



# Theory of mind and resource allocation in the context of hidden inequality



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## ABSTRACT

In many situations, children evaluate straightforward resource inequalities as unfair. It remains unclear, however, how children interpret *hidden inequalities* (i.e., inequalities that are unknown to allocators and/or recipients). Children 3–9-years-old ( $N=87$ ) evaluated and attributed intentions to a naïve resource allocator who, while unaware of a hidden inequality, made three hypothetical resource allocations: (1) an *unknowingly equitable* allocation (which rectified the inequality), (2) an *inequitable* allocation (which perpetuated the inequality), and (3) an *equal* allocation (which maintained the inequality). Children *without* false belief morally-relevant theory of mind (FB MoToM) attributed more positive intentions to the unknowingly equitable allocation than to the inequitable allocation. Children *with* FB MoToM, however, did not differ in their attributions of intentions to the unknowingly equitable and inequitable allocations, reflecting their knowledge that the naïve allocator was not aware of the hidden inequality. Further, children's attributions of intentions were related to their evaluations of the allocations. These findings underscore the importance of children's social cognitive inferences to their evaluations of resource allocation decisions.

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## 1. Introduction

The rectification of unjust inequalities is a fundamental moral concern when determining fair methods of allocating resources (Rawls, 1971; Sen, 2009). The recognition of this concern emerges early in childhood, as children become better able to understand the needs, desires, and emotions of others (Donovan and Kelemen, 2011; Killen, Elenbaas, Rizzo, & Rutland, 2017; Mulvey, Buchheister, & McGrath, 2016; Rizzo, Elenbaas, Cooley, & Killen, 2016; Sigelman and Waitzman, 1991). Children as young as 3–5-years-old give more resources to those who have less (Li, Spitzer, & Olson, 2014; Paulus, 2014; Rizzo & Killen, 2016), and sometimes even prefer to discard resources rather than create an inequality (Shaw & Olson, 2012). Children's preference for equality not only influences their own resource allocations but also extends to their evaluations of others' allocations (Cooley & Killen, 2015). Not all inequalities, however, are readily visible or easily rectified. Many inequalities are "hidden" from view and may not be apparent to resource allocators or even to those who are directly affected by the unequal distribution. That is, it is not always apparent that one recipient has more resources than another. Resource allocation contexts involving unobserved inequalities between recipients are important to investigate because: (1) many situations in social life require inferences about resources that are not observable to allocators; and (2) resource

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allocation decisions, like other morally-relevant decisions, rely on mental state attribution mechanisms that have not yet been discovered and documented. In fact, no research, to our knowledge, has examined how children respond to – or expect others to respond to – hidden inequalities.

### 1.1. Hidden inequalities

Understanding how children respond to hidden inequalities is important, as real-world resource allocation decisions often take place in social settings where the quantities of resources possessed by individuals are not known by all parties. The theoretical framework that guided this study is the Social Reasoning Developmental (SRD) model (Killen & Rutland, 2011; Rutland & Killen, 2017), which postulates that understanding the development of moral concepts, such as fair allocation of resources, requires assessments of other social cognitive competencies, such as intentionality (mental state knowledge) or social group processes (group dynamics). In this study, we focused on the former issue, mental state knowledge, to provide novel information about how children evaluate fair allocation of resources (also termed *distributive justice*). While alternative theories have proposed that knowledge about others (e.g., mental states) emerges prior to moral judgments, in the SRD model the approach is to document how children coordinate multiple domains of knowledge (forms of reasoning) to make moral decisions. In the present study, we examined children's conceptions of fairness by focusing on resource allocation in the context of a hidden inequality, a condition in which we propose that intentionality judgments must be coordinated with moral reasoning in order to evaluate the fairness of a resource allocation decision by another party.

In many cases, resource allocators must make resource allocation decisions based on recipients' claims, without being aware of any inequalities that may exist between recipients. While recent research has shown that children consider agents' mental states when making moral evaluations of their actions (Killen, Mulvey, Richardson, Jampol, & Woodward, 2011; Mulvey et al., 2016), it is unclear how children's understanding of others' intentions influences their evaluations of resource allocations. Children may, for example, encounter situations where a resource allocator must decide how to distribute resources to recipients with different claims and different amounts of possessions. When evaluating the fairness of another person's resource allocation, children must consider not only the numerical equality or inequality that results from the allocation, but also the beliefs and intentions of the allocator.

Taking into account the beliefs and intentions of the allocator is especially important for evaluating cases where the allocator distributes unequal quantities of resources to different recipients. Unequal resource allocations are not necessarily motivated by negative intentions. For example, an allocator who distributes more resources to a hard-working recipient than to an idle recipient may be acting on a positive intention to reward effort meritoriously (Baumard, Mascaro, & Chevallier, 2012; Rizzo et al., 2016). Similarly, an allocator may act on a well-intentioned desire to rectify inequalities by giving more to someone who has little or no resources than to another recipient who already has many resources (Elenbaas, Rizzo, Cooley, & Killen, 2016; Paulus, 2014; Rizzo & Killen, 2016). However, in the context of a *hidden inequality*, where there are no *known* differences in effort or need between recipients and where the two recipients both *appear* to possess the same number of resources, acting on a positive intention (to treat recipients the same by dividing resources equally) may actually cause a negative outcome (the maintenance of the status-quo inequality). As well, in the context of a hidden inequality, acting on a presumably negative intention (by favoring one recipient over another) may actually produce a positive outcome (the rectification of the status-quo inequality). Thus, assessing children's responses to resource allocation decisions that take place in hidden inequality contexts provides an avenue for investigating how children recruit their social cognitive reasoning skills when interpreting and evaluating resource allocation decisions. Social cognitive reasoning skills include attributions of intentionality and attributions of false belief (Wellman and Liu, 2004; Shiverick & Moore, 2007). Children equipped with these skills, known as Theory of Mind (ToM), may be able to incorporate the beliefs and intentions of resource allocators into their moral evaluations of resource allocations.

