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Children's consideration of effort and outcome in reward distribution tasks

Emily Kim | **Vanessa LoBue**

Department of Psychology, Rutgers University, Newark, New Jersey, USA

Correspondence
Emily Kim, Department of Psychology, Rutgers University, Newark, NJ, USA.
Email: emilyyrkim@gmail.com

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Abstract

In the current study, we asked whether children recognize initial inequalities in resources and the effect of these inequalities on subsequent outcomes. We presented 6- to 8-year-old children with a series of vignettes in which characters' contribution and effort to a joint task were manipulated, along with the tool they had to complete the task, which affected their relative advantage. Each vignette contained a situation where two children had to help a third person dig pails of sand. In each scenario, the number of pails each child dug, as well as the type of shovel (making it easier or harder for them to dig), was manipulated. Children were asked how rewards should be distributed and who they believed worked harder. We found that children weighed outcome, or the number of pails of sand produced, more heavily than other factors, and only the oldest children showed evidence of considering initial inequalities and effort when making decisions about resource allocation.

KEYWORDS
equitable distributions, fairness, resource allocation, resource distribution

1 | INTRODUCTION

Knowing how to behave fairly is essential for developing and maintaining social relationships. Previous research suggests that children from western, industrialized countries display a preference for fair behavior—which for the

purposes of our research, we operationalize as an equitable distribution of resources—early in life, even in infancy (Blake et al., 2015; Blake & McAuliffe, 2011; DeJesus et al., 2014; Elenbaas et al., 2016; Geraci & Surian, 2011; Olson & Spelke, 2008; Schmidt & Sommerville, 2011; Sloane et al., 2012; Smith et al., 2013). However, despite a large body of research suggesting that children have a general preference for equal distributions, there is not necessarily a one-to-one relationship between equality and *equity*, making fairness—even just in the context of resource allocation—a complex construct that involves accounting for various contextual features of a situation. Indeed, while equality involves assigning individuals the same number of resources, equity involves recognizing that different people have different circumstances and resources might need to be distributed differentially between individuals to create an equal outcome. There are several factors that one must account for when making equitable distributions. One of those features is merit. An individual who produces more *output*, for example, might merit a larger reward than an individual who produces less. Likewise, an individual who works harder than another—or puts forth more *effort*—might also merit a larger reward.

Studies examining merit and resource allocation in children typically manipulate merit by varying either effort or outcome or by explicitly varying both, as the two are naturally correlated. When examining children's merit-based resource allocation focusing on output specifically (i.e., painting more pictures, cutting out more shapes, picking more apples), classic studies suggest that equitable behavior does not develop until around 6 to 9 years of age (Sigelman & Waitzman, 1991; Olejnik, 1976). Taking it even further, in a series of third-party resource allocation tasks, Kienbaum and Wilkening (2009) found that although Swiss and German children begin to take context—such as the *need* for resources—into consideration by middle childhood, they do not consider the amount of work done by individuals until adolescence.

However, more recent work suggests that recognition of merit develops much earlier. For example, Kanngiesser and Warneken (2013) found that preschool-aged children consider merit even in first-party contexts. In this study, children kept fewer resources for themselves in trials where they contributed fewer coins in a collaborative game than their partner, thus giving away resources to their partner at a cost to themselves. Additionally, Xiao and colleagues (2019) found that in a third-party distribution task, preschool-aged children allocated more resources to an individual who picked more apples than another, even if that individual was a member of an outgroup.

Studies with effort-based resource allocation tasks follow a similar developmental timeline, and children begin to consider effort when allocating resources (i.e., being tired/lazy, having an extra step in a task) as early as age 3, particularly in collaborative contexts (Baumard et al., 2012; Hamann et al., 2014). For example, Baumard and colleagues (2012) found that when presented with a series of vignettes where one person worked hard and continued to produce cookies despite being "tired," while another gave up after being bored, 3-year-old children gave more rewards to the harder worker.

Although this research demonstrates that young children are capable of considering these two components separately at an early age, further work suggests that it is not until middle childhood that children consider multiple factors when making decisions about resource allocation. For example, Noh et al. (2019) found that when presented with vignettes in which both effort and output were compared to each other, children rewarded more resources to a hard-working character over a productive character with age. However, when asked to justify their decisions, 7- to 10-year-old children referred to *both* effort and output significantly more than younger 3- to 6-year-old children. These findings are consistent with previous work examining resource allocations based on a variety of contexts, including recipients' need for resources, the type of resources, and the distributor's relationship with the recipients (Sigelman & Waltzman, 1991; Rizzo et al., 2016; Kienbaum & Wilkening; 2009; Xiao et al., 2019).

Importantly, although studies tend to treat these factors separately, effort and output are often interrelated largely due to inequalities embedded in real-world contexts. Indeed, structural inequalities exist in many cultures, including Western cultures, that affect their ability to produce specific outcomes. For example, when at a relative disadvantage, one must cope with the consequences of having less access to resources compared to advantaged peers, which in turn affects an individual's contribution to a task and the amount of effort that an individual must exert to make the same

contribution. Relatedly, existing data on children's responses to preexisting inequalities are largely mixed. For example, some studies find that children as young as 4 or 6 distribute resources more generously to a relatively disadvantaged individual (Li et al., 2013; Elenbaas & Killen, 2016), whereas Olson and colleagues (2011) found that children this age *perpetuated* inequalities, while a group of older, 7.5- to 11.5-year-old children corrected them.

