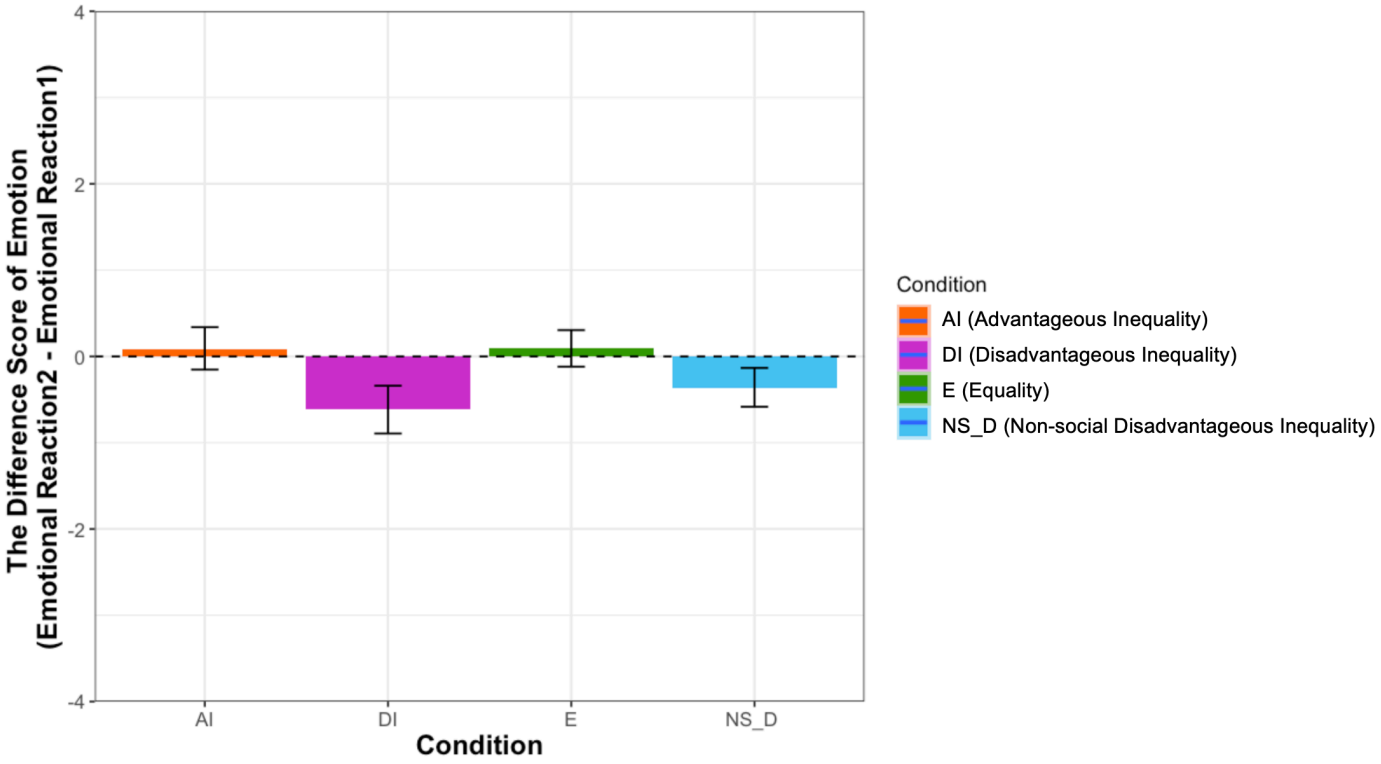
Sharing Task by Participant Gender, Age and Condition



Note. The number of stickers that girls (left) and boys (right) shared across age and condition. Shaded areas represent 95% confidence intervals.

Figure 4

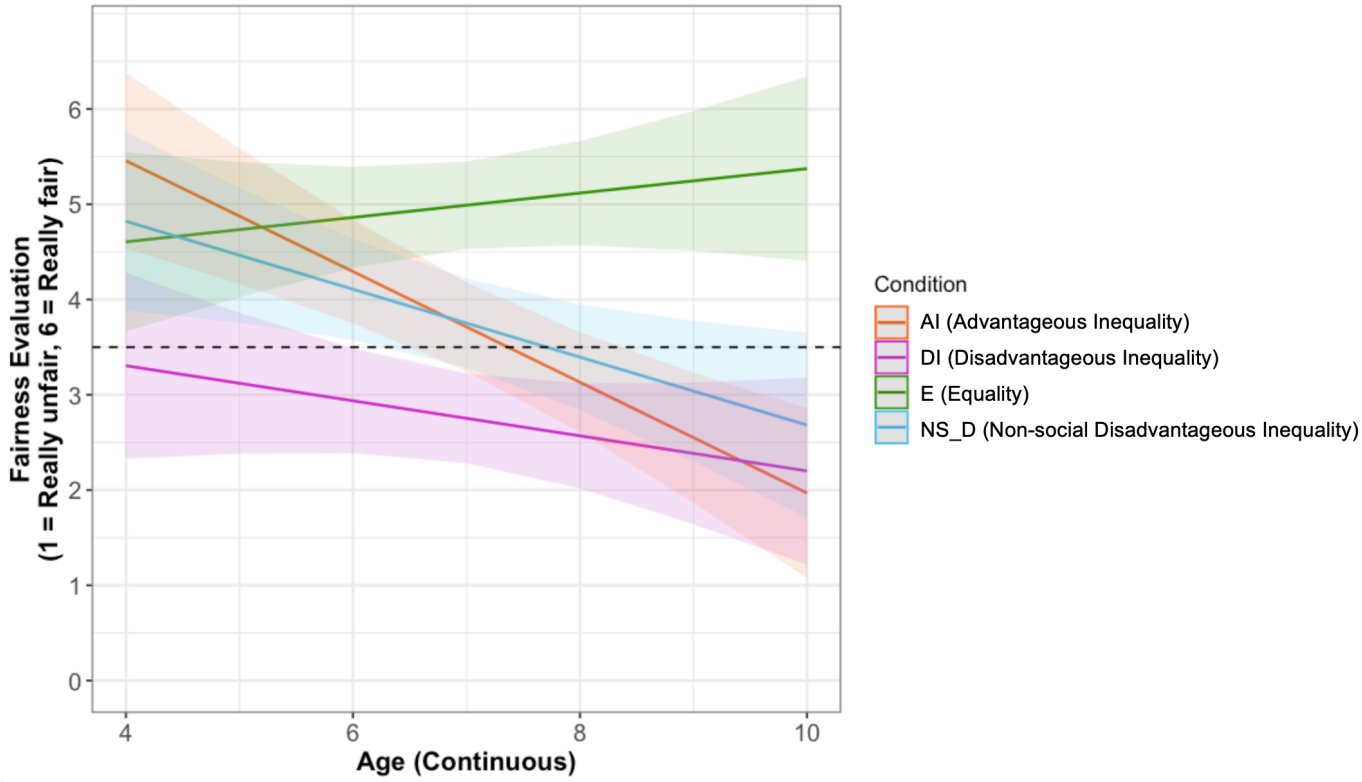
Emotional Reactions by Condition



Note. The difference score of children's emotional reactions across conditions. Emotional Reaction1 represents the pre-test emotional reaction, and Emotional Reaction2 represents the post-test emotional reaction. Error bars represent 95% confidence intervals.

Figure 5

Fairness Evaluation by Participant Age and Condition



Note. Children's fairness evaluation of the machine across age and condition. Shaded areas represent 95% confidence intervals.