Specifically, children with ToM proficiency would be expected to recognize that, in the context of a hidden inequality, enacting an unknowingly equitable allocation (distributing fewer resources to a recipient who already has resources, and distributing more resources to a recipient who has no resources) would reflect an unfair intention on the part of the naïve allocator, who (as the participant knows) is unaware of the disparity that exists between the recipients. Participants with ToM competence would also condemn an inequitable allocation (distributing more resources to the recipient who has resources, and distributing fewer resources to the recipient who has none), because this allocation not only enacts a negative intention to distribute resources unequally but also worsens the existing inequality. Crucially, however, participants with ToM would favor an equal allocation (dividing resources equally between the two recipients) because these participants would recognize that, from the perspective of the naïve allocator (who is unaware of the hidden inequality), it would be equally unfair to give more resources to either recipient. In light of the paucity of research investigating the role of social cognitive competencies in children's moral evaluations of resource allocation decisions, the assessment of children's evaluations of resource allocation decisions taking place in a hidden inequality context would provide meaningful insight into how children incorporate belief and intention information into their assessments of these decisions.

### 1.2. Social reasoning developmental model and morally-relevant theory of mind

The social reasoning developmental model draws on social domain research (e.g., Smetana, Jambon, & Ball, 2014), which has documented that children reason about moral principles (e.g., distributive justice, avoidance of harm, protection of rights,

etc.) as authority-independent, intrinsically justified, and generalizable across contexts. Moreover, children also develop psychological knowledge (Nucci, 2001), such as mental state knowledge, for evaluating the belief states of moral agents (Wainryb & Ford, 1998) as well as the intentionality of acts (Cushman, Sheketoff, Wharton, & Carey, 2013; Killen et al., 2011; Shiverick & Moore, 2007). Children's moral development has also been shown to be related to emotion understanding and false belief ToM (Killen et al., 2011; Lane, Wellman, Olson, LaBounty, & Kerr, 2010; Leslie, Knobe, & Cohen, 2006; Smetana, Jambon, Conry-Murray, & Sturge-Apple, 2012; Weller & Lagattuta, 2014), and research has documented several contexts in which children take agents' intentions into account when making moral judgments (Nobes, Panagiotaki, & Pawson, 2009; Yuill & Perner, 1988; Zelazo, Helwig, & Lau, 1996).

Supporting the SRD model, moral reasoning and theory of mind competencies have been shown to exert reciprocal influences on each other both diachronically in development (Smetana et al., 2012) and synchronically in tasks involving the ascription of mental states to agents in morally-relevant contexts (Killen et al., 2011; Leslie et al., 2006). For instance, children are more likely to attribute intentionality (e.g., "she did it on purpose") to someone who indifferently causes a negative outcome than to someone who indifferently causes a positive outcome (Leslie et al., 2006).

Additionally, children encounter difficulty not only with the attribution of intentions, but also with the attribution of beliefs to agents who commit accidental moral transgressions. Participants in a study by Killen et al. (2011) were shown a situation involving an accidental transgressor: a classroom helper throws away a bag containing a peer's special cupcake. Young children erroneously attributed false belief (e.g., "she knew what was in the bag") and negative intentions (e.g., "she threw away the bag on purpose") to the accidental transgressor, despite succeeding on "prototypic" false belief theory of mind tasks that lacked moral valence. Thus, mental state inferences may become more complex and more difficult with the introduction of *morally-relevant* considerations, such as the target of mental state attributions being an accidental transgressor or an unaware victim (e.g., a victim who did not observe the transgression occurring). Morally-relevant theory of mind (MoToM) proficiency involves the ability to inhibit moral judgments while making mental state inferences. Moral outcomes have also been shown to influence mental state attributions in the context of resource allocation, as children attribute more intentionality to an allocation decision that inadvertently creates an inequality than to an allocation decision that does not create an inequality (Donovan & Kelemen, 2011).

Other links between false belief ToM and children's moral judgments have also been established in the context of resource allocation. For example, children with false belief ToM evaluate inequitable resource allocations more negatively than do children without false belief ToM (Mulvey et al., 2016). Children's inequality aversion may therefore arise from an interplay of concerns for moral principles like fairness and avoidance of harm (Rizzo et al., 2016; Smetana et al., 2014) and social cognitive competencies such as false belief ToM. This combination of moral and social cognitive reasoning enables children to recognize that inequalities are wrong precisely because disadvantaged recipients experience harm as a result of inequality (see also, Elenbaas & Killen, 2016). In another demonstration of the interplay between ToM and moral cognition, Takagishi, Kameshima, Schug, Koizumi, and Yamagishi (2010) showed that children with false belief ToM offer fairer ways of sharing resources than children without false belief ToM, suggesting that false belief competency allows children to anticipate that others will react negatively to unfairness. However, it is not yet known how children would evaluate the resource allocation decisions of an allocator who, on the basis of incorrect beliefs, distributes resources to recipients with differing starting amounts of resources.