Further, much of the literature on preexisting inequalities examines inequalities in the quantity of resources one has or how "rich" or "poor" an individual or group is. However, another form of inequality is in the quality of the resources one has to complete a task. For example, in a task by Hamann et al. (2014), 3-year-old children were tested in pairs, and asked to pull ropes on a novel apparatus, either in a parallel or collaborative work context to obtain rewards (marbles). Within each pair, one child was placed in a disadvantageous position and was given a rope that required using a special tool to reach. In the Deserving Condition, the disadvantaged child received three marbles and the other received one, whereas in the Undeserving Condition, the distribution was reversed. While children in the parallel work task shared very little in both conditions, in collaborative contexts, children behaved more generously if their partner received fewer rewards despite being at a disadvantage, suggesting that they acknowledged the additional effort put in by their partner. This is further supported in the context of bigger structural inequities in a study by Zhao and Yang (2023), which finds that with age, children believe one who overcomes their disadvantages (i.e., lack of educational resources to achieve academic success) did so by putting in more effort than those who are privileged, and that by age 5 to 7, they appreciate those are able to achieve academic success despite lack of resources.

In these studies, being put at a relative disadvantage did not affect children's success in the task compared with their partner—whether or not the harder working child ended up with greater or fewer marbles was randomly assigned. In the real world, oftentimes starting out with more or better resources leads to more efficiency and successful work, perpetuating the initial inequality. Although it is important to recognize this disparity when examining fair behavior, unfortunately, time after time, such inequalities go unrecognized and those at a disadvantage are faulted for being unable to contribute as much as those who start out with a greater advantage, or they are viewed as lazy individuals who do not work as hard as their advantaged counterparts. To our knowledge, there is little research to date examining whether children *recognize* initial inequalities in resources and the effect of these inequalities on subsequent outcomes. Our goal here was to address this gap in the literature.

Here, we presented 6- to 8-year-old children with a series of vignettes in which characters' contribution and effort to a joint task were manipulated, along with the tool they had to complete the task, which affected their relative advantage. More specifically, each vignette contained a situation in which two children had to help a third person dig pails of sand. In each scenario, the number of pails each child dug, as well as the type of shovel they had (making it easier or harder for them to dig) was manipulated. Children were asked how rewards should be distributed and who they believed worked harder. We hypothesized that (1) in scenarios where output is manipulated, younger children would focus primarily on output—the more salient evidence of work—and that (2) in the scenarios where effort is manipulated, younger children will still focus on output while effort will be considered more with age. Likewise, we hypothesized that (3) when asking children to justify their reward distributions, they will provide outcome and effort-related responses that are in line with their reward distribution, and that (4) when both effort and outcome are manipulated, the oldest children will cite the relative disadvantage of the character with the smaller shovel and its effect on subsequent output.

2 | METHODS

2.1 | Participants

Participants included 96 6- to 8-year-old typically developing children (48 female; M = 7.43 years, SD = .83; Range = 6.01–8.82) recruited from the Rutgers University-Newark database and Children Helping Science

(https://childrenhelpingscience.org/). We chose this age range based on previous literature suggesting that children begin to consider the context when making resource allocations between the ages of 5 and 8 (Huppert et al., 2019, Paulus, 2014; Schmidt et al., 2016). Since we are asking a fairly novel question, we chose an age range where previous research suggests that children might be able to consider context when making decisions about fairness. We also treated age categorically so that we could see exactly where changes in reasoning begin to occur. A sample size of 96 was determined using G-power (alpha = 0.05, 80% power) based on the findings of Hamann et al. (2014), who reported a medium to large effect size on a similar task examining deservingness and collaboration.

Forty-eight (50%) parents identified their children as White or European American, 17 (17.7%) as Multiracial, 13 (13.6 %) as Asian or Pacific Islander, 4 (4.2%) identified as Black or African American, 4 (4.2%) as South Asian or Indian, 4 (4.2%) as Hispanic, 2 (2.1%) as American Indian or Alaskan Native, 3 (3.1%) identified with some other category, and 1 (1%) declined to respond. Sixty-one (63.5%) parents had earned an advanced degree, 25 (26%) parents had earned a bachelor's degree, 7 (7.3%) parents had gone to some college or trade school, 2 (2%) parents had earned a high school degree, and 1 (1%) of parents declined to respond. Nine additional children were tested but excluded from analyses due to experimenter error (3), equipment error (3), noncompliance (2), and a participant who could not speak English (1).

Participants completed the study from home online via Zoom, a video conferencing platform. The Rutgers University Institutional Review Board approved all procedures described here. Parental consent and demographic information were obtained during the testing session and all participants received a $10 gift card for their participation. All data have been made publicly available at Databrary.org and can be accessed at nyu.databrary.org/volume/1285. The study design, methods, and analyses were preregistered on AsPredicted.org (#56081). Data were analyzed using SPSS, version 28.0.0.0.

