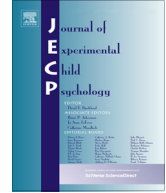




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## The emergence of young children's tolerance for inequality: With age, children stop showing numerically sensitive fairness



Nadia Chernyak

Department of Cognitive Sciences, University of California, Irvine, Irvine, CA 92617, USA

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### ABSTRACT

One persistent and pernicious feature of outstanding social inequality is that even relatively extreme forms of inequality can be justified with reference to merit-based considerations. One key feature of *fairness* with respect to resource allocation is that it is *numerically sensitive*; greater (more extreme) inequalities are generally seen as less fair than less extreme ones. This work sought to document the emergence of numerically sensitive fairness in children aged 4 to 8 years. A total of 81 4- to 8-year-olds completed a series of within-participants fairness judgment trials in which they observed two characters receive either equitable or inequitable shares of resources—ranging from 50/50 (completely fair) to 0/100 (completely unfair)—in two contexts: one in which the two characters were described as working the same amount (equality context) and one in which one character was described as working harder than the other character (merit context). Children of all ages showed numerically sensitive fairness in the equality context. However, whereas younger children continued to show numerically sensitive fairness in the merit context, older children approved even relatively extreme inequalities when one person was described as working harder. This effect emerged with age, suggesting a double-edged sword to acquiring beliefs in merit-based fairness; as children get older, they may begin to accept even relatively extreme forms of inequality when presented in a merit context. Results are discussed with respect to the acquisition of meritocracy as a normative belief of fairness.

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E-mail address: [nadia.chernyak@uci.edu](mailto:nadia.chernyak@uci.edu)

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## Introduction

One of the most critical aspects of human social functioning is the development of a sense of fairness, or equality in resource allocation behavior. To this end, by the preschool age, young children develop the strong intuition that resources ought to be distributed *equally* (Chernyak et al., 2016, 2019, 2022; Geraci & Surian, 2011; Hamann et al., 2011; Huppert et al., 2019; Olson & Spelke, 2008; Rakoczy et al., 2016; Schmidt & Sommerville, 2011; Sheskin et al., 2016; Ulber et al., 2017). In concert with this intuition is the development of a tolerance for *inequality*, or the normalization of distributing resources in ways that deviate from equal outcomes (Elenbaas, 2019; Paulus & Essler, 2020; Rizzo et al., 2016; Schmidt et al., 2016), and one consistent case in which inequality is seen as justified is when one party is seen as more meritorious (Jara-Ettinger et al., 2016; Kanngiesser & Warneken, 2012). Although both equity- and merit-based principles of fairness are present in young children's early understanding of fairness, less is known about how and when young children make trade-offs between their preference for *equality* and their tolerance for legitimate reasons for *inequality* such as merit.

Notably, justifications for inequality may be rooted in normative principles of fairness (merit, charity, just deserts; see Baumard et al., 2012; Elenbaas, 2019; Paulus, 2014; Smith & Warneken, 2016; Wörle & Paulus, 2018), or they may be idiosyncratic and rooted in early biases, preferences, and prejudices (Dunham et al., 2011; Mandalaywala et al., 2021; Rhodes et al., 2018). Recent work finds that despite preschool-aged children's remarkable sensitivity to principles of fairness, young children also accept idiosyncratic sources of inequality (Schmidt et al., 2016); when allocating resources, 8-year-old children, but not preschool-aged children, distinguished between cases where someone is given more resources because that person is more deserving and cases where someone simply demands more resources. One widely recognized normative source of unequal distribution of resources is merit (Starmans et al., 2017); in fact, by middle childhood, children not only distribute goods according to merit but also believe that failing to do so would be unfair (Elenbaas, 2019).

At the same time, normative justifications for inequality, such as merit, pose a special challenge for resource allocation decisions; unlike equality, which has one specific "correct" outcome (giving everyone exactly equal amounts), many types of potentially meritorious inequalities may be considered reasonable. If, for example, two workers, John and Stefan, join forces to engage on a joint business venture and John works considerably harder than Stefan, it may be reasonable to provide John with 60% of the proceeds from that project or even 90% (and potentially many other amounts). The fact that merit-based resource allocations are inherently flexible, subjective, and context specific may form the basis of beliefs that current and outstanding inequalities are deserved. Large inequalities may be justified on the basis of a legitimate *source* (e.g., merit) without careful consideration of *degree* (e.g., the harder worker receives 99% of the wealth but conducted only 75% of the work). To complicate matters, in the context of both real-world resource allocation decisions (e.g., promotions) and conversations with young children, precise numerical information about how *much harder* someone worked is rarely fully available.