### 1.3. Present study

In light of the significant role that theory of mind plays in children's understanding of resource allocations when inequalities are known (Mulvey et al., 2016; Takagishi et al., 2010), the present study investigated how children make use of social cognitive competencies (e.g., false belief and intentionality attributions) when evaluating resource allocations in a *hidden inequality* context.

Children heard a vignette in which a "naïve allocator" (a teacher) possessed two resources to distribute between two recipients (children going on a field trip), both of whom claimed to have no resources. Unbeknownst to the allocator and recipients, however, one of the recipients already possessed two resources. Subsequently, participants were asked to evaluate three hypothetical allocation decisions that the naïve allocator (the teacher) could make: (1) an *unknowingly equitable* allocation of two resources to the disadvantaged recipient (resulting in two resources for each recipient, thereby rectifying the inequality), (2) an *inequitable* allocation of two resources to the advantaged recipient (resulting in four resources for one recipient and zero for the other recipient, thereby perpetuating the inequality), and (3) an *equal* allocation of one resource to each recipient (resulting in three resources for one recipient and one resource for the other recipient, thereby maintaining the existing inequality). To clarify, the equitable allocation in this study was termed the *unknowingly equitable* allocation because the naïve allocator did not intend to bring about an equitable outcome. However, the inequitable allocation was not termed the *unknowingly inequitable* allocation because the naïve allocator was still *knowingly* giving inequitably.

Participants were assessed on their *morally-relevant* ToM capacities to attribute false beliefs and intentions to the resource allocator. Participants also made moral evaluations of the three allocations. The present study therefore examined the relation of theory of mind to the moral judgment of resource allocators' allocation decisions, particularly when the participant was – but the allocator was not – aware of a hidden inequality. Consistent with past research (Killen et al., 2011; Mulvey et al., 2016), false belief morally-relevant ToM (FB MoToM) was assessed. The FB MoToM assessment is uniquely suited to the task demands of our hidden inequalities situation, which involves evaluating a moral agent who acts on the basis of a false

belief (e.g., the belief that two resource recipients are equally in need of resources) and in the process causes fair or unfair distributive outcomes. In the current study, the age range was extended beyond the years (e.g., 4 or 5) at which children typically pass prototypic false belief tasks in order to include older children (e.g., 6–9-year-olds), who would be more likely to pass morally-relevant ToM assessments (Killen et al., 2011).

#### 1.4. Hypotheses

As previous research has shown that children pass morally-relevant ToM tasks later in development than they pass prototypic false belief tasks (Killen et al., 2011), we hypothesized that children would be more likely to pass the morally-relevant false belief ToM assessment with increasing age.

Regarding children's attributions of intentions to the resource allocation decisions, we hypothesized that children, as a whole, would attribute more positive intentions to the *equal* and *unknowingly equitable* allocations than to the *inequitable* allocation. Furthermore, we predicted that children with and without FB MoToM would differentially attribute intentions to the unknowingly equitable, inequitable, and equal allocations. We expected that children who passed the FB MoToM assessment would realize that the naïve allocator was unaware of the inequality, and would therefore attribute equally negative intentions to the unknowingly equitable and inequitable allocations. This is due to the fact that children with FB MoToM would understand that, from the perspective of the naïve allocator, the unknowingly equitable and inequitable allocations would appear equally unfair. In contrast, children who failed the FB MoToM assessment would wrongly assume that the naïve allocator, in making an unknowingly equitable allocation, intended to correct the inequality, and therefore would attribute more positive intentions to the unknowingly equitable allocation than to the inequitable allocation.

Regarding children's evaluations of the allocations, we hypothesized that children would generally evaluate equal and unknowingly equitable allocations more positively than inequitable allocations. Furthermore, we hypothesized that children's attributions of intentions to each resource allocation decision would predict their evaluation of that particular resource allocation decision. While the inequitable allocation involved a *consistent* intention-to-outcome mapping, the other two strategies (the unknowingly equitable and equal allocations) involved *inconsistent* intention-to-outcome mappings. Thus we expected that children's evaluations of the allocations with inconsistent intention-to-outcome mappings would be informed by their attributions of intentions to these allocation strategies, as these are exactly the types of morally ambiguous situations in which forming a correct interpretation of the situation requires sophisticated theory of mind skills.

Specifically, a child who recognizes that the naïve allocator, in believing that neither recipient has resources, is acting on *negative* intentions in unequally allocating resources would thereby evaluate the unknowingly equitable allocation *negatively*. However, a child who mistakenly believes that the allocator intends to produce a *positive* consequence (rectification of inequality) in unequally allocating resources would evaluate the unknowingly equitable allocation *positively*. Accordingly, those children who (correctly) attributed negative intentions to the unknowingly equitable allocation would evaluate the unknowingly equitable allocation less positively than children who (wrongly) attributed positive intentions to the unknowingly equitable allocation.

The same logic informed our prediction that children's attributions of intentions to the equal allocation would predict their evaluations of the equal allocation. A child who recognizes that the allocator, in believing that neither recipient has resources, is acting on *positive* intentions in equally allocating resources would thereby evaluate the equal allocation *positively*. However, a child who mistakenly believes that the allocator meant to produce a *negative* consequence (the maintenance of inequality) in equally allocating resources would evaluate the equal allocation *negatively*. Thus, children who (correctly) attributed positive intentions to the equal allocation would evaluate the equal allocation more positively than children who (wrongly) attributed negative intentions to the equal allocation.

We expected that all children would negatively evaluate the inequitable allocation because both the intention (to unequally distribute resources) and the consequence (the perpetuation of inequality) of this allocation strategy are negative, and thus children would not find it difficult to conceptualize the consistent mapping between a negative intention and a negative outcome.