2.2 | Procedure

2.2.1 | Vignette task

This study had a within-subject design, in which each participant was shown a series of five videos with pre-recorded audio. In the first video, participants were given a background story for the subsequent four videos, in which the participants were introduced to Matt, who is "at the beach and wants to build sandcastles but needs a lot of sand. Matt asks his friends to help dig pails of sand and in return, he will give them candies." In the next four videos, participants watched vignettes in which two of Matt's friends were presented, and both the contribution and effort they put into the joint task of digging pails of sand were manipulated. The first video served as a baseline measure for whether children would distribute rewards evenly when all factors were held constant. In this video, children were explicitly told that each character had the same size shovel, and each dug one pail of sand. The second video manipulated outcome, in which both characters had the same size shovel, and one character dug one pail of sand and the other dug four. This was followed by a manipulation of effort. Here, effort was manipulated with the type of resource the character started off with—either a "big shovel, that can carry a lot of sand, [making] it faster and easier for them to dig" or a "small shovel, that can only carry a little sand, [making] it harder and slower for them to dig," while outcome remained constant, with each character digging one pail of sand. Finally, in the last video, both effort and outcome were manipulated to examine whether children recalibrated based on both effort and outcome, in which the characters had different shovels and the character with the bigger shovel dug four pails of sand and the other dug one. Each participant was presented with the same order of the videos, from what was deemed easiest to most difficult. Each video ended with a forced choice question asking: "Should Matt give [Child 1] more candies, [Child 2] more candies, or should he give [Child 1] and [Child 2] the same amount?," with a visual representation of the distribution of the candies in the videos. After the forced-choice question, children were asked to justify why Matt should share the candies in that manner.

TABLE 1 Codes for children's justifications of reward distribution.

Code	Description
Equality	Responses that included any references to fairness rules (i.e., "because [equal splits] is the fair thing to do") or the need for equal distributions, rather than equitable distributions.
Effort	Responses that mentioned "working hard" or the difference between the sizes of the shovels between the characters.
Outcome	Responses that mentioned the number of pails or one child digging more than the other.
Effort & outcome	Responses could also have been coded as both effort and outcome if participants mentioned both the number of pails and the discrepancy in effort and/or the size of the shovels.

2.2.2 | Manipulation check and explicit effort question

Next, the children were shown the same four videos again. After each, children were asked two questions to gauge their understanding of the manipulations in the videos: 1. "How many pails did [Child 1 dig]? How many pails did [Child 2 dig]? Did [Child 1] dig more pails of sand, did [Child 2] dig more pails of sand, or did they dig the same number of pails of sand" and 2. "Did [Child 1] have the bigger shovel? Did [Child 2] have the bigger shovel? Or did they have the same size shovel?" These manipulation check questions were asked after the vignette task so that the questions did not guide their answers regarding the reward distribution. In the first three videos, all children either correctly identified the number of pails for both characters, or they correctly answered the question of who dug more, while in the last video, one child failed to answer all three questions correctly. When asked who had the bigger shovel, 89.6% of children correctly answered. Finally, to gauge children's explicit belief on who exerted more effort, children were asked, "Did [Child 1] work harder? Did [Child 2] work harder? Or did they work the same amount?"

2.3 | Coding

All sessions were recorded via Zoom. Trained research assistants coded the "Why should Matt share the candies that way?" for equality, outcome, or effort-related responses, in the same manner as Noh and colleagues', 2019 study (see Table 1). Equality-based responses included any references to fairness or the need for equal distributions, rather than equitable distributions (i.e., "because it'll be equal," "because it wouldn't be fair for the other to have more"). Outcome-based responses included any responses that mentioned the number of pails or one child digging more than the other. Effort-based responses included any mention of "working hard" or the difference between the sizes of the shovels between the characters. Responses could also have been coded as both effort and outcome if participants mentioned both the number of pails and the discrepancy in effort and/or the size of the shovels. All other responses were coded as not applicable.

An additional coder randomly coded 24 participants (25%). Cohen's Kappa (κ) was used to establish interrater reliability for "Why should Matty share the stickers that way" for each of the four scenarios. Cohen's Kappa was .93 for the first scenario, .76 for the second scenario. ,74 for the third scenario, and .92 for the fourth scenario. All discrepancies between the two coders were discussed until a code was agreed upon.

3 | RESULTS

We preregistered a series of 3 (Age group) by 3 (Distribution choice) chi-square tests for each scenario to determine whether there were age-related differences in how children distributed resources, and specifically whether their distributions were equality- or equity-based. Follow-up analyses were also run on groups that provided specific