The current research sought to investigate the development of children's beliefs about different types of numerical inequalities created on the basis of merit. Children were presented with a series of scenarios in which one person was presented as having worked harder than another to bake a set of cookies. To mimic how merit-based information might be typically discussed, we intentionally did not provide numerical information about how much harder one person worked than another. We surveyed children during the developmental time period when they move from predominantly equality-based resource allocation (preschool age) to resource allocation based on other forms of fairness (middle childhood) such as merit and charity (Chernyak & Blake, 2017; Elenbaas, 2019; Hook & Cook, 1979; Rizzo et al., 2016). In a within-participants design, children were presented with a series of trials in which one person worked harder than another and were told that a set of resources (10 cookies) were distributed between them. Children were then tasked with judging the fairness of all possible resource allocation decisions in which the harder worker received more, ranging from the most extreme inequality (the harder worker receives 10 cookies) to nonexistent inequality (both people receive equal amounts). These were contrasted with trials in which two people were presented as

having worked the same, and thus acceptance of the resource distribution inequality should be inversely related to how extreme it was (we call this *numerically sensitive fairness*).

First, in trials where people work equal amounts, we expected that children would show numerically based fairness (trials in which each person receives 50% would be the most fair, followed by trials in which one person receives 60%, etc.). However, for merit trials, we had two potential hypotheses; given that preschool-aged children struggle with proportional reasoning more generally (Boyer et al., 2008; Chernyak et al., 2020; Hurst & Cordes, 2018; Hurst et al., 2020; McCrink et al., 2010), which may be implicated in merit-based resource allocation, and also tolerate many idiosyncratic forms of inequitable resource distribution (Schmidt et al., 2016), we reasoned that they may respond by accepting *all* forms of inequality. On this account, young children may be *hypertolerant* of inequality even when it is extreme, and more *numerically sensitive fairness* develops in concert with proportional reasoning skills during middle childhood, when children can more readily recognize that “working harder” does not necessarily license one to receive *all* the resources. On the other hand, because young children are deeply sensitive to norms of equal resource distribution, they may instead display numerically sensitive fairness at earlier ages, whereas older children who have acquired normative principles of fairness such as merit may tolerate relatively large inequalities.

## Method

### Participants

Participants were 81 4- to 8-year-old children ( $M_{\text{age}} = 6.51$  years, range = 4.00–8.88; 43 girls and 38 boys) recruited through lab databases and social media advertisements and tested via a 15-min Zoom interview online (with the exception of 3 children who were tested at a local children’s museum). Data were collected from December 2020 to January 2023. Children who participated online were compensated with a \$3 Amazon gift card (or stickers/small toy for in-person participants). Sample size was set a priori based on similar work using a similar analytic approach (Chernyak & Blake, 2017). Approximately half (51%) of parents filled out an optional demographics form; of these, 43% reported their children’s race as White, 10% as Black, 30% as Asian/Pacific Islander, 10% as other, and 7% as Hispanic. In terms of income, 7% reported their household income as less than \$30,000, 18% as \$30,000 to \$59,000, 32% as \$60,000 to \$89,000, 18% as \$90,000 to \$119,000, and 24% as \$120,000 or more.

### Procedure

Stimuli were presented to children in Inquisit 5 computer software (<https://www.millisecond.com>; Millisecond, Seattle, WA, USA) via computer. All children viewed stimuli that displayed silhouettes depicting either girls or boys (gender matched to participants’ gender), and in each trial gender-neutral names (e.g., “Alex and Riley”) were used, which varied across each trial. All children completed the following procedures.

### Pretest

To introduce children to the fairness judgment task, the experimenter showed children a happy face and a sad face and told them that these faces represent something being “OK” and “not OK,” respectively, and asked children to confirm what each face means. If children failed confirmation, they were provided corrective feedback and re-asked until they were able to report accurately. Children then completed two familiarization trials, one in which a child hits another child and one in which a child cleans up toys, prompting children to choose “not OK” and “OK,” respectively. After introducing each familiarization trial, children were asked to select whether the action was “OK” or “not OK.”

### Test trials

Following pretest, children completed two blocks (referred to as the equality block and the merit block) of 6 test trials each, totaling 12 trials per child. In each trial, children were introduced to two new characters (character names varied across each trial) and told that the characters collaborated

on a joint task of baking 10 cookies. After introducing the two characters in each trial and reminding children that either the characters did the same amount of work (equality block) or one character worked harder (merit block), children were immediately shown how the output of their collaboration was distributed. In each of the 6 trials within each block, children were then told that they needed to split up the cookies and then saw one of the possible distributions (depending on trial type: 5–5, 6–4, 7–3, 8–2, 9–1, or 10–0); the experimenter verbalized the distribution (“[Character A] got [X] cookies and [Character B] got [Y] cookies”) and then asked children to indicate whether this distribution was fair (“Is that OK or not OK?”) by pointing to one of the smiley faces. Trials were randomly ordered within each block, and all children saw all possible trial types/distributions.