In summary, we expected to find age-related increases in FB MoToM proficiency, a relation between FB MoToM and the attributions of intentions to the allocation decisions, and a relation between the attributions of intentions to the resource allocation decisions and the evaluations of those allocations.

## 2. Methods

### 2.1. Participants

Participants were children ( $N = 87$ ;  $M = 6.22$ ,  $SD = 2.27$ ; range: 3.17–9.96 years) attending middle-income schools in the Mid-Atlantic United States. The sample was representative of the United States population and consisted of children from European American (41%), African American (30%), Asian American (14%), Hispanic (10%), and other or multiethnic (5%) backgrounds. All participants provided written parental consent and on-site verbal assent. Initial analyses revealed no differences based on the ethnicity or gender of the participants; thus these variables were not included in any subsequent analyses.

## 2.2. Procedure

Trained research assistants interviewed participants in individually administered sessions. In each session, the research assistant narrated the vignette (accompanied by Microsoft PowerPoint slides on a laptop) while recording the participant's responses on both a paper protocol and a digital voice recorder (see Fig. 1 for a sample slide from the protocol). Participants were trained on how to use the Likert-type scales, and all participants demonstrated proficiency with the scale prior to beginning the study.

In the vignette, two characters (gender-matched to the participant) were told to bring juice to school for an upcoming class field trip. Whereas one character, Alex (termed *the disadvantaged recipient*), was shown with an empty refrigerator and no juice boxes, the other character, Sam (termed *the advantaged recipient*), was shown with a refrigerator full of juice boxes. Notably, the advantaged character held a false belief about the number of juice boxes in his/her backpack, and on the basis of this false belief makes a false claim when the teacher asks if anyone needs juice. The script was read to participants as follows (girl version):

This is Sam. This is Alex. Their class is going on a field trip. And all of the students were told to bring juice for the field trip. Without juice, they will get very thirsty! Look, Sam [shown with a refrigerator full of juice boxes] has a lot of juice boxes at home that she could bring with her on the field trip. But, look, Alex [shown with an empty refrigerator] does not have any juice boxes at home that she could bring with her on the field trip.

The night before the field trip, Sam went to bed without putting juice in her backpack. While Sam was asleep, her big brother put two juice boxes in Sam's backpack and zipped it up. In the morning, Sam sees that her backpack is zipped up. Sam grabs her backpack and runs off to school. At school, before the class leaves for the field trip, the teacher says, "Does anyone need any juice? I have two extra juice boxes for anyone who does not have any juice." Alex says to the teacher, "I do not have any juice boxes." Sam also says to the teacher, "I do not have any juice boxes."

Thus, the vignette was constructed such that the inequality between the advantaged and disadvantaged recipients was not due to negligence on the part of the disadvantaged recipient (in forgetting to bring resources), but rather due to the disadvantaged recipient's lack of available resources.

While listening to the vignette (immediately after Sam grabs her backpack and runs off to school), participants responded to a memory check: "Did Sam see inside his/her backpack before he/she left for school?" The memory check ensured that participants understood the premise of the story, namely, that Sam lacked access to the knowledge that there were already resources in his/her backpack. Participants were retold the story up to two times until they answered correctly. All participants passed the memory check.



**Fig. 1.** The resource allocation setting with the advantaged recipient (Sam), the disadvantaged recipient (Alex), the resource allocator (teacher), and the thought bubble accompanying the false belief morally-relevant theory of mind assessment ("What did Sam think was in the backpack?").



## 2.3. Measures

### 2.3.1. False belief morally-relevant theory of mind

The first question assessed the participant's ability to correctly assign a false belief to an accidental transgressor in a morally-relevant context (Killen et al., 2011), and is referred to here as a false belief morally-relevant theory of mind assessment (FB MoToM). This morally-relevant false belief task was chosen as the most appropriate measure of false belief for our hidden inequalities situation, given that the allocator in this situation was a moral agent who acted on a false belief and produced morally-relevant outcomes. This measure was also deemed appropriate for the sample age range, given its expected variability. Although children typically pass prototypic (e.g., location-change or false-contents) false belief tasks by age 4 or 5 years, Killen et al. (2011) found that children do not reliably pass a morally-relevant false belief task until 7.5-years-old. Participants were asked, "What did Sam think was in the backpack?" Participants who answered "juice" were coded as having failed the assessment (0), whereas participants who answered "nothing" were coded as having passed (1). In instances where a participant provided other responses (e.g., "books", "paper", "pencils"), interviewers were trained to ask, "Did Sam think there was anything else in the backpack?" to probe children for a dichotomous response of either "Nothing" or "Juice".

### 2.3.2. Allocation strategies

Following the MoToM assessment, participants were presented with three hypothetical allocation strategies that the teacher could use to allocate the two juice boxes. A fixed order based on past research was used that did not yield order effects across multiple evaluations of allocation assessments (Rizzo et al., 2016; Rizzo & Killen, 2016). The three allocation stories were presented in a fixed order as follows: Unknowingly Equitable Allocation, Inequitable Allocation, and Equal Allocation. Critically, each allocation strategy was presented as part of a new hypothetical situation (i.e., the characters did not accumulate resources), and an animation on the screen showed the juice boxes from the previous strategy disappearing before the presentation of the next allocation strategy and its assessments.