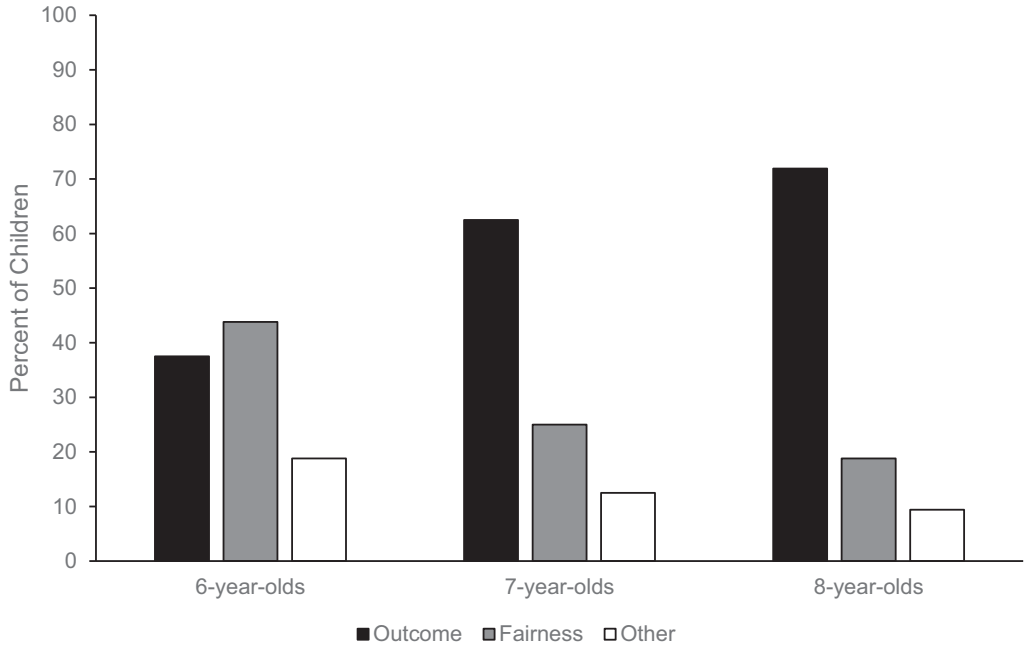

FIGURE 1 Frequency of children's justifications for why the rewards should be split equally in Scenario 1.

responses, but note that the sample size was based on our main analyses, and these follow-ups should be considered exploratory. We treated age categorically so that we can see when major shifts occur in children's ability to reason about context when making decisions about fair allocations. However, at the request of a reviewer, we also ran our main analysis for Scenarios 2–4 with age as a continuous variable (which was not preregistered). The results were all the same as the results of the chi-square analyses, with the exception of one analysis where the effect of age was approaching significance in the chi-square, but was significant in the regression (Scenario 2, described below).

3.1 | Scenario 1: Baseline measure

In the first video, in which both characters had the same-sized shovel and dug one pail of sand each, 100% of children across all age groups claimed that the rewards should be distributed equally. Children's justifications were categorized as fairness-related responses (i.e., "because it's fair," "so it's equal"), outcome-related responses, explicitly citing that each character dug one pail of sand, or irrelevant/other responses (i.e., "so they don't argue about how many the other person has"). We ran a chi-square analysis to determine children's justification for the equal distribution of rewards and found a non-significant trend for age, X^2 (4, $N = 96$) = 8.32, $p = .081$. Further, the frequency of children's fairness and irrelevant/other responses declined with age, while outcome-related responses increased with age (Figure 1), suggesting that the principle of fairness alone is no longer a sufficient justification for older children, even in the simplest of scenarios. One hundred percent of the children said that the characters worked the same amount after watching the videos the second time around.

3.2 | Scenario 2: Outcome manipulation

We ran a 3 (Age group) by 3 (Distribution choice) chi-square analysis to determine if there were age-related differences in how resources were distributed—namely, if the distributions were based on the principle of equality or equity.

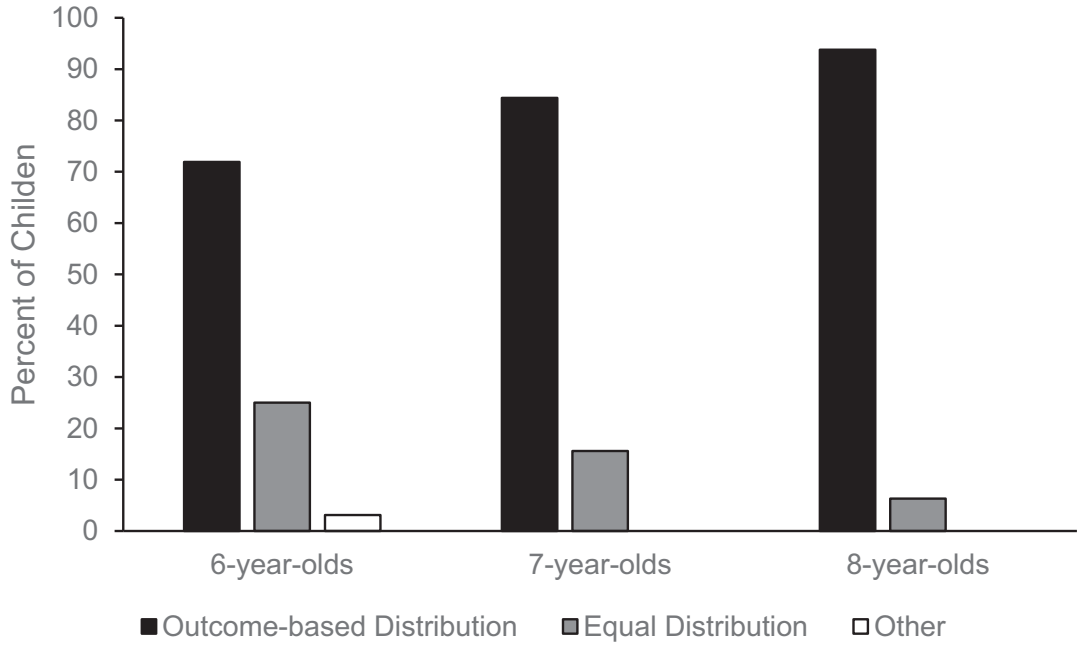

FIGURE 2 Frequency of children's responses to how rewards should be distributed in Scenario 2.