In each trial of the equality block, children were told that each of the characters did half the work to bake the cookies. In each trial of the merit block, children were given an ambiguous quantifier to represent the amount of work each character performed and were told that one character “did a lot of the work” and the other “did a little bit of the work.” During the first trial of each block, children were given a comprehension check and asked whether one character did more work or whether they did the same amount of work, and they were provided with corrective feedback until they answered the question correctly.

The ordering of the blocks and the side of the harder working character were counterbalanced across participants. The ordering of trials within each block was randomized.

### Coding

Data were automatically recorded via Inquisit software and videotaped (when parents consented). Two independent research assistants coded data into REDCap (research electronic data capture) software (Harris et al., 2009). Inter-rater reliability was 98%, and discrepancies were resolved via a third coder.

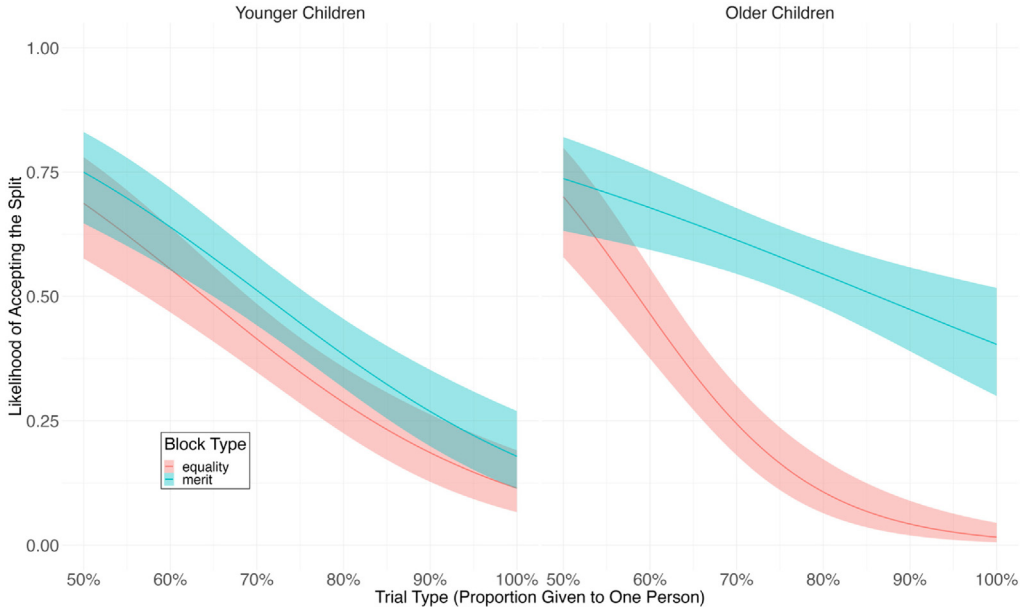
### Results

All stimuli, data, and analyses are available on the Open Science Framework ([https://osf.io/g4u32/?view\\_only=975985f520624fe38a4d617820899731](https://osf.io/g4u32/?view_only=975985f520624fe38a4d617820899731)).

Initial analyses showed no effects of gender, and so data were collapsed across this variable. To investigate whether children’s fairness judgments varied across age, block, or trial type, we ran a mixed effects binomial logistic regression predicting their fairness judgments (1 = OK) from age, block type (equality vs. merit), trial type (modeled as a continuous predictor ranging from 50% to 100% representing the proportion of the endowment allocated to the person with more), and all interactions as predictors. Participant ID was included as a random effect. The results showed a significant effect of block type,  $\chi^2(1) = 23.012$ ,  $p < .001$ , and trial type,  $\chi^2(1) = 98.512$ ,  $p < .001$ , qualified by significant interactions of Age  $\times$  Block Type,  $\chi^2(1) = 13.556$ ,  $p < .001$ , Block Type  $\times$  Trial Type,  $\chi^2(1) = 12.123$ ,  $p < .001$ , and Age  $\times$  Trial Type  $\times$  Block Type,  $\chi^2(1) = 24.450$ ,  $p < .001$ .

As shown in Fig. 1, younger children generally showed numerically sensitive fairness regardless of block type; children were most likely to rate the split as fair the closer it was to equality, and extreme inequalities were the least likely to be judged as fair. In contrast, older children showed numerically sensitive fairness only in the equality block (when both people produced equal amounts of work), but relative to younger children they were comfortable with most forms of inequality.