### 2.3.3. Unknowingly equitable allocation

In the first hypothetical allocation (termed the *unknowingly equitable* allocation), the teacher gave both of the two juice boxes to the disadvantaged recipient (e.g., "Let's say that the teacher decides to give two juice boxes to Alex, and no juice boxes to Sam"). Participants were asked to make an *Evaluation of the Allocation* (e.g., "Based on what she knew, do you think it was OK or not OK for the teacher to give two juice boxes to Alex and none to Sam? How OK/not OK?") by pointing to a 6 point Likert-type scale displayed on the laptop (1: Really not OK, 2: Not OK; 3: A little not OK, 4: A little OK, 5: OK, 6: Really OK). Next, participants were asked to make an *Attribution of Intention* to the teacher (e.g., "Does the teacher think that she was doing something OK or not OK by giving two juice boxes to Alex and none to Sam? How OK/not OK?"), also by pointing to a 6 point Likert-type scale displayed on the laptop (1: Really not OK, 2: Not OK; 3: A little not OK, 4: A little OK, 5: OK, 6: Really OK).

### 2.3.4. Inequitable allocation

In the second hypothetical allocation (termed the *inequitable* allocation), the teacher gave both of the two juice boxes to the advantaged recipient. Participants were asked to make an *Evaluation of the Allocation*, as well as an *Attribution of Intention*, again by pointing to a 6 point Likert-Type scale on the laptop.

### 2.3.5. Equal allocation

In the third hypothetical allocation (termed the *equal* allocation), the teacher gave one juice box to the advantaged recipient and one juice box to the disadvantaged recipient. Again, participants were asked to make an *Evaluation of the Allocation*, followed by an *Attribution of Intention*, by pointing to a 6 point Likert-Type scale on the laptop.

## 3. Results

To test age-related hypotheses regarding children's ability to pass the FB MoToM assessment, a linear regression was conducted. Overall, 55 children passed and 32 children failed the FB MoToM assessment. Consistent with our hypotheses, with age, children were more likely to pass the FB MoToM assessment,  $B = 0.09$ ,  $p < 0.001$ ,  $R^2 = 0.17$ .

To test hypotheses about the relationships between False Belief Morally-Relevant Theory of Mind (FB MoToM), Attributions of Intentions, and Evaluations of the Allocations, Univariate ANCOVAs, with age included as a covariate, were conducted. Age was included as a covariate in order to dissociate the MoToM effects of interest from potential confounding effects of age.

### 3.1. False belief morally-relevant theory of mind and attributions of intentions

To investigate the hypothesis that FB MoToM predicted Attributions of Intentions, a 2 (ToM: Pass, Fail) X 3 (Allocation: *Unknowingly Equitable*, *Equal*, *Inequitable*) repeated measures ANCOVA was conducted with age as a covariate. An interaction between FB MoToM and allocation decision was found ( $F(2, 164) = 4.97$ ,  $p = 0.008$ ,  $\eta_p^2 = 0.06$ ). As shown in Table 1,

**Table 1**

Means (and Standard Deviations) for Attributions of Intentions following Allocation Types by False belief Morally-Relevant Theory of Mind.

Allocation Strategy	False belief Morally-Relevant Theory of Mind			
	Fail		Pass	
	M	SD	M	SD
Unknowingly Equitable	3.80 <sup>a</sup>	(1.99)	3.16 <sup>a</sup>	(1.81)
Inequitable	2.50 <sup>b</sup>	(1.80)	2.62 <sup>a</sup>	(1.74)
Equal	3.87 <sup>a</sup>	(2.01)	5.18 <sup>b</sup>	(1.38)

Note. M = Mean; SD = Standard deviation. Means are on a 1–6 point Likert-type scale from “Really not OK” to “Really OK”. Superscripts <sup>a</sup> and <sup>b</sup> denote significant differences ( $p < 0.05$ ) between rows (Allocation Strategy) within each column (ToM competence).

children who failed the FB MoToM assessment attributed more negative intentions regarding inequitable than unknowingly equitable allocations ( $p = 0.01$ ), whereas children who passed the FB MoToM assessment did not differ in their attributions of intentions regarding inequitable and unknowingly equitable allocations ( $p > 0.05$ ). Further, children who passed the FB MoToM assessment attributed more negative intentions regarding unknowingly equitable allocations than equal allocations ( $p < 0.001$ ), whereas children who failed the FB MoToM assessment did not differ in their attributions of intentions regarding unknowingly equitable and equal allocations ( $p > 0.05$ ). Finally, both children who passed ( $p < 0.001$ ) and children who failed ( $p = 0.01$ ) the FB MoToM assessment attributed more negative intentions regarding inequitable than equal allocations.

Thus, children who passed the FB MoToM assessment did not differ in their attributions of intentions for the unknowingly equitable and inequitable allocations, but did attribute more negative intentions for the unknowingly equitable and inequitable allocations than for the equal allocations. Conversely, children who failed the FB MoToM assessment attributed more negative intentions for the inequitable than unknowingly equitable allocations. Additionally, children who failed the FB MoToM assessment did not differ in their attributions of intentions for the unknowingly equitable and equal allocations.

### 3.2. False belief morally-relevant theory of mind and evaluations of allocations

To investigate the hypothesis that FB MoToM predicted Evaluations of Allocations, a Univariate ANCOVA with age as a covariate was conducted. A main effect of allocation was found ( $F(2, 166) = 14.47, p < 0.001, \eta_p^2 = 0.15$ ). Children evaluated inequitable allocations ( $M = 1.80, SD = 1.30$ ) more negatively than unknowingly equitable ( $M = 2.99, SD = 2.00; p < 0.001$ ) and equal ( $M = 4.97, SD = 1.44; p < 0.001$ ) allocations, and evaluated unknowingly equitable allocations more negatively than equal allocations ( $p < 0.001$ ). Neither an effect of FB MoToM nor an interaction between FB MoToM and Evaluations of Allocations was found.