Of the 96 children tested, 83.3% said that the person who dug four pails of sand deserved more rewards than the person who dug one. An additional 15.6% of children believed that the rewards should be split equally, while 1% believed that the person who dug fewer pails should receive more rewards. There were no significant age-related differences, X^2 (4, $N = 96$) = 6.53, $p = .163$. The effect of age was significant when run as a regression, with children choosing to give more rewards to the child who dug more pails of sand with age, and distributing rewards equally less often with age, $\beta = 1.02$, $SE = 0.42$, $Wald = 6.20$, $p = .020$ (Figure 2). It is likely that we did get an age effect in one analysis but not the other because children were nearly at the ceiling for distributing resources based on outcome (see Figure 2). Indeed, a chi-square goodness-of-fit test suggested that children's decision to allocate based on outcome was significantly above the chance level, X^2 (2, $N = 96$) = 111.06, $p < .001$.

Of the children who claimed that the person who contributed more should receive more rewards ($N = 80$), we ran another chi-square analysis to examine whether there were age-related differences in their reasoning when asked why the rewards should be distributed in that manner. Of the 80 children, responses provided were either outcome-based or irrelevant/other. There were no age-related differences, X^2 (2, $N = 80$) = 1.99, $p = .370$, as 79 children (98.8%) provided outcome-related responses, referencing the amount of sand dug to justify their choice in distribution. When examining their responses to who worked harder, there were no age differences, X^2 (4, $N = 96$) = 4.33, $p = .363$; most children of all ages (82.3%) claimed that the child who dug more pails worked harder.

3.3 | Scenario 3: Effort manipulation

We again ran a 3 (Age group) by 3 (Distribution choice) chi-square analysis to determine if there were age-related differences in how the resources were distributed in the third scenario—particularly due to recognizing differing efforts put into the tasks by the two characters. There was a non-significant age trend, X^2 (4, $N = 96$) = 9.02, $p = .061$. A chi-square goodness-of-fit test suggested that children's decision to allocate rewards equally between the two characters was significantly above the chance level, X^2 (2, $N = 96$) = 60.94, $p < .001$. When examining the trends

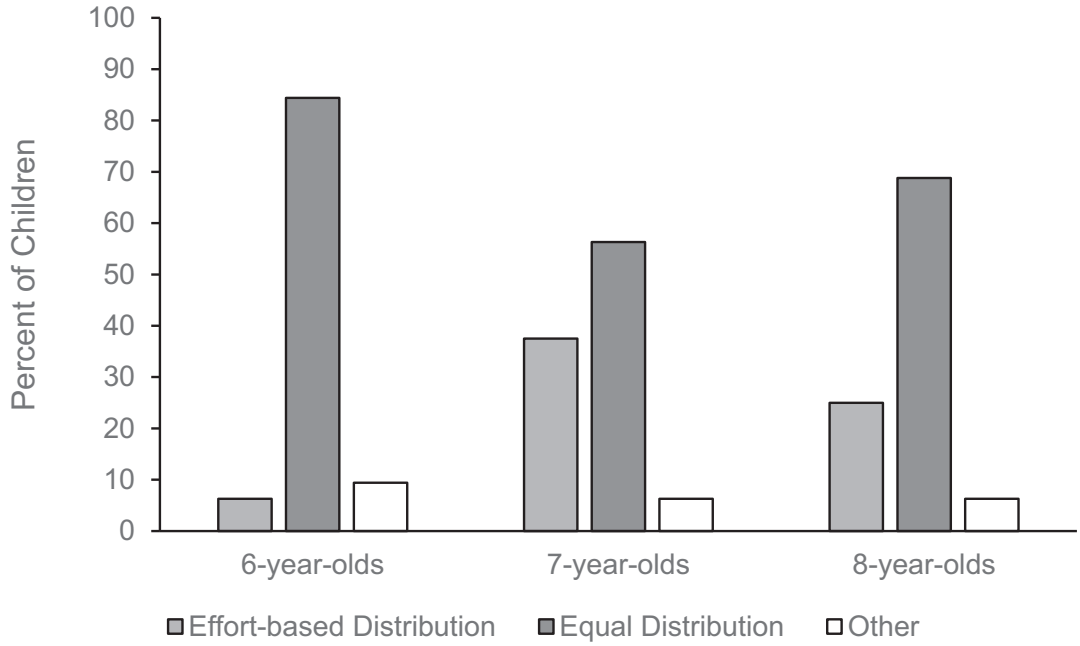

FIGURE 3 Frequency of children's responses to how rewards should be distributed in Scenario 3.

for the frequencies of children's responses, 69.8% of children stated that the rewards should be distributed equally between the two characters, 22.9% of children stated that more rewards should be distributed to the character who had the smaller shovel, and subsequently had to exert more effort, and 7.3% of children stated that more rewards should be distributed to the character with the larger shovel. Breaking down by age groups, only two 6-year-old children (6.3%) distributed the rewards based on effort, while children in the older age groups did so more frequently, with 12 7-year-olds (37.5%) and 8 8-year-olds (25%) (Figure 3).