To further explore the three-way interaction, regressions were run separately for younger and older children, defined by a median age split of 6.44 years. Within the younger children subgroup, there was a small significant effect of block type,  $\chi^2(1) = 5.938$ ,  $p = .015$ , with people being slightly more likely to judge the inequalities as fair in the merit block, and a significant negative effect of trial type,  $\chi^2(1) = 5.938$ ,  $p < .001$ , indicating numerically sensitive fairness; children generally were increasingly less likely to accept the inequality if it was extreme. As indicated by the nonsignificant interaction ( $p > .55$ ), children showed numerically sensitive fairness within both conditions. Within the older children subgroup, there was a significant effect of block type,  $\chi^2(1) = 29.205$ ,  $p < .001$ , trial type,  $\chi^2(1) = 37.138$ ,  $p < .001$ , and a Block Type  $\times$  Trial Type interaction,  $\chi^2(1) = 22.574$ ,  $p < .001$ . Follow-



**Fig. 1.** Likelihood of accepting the split as a function of split type, block type, and age group. “Younger” and “older” children were defined by a median split (age = 6.44 years).

ups showed that both the merit and equality blocks showed significant effects of trial type, although as indicated by the significant interaction the slope in the merit block was much less steep, indicating less numerically sensitive fairness when there was a cover story.

**Discussion**

In a within-participants design, we documented the emergence and decline of numerically sensitive fairness; younger children appeared most sensitive to inequality based on how *extreme* it was, both in cases where characters worked equally hard and in cases where one character worked harder than the other. Older children, however, largely showed numerically sensitive fairness—that is, inequality that was sensitive to how extreme it was—when two people worked equal amounts, but they were less likely to show numerically sensitive fairness when one person was described as doing most of the work. This documented developmental difference dovetails prior findings showing that during middle childhood children’s resource allocation moves from primarily egalitarian splits to merit-based considerations (Elenbaas, 2019; Hook & Cook, 1979; Jara-Ettinger et al., 2016; Rizzo et al., 2016) and shows that one downside of acquiring merit-based normative principles of fairness is becoming less sensitive to extreme forms of inequality.

Unlike many developmental phenomena, in which children generally become *more* precise (especially in the number cognition domain; (Halberda & Feigenson, 2008) as they age, younger children generally showed *more* numerical sensitivity to the degree of inequality in the merit-based case. One deflationary possibility is that only older children understood the concept of “merit,” and thus younger children effectively treated the merit block the same way they would the equality block. Although such a possibility is consistent with general trends showing a shift from predominantly equality-based source distribution to resource distribution on the basis of merit as children move from preschool age to middle childhood (Chernyak & Blake, 2017; Jara-Ettinger et al., 2016; Rizzo et al., 2016; Rizzo & Killen, 2020), it is *inconsistent* with work showing that even infants and preschool-aged children possess implicit understandings of merit (Baumard et al., 2012; Kanngiesser &

Warneken, 2012; Sloane et al., 2012). It would also be inconsistent with the finding that even the younger (preschool-aged) children showed a difference in their judgments in the merit block in comparison with the equality block.

What the younger children did *not* show—that the older children did—was a relative tolerance for relatively *extreme* forms of inequality in which one person received nearly all or almost none of the reward despite the fact that it was made clear that both people joined efforts. One speculative possibility is that the inability to distinguish between different types of normative sources of inequality (extreme and nonextreme) forms the building block of so-called “just world beliefs,” or beliefs that outstanding inequalities are deserved (Lerner & Lerner, 1980). Given that the extent to which people show such beliefs shows individual and cultural variability, future work may focus on how tolerance for extreme forms of inequality persists even into adulthood.

Another possibility that may explain the reported results is that acquiring an understanding of explanations for inequality (in this case merit-based inequality) develops prior to the ability to carefully scrutinize those explanations. If this is the case, future work ought to delineate the types of cognitive building blocks needed to process and ultimately reject extreme forms of inequality, even when they are partly justified. Another fruitful area for future work may be to study cultural differences in the endorsement of relatively extreme forms of inequality; the U.S.-based cultural context in which this work was based shows relatively high forms of income inequality *and* a capitalist society, both of which may provide a cultural context in which merit-based beliefs override numerically sensitive fairness.

In general, two strong and ubiquitous cultural messages are that hard work ought to be rewarded and (especially extreme) inequality ought not to be tolerated. This work takes one step toward documenting how we make trade-offs between these two messages in early development. To form a just society, it is ultimately important to reconcile different and potentially conflicting modes of fairness when deciding how to justly allocate resources.

## Data availability

Data are available on Open Science Framework (<https://osf.io/g4u32>).

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