Thus, children in general evaluated inequitable allocations more negatively than unknowingly equitable and equal allocations, and evaluated unknowingly equitable allocations more negatively than equal allocations.

### 3.3. Attributions of intentions and evaluations of the allocations

To investigate hypotheses that children's Attributions of Intentions regarding an allocation would predict their Evaluation of the Allocation for that allocation, participants were split into two groups (positive intentions, negative intentions) for each allocation strategy: *Unknowingly Equitable* (positive intentions:  $n = 41$ , negative intentions:  $n = 45$ ), *Inequitable* (positive intentions:  $n = 26$ , negative intentions:  $n = 61$ ), and *Equal* (positive intentions:  $n = 69$ , negative intentions:  $n = 17$ ). Independent samples  $t$ -tests were then conducted for children's evaluations of each allocation strategy by their attributions of intentions (positive, negative) for that allocation strategy (see Fig. 2).

#### 3.3.1. Unknowingly equitable allocations

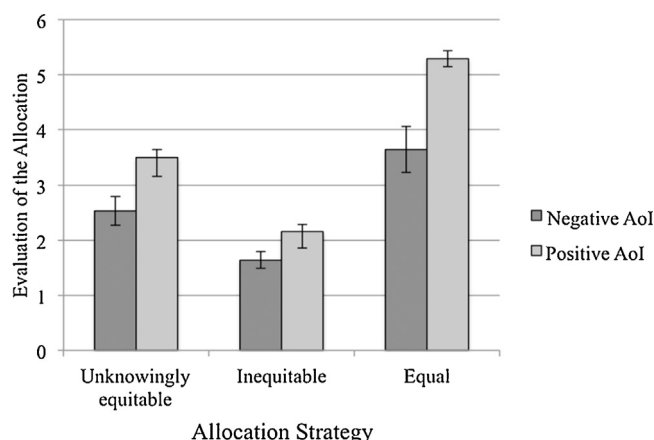
The independent samples  $t$ -test for *Unknowingly Equitable* allocations revealed that children who attributed negative intentions regarding an unknowingly equitable allocation ( $M = 2.53, SD = 1.77$ ) evaluated the allocation more negatively than children who attributed positive intentions ( $M = 3.50, SD = 2.16; t(83) = 2.27, p = 0.025, d = 0.49$ ).

#### 3.3.2. Inequitable allocations

The independent samples  $t$ -test for *Inequitable* allocations revealed that children who attributed negative intentions regarding an inequitable allocation ( $M = 1.64, SD = 1.18$ ) did not differ in their evaluations from children who attributed positive intentions ( $M = 2.15, SD = 1.49$ ),  $p > 0.05$ . Thus, children in general, regardless of their attributions of intentions to the inequitable allocation, evaluated the inequitable allocation negatively.

#### 3.3.3. Equal allocations

The independent samples  $t$ -test for *Equal* allocations revealed that children who attributed negative intentions regarding an equal allocation ( $M = 3.65, SD = 1.73$ ) evaluated the allocation more negatively than children who attributed positive intentions ( $M = 5.29, SD = 1.16; t(84) = 4.70, p < 0.001, d = 1.11$ ).



**Fig. 2.** Children's evaluations of the three resource allocation strategies based on their attributions of intentions to each allocation strategy. AoI: Attributions of Intentions. Error bars represent standard error of the mean.

#### 4. Discussion

Children ages 3–9-years-old evaluated the allocation decisions of, and attributed intentions to, a naïve resource allocator who made three hypothetical resource allocation decisions (*Unknowningly Equitable*, *Equal*, *Inequitable*) in a hidden inequality context. The three hypothetical resource allocation decisions included an *unknowningly equitable* allocation that rectified the hidden inequality (by giving both of two resources to the disadvantaged recipient), an *inequitable* allocation that perpetuated the hidden inequality (by giving both of two resources to the advantaged recipient), and an *equal* allocation that maintained the hidden inequality (by giving one resource to each recipient).

The first set of novel findings from the present study revealed that FB MoToM competence was significantly related to the accurate attributions of intentions to a naïve resource allocator, supporting the SRD model that children must actively coordinate different types of knowledge simultaneously to make attributions of fair decision-making regarding resource allocations. Children who failed the FB MoToM assessment attributed more positive intentions to the *unknowningly equitable* allocation than to the *inequitable* allocation, due to the fact that, without FB MoToM, they wrongly expected that the naïve allocator knew about the inequality. However, children who passed the FB MoToM assessment attributed negative intentions to both the *unknowningly equitable* and the *inequitable* allocations. These children understood that the naïve allocator, who was unaware of the inequality, would consider it a moral transgression to favor either recipient over the other.

The second set of novel findings revealed the relation between children's attributions of intentions and their moral evaluations of the allocations. Across many domains of moral judgment, children consider both the outcomes and intentions of an action (Nobes et al., 2009). It follows that in the domain of resource allocation, as well, children should be expected to consider both the distributive equality or inequality resulting from the allocation decision as well as the beliefs and intentions of the allocator when making evaluations. This study illuminated the influence of a resource allocator's intentions on children's moral evaluations.