When examining justifications for their responses, children provided fairness responses, outcome-based responses (citing the number of pails), or irrelevant/other responses. We first examined the group of participants who said that the rewards should be distributed equally ($n = 67$). Most children in this group ($n = 46$; 68.7%) claimed that the rewards should be split equally because each character dug the same amount, focusing on an outcome-related response. Thirteen additional children (19.4%) provided fairness-related responses, while the remaining 8 children provided irrelevant/other responses (12%). There were no age-related differences X^2 (6, $N = 67$) = 4.12, $p = .661$.

Next, we examined the children who said that more rewards should be distributed to the character with the smaller shovel ($N = 22$), which subsequently made the task more difficult. Again, there were no age-related differences ($p = .446$), and as expected, most children (17 children; 77.3%) provided effort or shovel-related responses (i.e., "it wouldn't be fair because the other person didn't have a big shovel"). When examining their responses to the question of who worked harder, there were no age differences, X^2 (4, $N = 96$) = 4.88, $p = .300$ (see Figure 4). We also ran a chi-square analysis to examine whether participants' resource allocation decisions were related to their responses to who worked harder. We found that there were significant group differences, with trends in the expected direction, X^2 (6, $N = 96$) = 42.17, $p < .001$, suggesting that those who allocated more rewards to the character with a smaller shovel did so because they believed that the character worked harder. However, it is interesting to note that only 6.3% of children claimed that the character with the bigger shovel worked harder. Overall, 40.6% of children said that the character with the smaller shovel worked harder, and this response increased with age. Further, 53.1% of children said that the characters worked equally hard, and this response decreased with age.

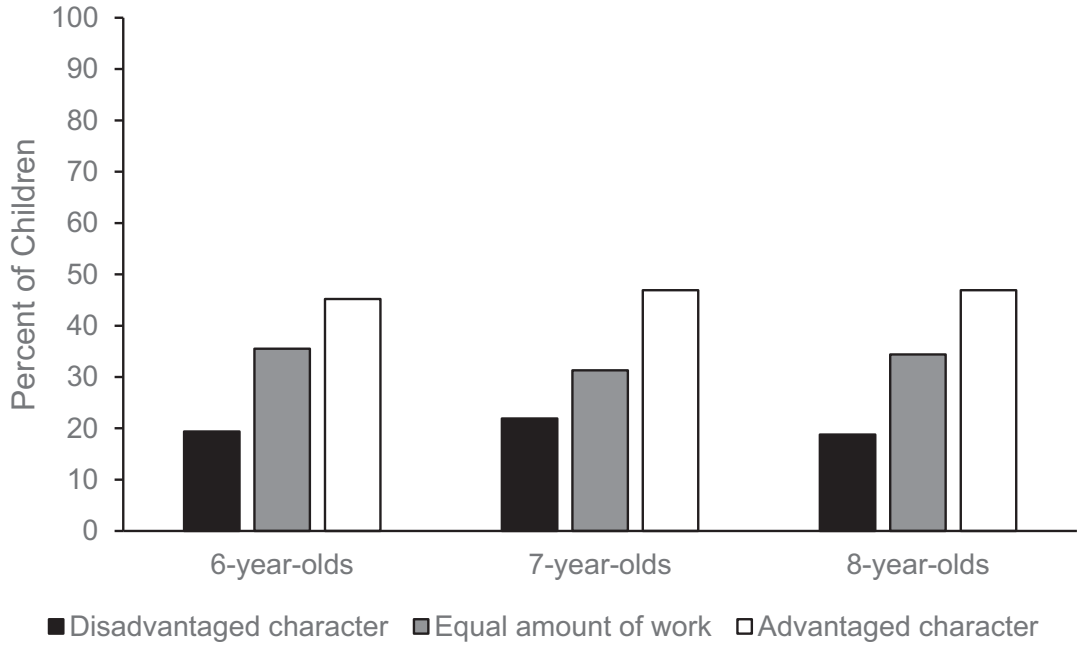

FIGURE 4 Frequency of children's responses to who worked harder in Scenario 3.

3.4 | Scenario 4: Effort-outcome manipulation

Finally, we examined children's responses to Scenario 4, in which both effort and outcome were manipulated. Of the children who responded, we found no age-related differences X^2 (4, $N = 96$) = 2.74, $p = .602$. A chi-square goodness-of-fit test suggested that children's decision to allocate more rewards to the character who had a bigger shovel and subsequently dug more pails was significantly above the chance level, X^2 (2, $N = 96$) = 42.44, $p < .001$. Across all three age groups, most children (61.5%; $n = 59$) claimed that the child who had a bigger shovel and subsequently dug more pails of sand should receive more rewards, with all but 4 children citing the number of pails as their justification, thus there were no statistically significant differences between age groups when examining their justifications, X^2 (4, $N = 59$) = 4.32, $p = .364$. The second most common response ($N = 30$) was that the rewards should be split equally. Interestingly, when examining children's justifications for their sharing responses, there were significant age-related differences, X^2 (4, $N = 30$) = 14.09, $p = .029$ (see Figure 5).