##### 4.1. Children's attributions of intentions predict their evaluations of allocations

As expected, children as a whole negatively evaluated the inequitable allocation; there was no significant difference between children with or without intention attribution proficiency with respect to their evaluations of the inequitable allocation. Children's evaluations of the *unknowningly equitable* and *equal* allocations, however, were informed by their attributions of intentions to those allocation decisions. Children who attributed negative intentions to the *unknowningly equitable* allocation evaluated the allocation more negatively than did children who attributed positive intentions to the *unknowningly equitable* allocation. Similarly, children who attributed negative intentions to the *equal* allocation evaluated the allocation more negatively than did children who attributed positive intentions to the *equal* allocation.

These findings attest to the connections between ToM and moral judgments in the domain of resource allocation. That children's attributions of intentions to resource allocators predicted their evaluations of resource allocators' decisions demonstrates that children, in evaluating resource allocations, consider not only the quantities of resources that are given and received, but also the moral valence of allocators' intentions.

These findings are also interesting in light of McCrink, Bloom, and Santos' (2010) finding that children, with age, will favor an allocator who gives a *proportionally* larger amount of their resources (e.g., 3 out of their 4 resources) over an allocator who gives the same *absolute* number of resources but proportionally less (e.g., 3 out of their 12 resources). That children evaluate resource allocations on the basis of the allocators' intentions, and not only on the basis of the distributive outcomes, seems to be supported by both the present findings and McCrink et al.'s (2010) findings. According to this account, the children in



McCrink et al.'s (2010) study may have recognized that the allocator who gave proportionally more acted on more positive intentions than the allocator who gave proportionally less. When it comes to resource allocations, then, children seem to recognize that allocators' mental states are morally significant. We thus found that both the outcomes of an allocation and the intentions of the allocator bear on children's moral evaluations of allocation decisions, which is consistent with the view that both outcomes and intentions are integrated into moral judgments (Nobes et al., 2009). Thus, the present findings extend this conception of the dual influences of outcomes and intentions on moral judgment into the morally-relevant domain of resource allocation.

#### 4.2. The role of false belief theory of mind in children's attributions of intentions

Children's attributions of intentions to the resource allocator were contingent on their false belief theory of mind proficiency. Children *without* false belief theory of mind attributed more negative intentions to the inequitable allocation than to the equitable allocation. Children *with* false belief theory of mind, however, attributed negative intentions of the same magnitude to both the equitable and inequitable allocations. This novel finding shows that false belief theory of mind is involved in children's ability to accurately attribute intentions to a naïve resource allocator. The children *with* false belief theory of mind recognized that, from the perspective of the naïve allocator, it would be equally unfair to give more resources to either recipient. Conversely, the children *without* false belief theory of mind attributed more negative intentions to the allocation that caused a negative outcome than to the allocation that produced a positive outcome, perhaps because they experienced "interference" from the negative moral outcome (Killen et al., 2011; Leslie et al., 2006).

The present findings indicate that social cognitive skills are related: false belief theory of mind proficiency was involved in children's attributions of intentions, which were in turn predictive of children's moral evaluations. These findings are consistent with the view (e.g., Moses, 2001) that intentions are conceptually contingent on the beliefs that underlie intentions (e.g., the belief that a given act is possible, or the belief that a given act will produce a certain outcome). Moreover, these findings suggest that moral outcomes may interfere with mental state attributions in the domain of resource allocation, a previously unexplored domain for this type of moral-to-mental interference. Killen et al. (2011) found that accidental resource *destruction* (e.g., a classroom helper throwing away a paper bag containing a peer's special cupcake) elicited errors in children's attributions of beliefs (e.g., that the transgressor knew there was a cupcake in the bag) as well as intentions (e.g., that the transgressor destroyed the cupcake on purpose). Similarly, our findings extend Killen et al.'s (2011) demonstration that moral outcomes influence intentionality attributions by showing that this moral-to-mental interference also occurs in the domain of resource *allocation* decisions. Thus, in the domain of resource allocations, as in other moral domains, there is a reciprocal relationship between mental and moral cognition: intention attributions inform moral judgments and moral judgments inform intention attributions.

Our finding that the accidentally unfair outcomes of resource allocation decisions may disrupt children's intentionality attributions testifies to the significance of resource allocation decisions in children's moral judgments. The heightened moral significance of resource allocation decisions may be a consequence of the significant extent to which children's play and peer interactions are centered around resources, such as toys or food. The finding that the fair or unfair outcomes of resource allocations would strongly influence attributions of intentions is also consistent with past research on children's understanding of equity (Fehr, Bernhard, & Rockenbach, 2008; Rizzo et al., 2016; Rizzo & Killen, 2016; Ulber, Hamann, & Tomasello, 2015).

Notably, this demonstration that resource allocation outcomes may induce interference in children's theory of mind was made possible by the use of a hidden inequality situation, which allowed for a dissociation between a naïve allocator's *intentions* in allocating resources and the resulting fair or unfair *outcomes* of the allocation decision. Recent research on children's evaluations of resource allocation decisions have shown that children negatively evaluate decisions that create inequalities (Donovan & Kelemen, 2011; Elenbaas & Killen, 2016; Mulvey et al., 2016), and additional studies have demonstrated that children will act to rectify inequalities in many contexts (Blake et al., 2015; Li et al., 2014; Paulus, 2014; Shaw & Olson, 2012). The resource inequalities presented in previous studies, however, were straightforward and known to all parties (i.e., were known to all allocators and recipients). Thus, the role of mental state knowledge in children's evaluations of resource allocation decisions has remained largely unexplored, and no prior study (to our knowledge) has investigated children's responses to hidden inequalities. Future research may benefit from employing other variations of a hidden inequality setting to further investigate how children incorporate the mental states of allocators and recipients into their moral evaluations of resource allocations.