Overall, of the children who said that the rewards should be split equally, most (56.7%) provided responses coded as Effort Outcome, in which they acknowledged both the number of pails and the sizes of the shovels, and/or that each child put in the same amount of work, considering both factors in their decision. An additional 26.7% of children provided fairness-related responses, saying that resources should be split evenly due to the principle of fairness. A final 16.7% of children provided irrelevant/other responses. When breaking down by age group however, we see an increase in Effort Outcome-related responses and a decrease in Fairness responses with age, with a post-hoc (Bonferroni corrected) test revealing that the frequency of effort outcome responses was significantly lower in 6-year-old children than expected. When examining their responses to who worked harder, there were no age differences, X^2 (4, $N = 96$) = 0.98, $p = .914$. 32.3% of children claimed that the characters worked equally hard, 9.8% of the children claimed that the character with the smaller shovel and who dug fewer pails worked harder, and 47.9% of children claimed that the character with the bigger shovel who dug more pails worked harder. We also ran a chi-square analysis to see if the participants' resource allocation decisions were related to their responses to who worked harder. We found that there were significant group differences with trends in the expected direction, X^2 (6, $N = 94$) = 9.52, $p < .05$,

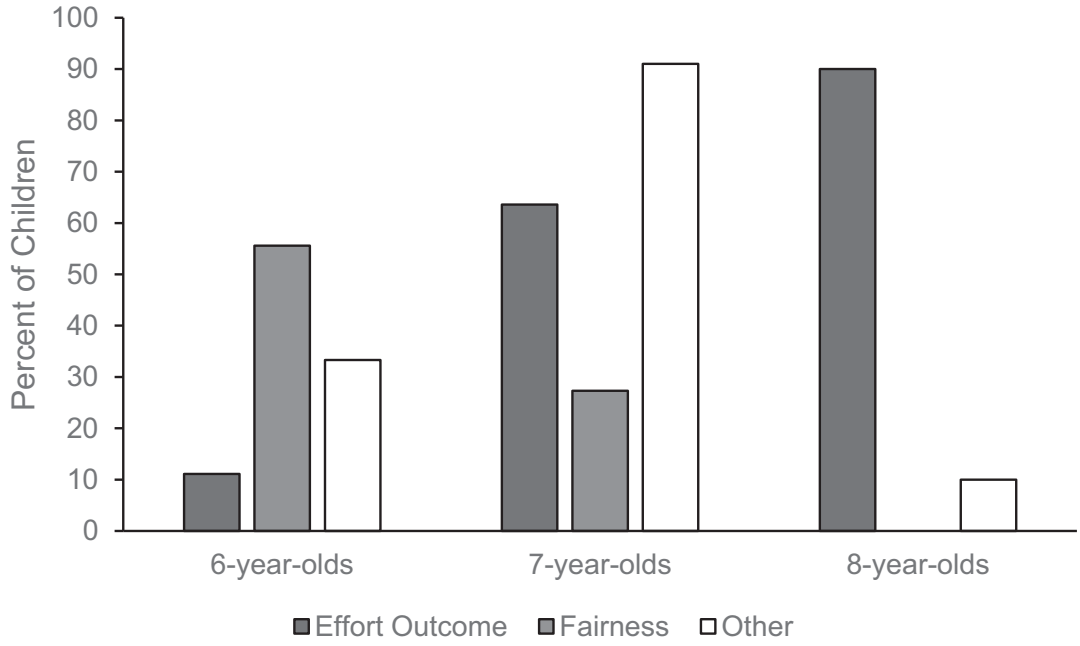

FIGURE 5 Frequency of children's justifications from those who reported that the rewards should be split equally ($N = 30$) in Scenario 4.

suggesting that children made their reward allocations based on their beliefs regarding the characters' efforts in the task, accounting for the shovel and pail manipulation.

4 | GENERAL DISCUSSION

In the current study, we presented 6- to 8-year-old children with a series of vignettes in which characters' contribution and effort to a joint task were manipulated, along with the tool they had to complete the task, which affected their relative advantage. Children were asked how rewards should be distributed and who they believed worked harder in four situations where two children had to help a third person dig pails of sand. In these scenarios, effort was manipulated by changing the resources one had, in that an individual would have to put in more work to create the same outcome as another individual with better resources. We were interested in how children would weigh relative advantage based on *effort*, or how much sand the fictional children dug with two unevenly sized shovels, and the *outcome* of each scenario, or how many pails of sand each child produced.

Based on the first scenario, in which neither effort nor outcome was manipulated, it was clear that by the age of 5, children understand that at the most basic level, with all factors held constant, rewards should be distributed equally. Furthermore, the trends in children's justifications for their responses suggest that with age, children start thinking about fairness rules more equitably, citing an equal amount of work as the reason for an equal distribution of rewards more frequently than simply stating that sharing equally is the fair or right thing to do.