#### 4.3. Necessity of assessing intentions, not just false belief, as a measure of MoToM

Notably, the children in this study were tested on their abilities to attribute intentions as well as beliefs. Undoubtedly, false belief theory of mind is essential to moral judgment (Smetana et al., 2012), and false belief proficiency has previously been shown to inform children's moral evaluations of resource allocations (Mulvey et al., 2016). Further investigation is needed, however, on the role that *intentionality* attributions fulfill in children's moral judgments. Agents act on the basis of their beliefs, but it is their intentions, in particular, that are morally-relevant. Two hypothetical agents who hold the same belief about the world may differ dramatically in the moral valences of the intentions behind their actions (e.g., one agent believes that a given course of action would hurt others and chooses to perform the action – thereby acting on a negative

intention, whereas another agent who also believes that a given course of action would hurt others refrains from performing the action – thereby acting on a positive intention). Whereas previous research (Kenward & Dahl, 2011) has shown that children are sensitive to the moral valence of resource recipients, ours was an early investigation into children's sensitivity to the intentions of resource *allocators*. The present finding that children's evaluations of actions were predicted by their attributions of intentions, but *not* by their false belief proficiencies, is an early demonstration of a divergence between the roles of false belief theory of mind and intentionality theory of mind in moral judgment.

#### 4.4. Future directions

This study has demonstrated that children's evaluations of resource allocations are indeed influenced by their attributions of intentions to the allocator. A worthy direction of future investigation concerns how children would respond to the intentions of a resource *claimant*. Many previous studies have presented children with resource allocation situations focused on (relatively passive) resource recipients, but there is a lack of research on the roles of recipients as *active*, participatory agents in the resource allocation decision-making dynamic. Resource recipients may raise claims, for example, that entail morally-relevant consequences. As such, it is not only resource allocators who may commit moral transgressions, but resource claimants as well. For example, a claimant may commit a moral transgression by asking for resources that he or she already possesses. Claiming resources that one does not need may constitute an *accidental* transgression if the claimant is unaware that he or she already has enough resources, or, alternately, may constitute a more serious *deliberate* moral transgression if the claimant knows about the resources in his or her possession. By claiming a need for resources that he or she does not actually need, a resource claimant may inadvertently divert resources from another claimant who needs them more, thereby causing psychological or physical harm.

Indeed, a recent study demonstrated that, with age, children improve at distinguishing between legitimate claims (e.g., on the basis of merit, need, or procedural rules) and illegitimate claims (e.g., “I just want more”) to resources (Schmidt, Svetlova, Johe, & Tomasello, 2016). Further demonstrations that children do give weight to resource claims would testify to the socially situated nature of resource allocations. That children consider both mental state knowledge (as demonstrated in this study) as well as social factors, such as resource claims, is consistent with the social reasoning developmental model's prediction that both psychological and social knowledge inform children's evaluations of resource allocations (Killen & Rutland, 2011; Rutland & Killen, 2017).

Resource type is another understudied parameter of resource allocation decisions (see Rizzo et al., 2016). Whereas some resources, such as medicine, may be characterized as necessary resources (i.e., required for well-being and avoidance of harm), other resources, such as candies, may be considered luxury resources (i.e., pleasant to have but not necessary for survival). The necessary or luxury status of the resources being allocated in a given allocation context would likely influence children's assignments of evaluations, blame, and perhaps even intentions to the resource allocators and claimants. It is plausible that a child would attribute more intentionality to an allocator who negligently deprives a recipient of a necessary resource than to an allocator who negligently deprives a recipient of a luxury resource – in the former situation, more is at stake, and the ensuing harm (e.g., forgetting to give a student their medication) may exert a stronger “moral interference” effect on morally-relevant theory of mind attributions than would a minor transgression (e.g., forgetting to give a student candy).

Finally, reasoning data have been instrumental in revealing children's explanations of resource allocation decisions (Damon, 1977; Killen & Smetana, 2015). Assessing the reasoning behind children's positive or negative evaluations of allocation decisions could help to demonstrate age-related changes in morally-relevant theory of mind capabilities, e.g., in children's perceptions of the moral status of unknowingly equitable and inequitable allocations in a hidden inequality context. We speculate that the children in the present study who evaluated the unknowingly equitable allocation as unfair would reference the allocator's negative intentions, whereas the children who evaluated the unknowingly equitable allocation as fair would reference the positive consequences (e.g., the rectification of inequality). Further, we expect that children's theory of mind proficiency would be reflected in their reasoning about the unknowingly equitable allocation: children with morally-relevant theory of mind proficiency would reference the *unknowing* aspect of the unknowingly equitable allocation (e.g., “the teacher *did not know* that one child already had resources”), whereas children without theory of mind proficiency would fail to refer to mental states.

#### 4.5. Conclusion

Resource allocations, like other morally-relevant decisions, take place in socially situated settings. Resource allocators and recipients alike act on the basis of their assumptions about the mental states of other actors in a given situation. This study investigated the role of mental state inferences in children's interpretations of resource allocation decisions. Children were presented with three hypothetical allocation decisions – unknowingly equitable, inequitable, and equal allocations – in the novel context of a hidden inequality. The results provide a novel demonstration that both the mental state attributions to the resource allocator and the considerations of the fairness or unfairness of distributive outcomes contribute to children's moral evaluations of resource allocation decisions.

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