Based on the second scenario, it was also clear that overall, children between the ages of 6 and 8 believe that rewards should be distributed based on the outcome of the characters' work, with children more frequently reporting that the character who dug more pails of sand should receive more rewards. This is further supported by children's justification for their responses on how the rewards should be distributed.

A third and final finding from our study is that we are only beginning to see children weigh effort in resource allocations around the age of 7. Although we did not see age-related differences, trends demonstrate that children of this age are beginning to cite differences in effort caused by the discrepancy between the sizes of the shovels when asked to justify their distributions. This is further supported by a small but substantial group of children ($N = 22$) who distributed more rewards to the child with the smaller shovel in Scenario 3. We expect this number to grow with age, but it is also noteworthy that individual differences in other developing abilities might be contributing to these findings. For example, differences in children's developing theory of mind, empathy, and general intelligence may explain why only a subset of children inferred effort from resources while others did not. These are all important topics for future research.

It is also noteworthy, however, that many of our participants did not say that the child with the smaller shovel worked harder, despite this being made explicit by the experimenter in the vignette. This suggests that children, particularly at younger ages, may not recognize that initial resources place some people at a disadvantage in a task, and this recognition is only beginning to develop in our age range. Accordingly, most children believed that the rewards should be distributed evenly in Scenario 3. Additionally, we did not find strong age-related differences in the children's responses. These results are supported by the findings from Scenario 4 where both effort and outcome were manipulated. In this scenario, most children defaulted to outcome or equality when both effort and outcome were manipulated at the same time. It is important to note that we found evidence that by ages 7 and 8, some children are beginning to explicitly consider relative disadvantage and subsequent effort simultaneously, suggesting that reasoning about effort might develop at later ages. However, we cannot rule out the possibility that our manipulation of effort was too subtle and that with a more explicit manipulation, children in our age range would show some understanding. Indeed, the design of the study is closely aligned with structural inequality (i.e., the characters start with different tools), which, despite real-world relevance, can be more subtle than more obvious inequalities such as inequalities in the number of resources (i.e., the characters start with a different number of tools). Future research is important to further investigate this issue.

Altogether, in line with findings from previous research, results from the current study suggest that it is not until later in childhood that children consider multiple factors when making decisions about reward distributions (Noh et al., 2019). However, inconsistent with previous work (Hook & Cook, 1979; Hamann et al., 2014; Noh et al., 2019), we found that only a minority of children within our age range (22.9% of children across all age groups) considered effort in research allocations, even when presented in the absence of any other factor (as in Scenario 3). One potential explanation for the inconsistency of these findings with the literature is while children were told that the characters in the story either had a "big shovel, that can carry a lot of sand, [making] it faster and easier for them to dig" or a "small shovel, that can only carry a little sand, [making] it harder and slower for them to dig," drawing attention to the inequality, they were not told explicitly that one character put forth more effort than the other. Thus, it is possible that our manipulation of effort and resources was simply not strong enough for children in our age range. It is certainly possible (and likely) that providing children with additional contextual cues (e.g., describing a character as wealthy) would result in stronger age-related differences when distributing rewards based on effort. Further, it is also possible that given the lack of additional contextual information, participants in our study were making inferences about how children came to have different shovels (e.g., the child with the bigger shovel was simply luckier, Olson et al., 2006) that affected their responses in ways that we could not measure. Future research is needed to examine this question.

Despite these possibilities, the current study still has important implications for children's real-world reasoning about fairness, as in the real world, the sources of discrepancies in resources and effort are not always explicit. Thus, this research does suggest that, in the absence of additional contextual information, it is not until middle childhood that children make inferences about inequities that might cause some people to produce less than others, and that such inequities may have to be made completely explicit to be considered. This is important, as unlike the situation presented in Scenario 1, many people—children and adults alike—do not necessarily start off with the same resources when given a task, and structural inequities are a part of most industrialized societies. Thus, these data have direct implications for when children might begin making choices that consider such inequities, particularly in the moral

domain. Future work probing this question in older children and adults is necessary to further explore this important issue.

Despite the importance of this work, our study does have some limitations. First, we presented all the scenarios in a fixed order to standardize the experimental procedure. This is especially important considering that reasoning in Scenario 3 (effort manipulation) could have led participants to focus more on the effort cue when making judgments in Scenario 4. Further, our age range only included children up to age 8; thus, it is possible that older children and adults also weigh outcome more heavily than effort, regardless of any disadvantage faced by individuals who produce less. This is still an open question, but the current work and future work of its kind have implications for how people weigh the effort put forth by others who may experience structural inequities like discrimination or poverty. Further work is needed to examine this question more broadly across the lifespan, and the specific factors that might lead individuals to weigh effort more heavily when making decisions about equity.

In conclusion, here we examined how two interrelated factors—effort and outcome—affect how children think about reward distribution. Our data suggest that young children do not necessarily consider the circumstances that put others at a disadvantage, rewarding people primarily for the work produced rather than recognizing the effort put forth by both parties and the lack of adequate resources that drove the effort and output.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Effort-Outcome at https://nyu.databrary.org/volume/1285, reference number 1285.

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