Received: 12 October 2015 | Accepted: 18 July 2016

DOI: 10.1111/desc.12492

PAPER

WILEY Developmental Science

# Taxing behavioral control diminishes sharing and costly punishment in childhood

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## Abstract

Instances of altruism in children are well documented. However, the underlying mechanisms of such altruistic behavior are still under considerable debate. While some claim that altruistic acts occur automatically and spontaneously, others argue that they require behavioral control. This study focuses on the mechanisms that give rise to prosocial decisions such as sharing and costly punishment. In two studies it is shown in 124 children aged 6–9 years that behavioral control plays a critical role for both prosocial decisions and costly punishment. Specifically, the studies assess the influence of taxing aspects of self-regulation, such as behavioral control (Study 1) and emotion regulation (Study 2) on subsequent decisions in a Dictator and an Ultimatum Game. Further, children's perception of fairness norms and emotional experience were measured. Taxing children's behavioral control prior to making their decisions reduced sharing and costly punishment of unfair offers, without changing perception of fairness norms or the emotional experience. Conversely, taxing children's emotion regulation prior to making their decisions only led to increased experience of anger at seeing unfair offers, but left sharing, costly punishment and the perception of fairness norms unchanged. These findings stress the critical role of behavioral control in prosocial giving and costly punishment in childhood.

## RESEARCH HIGHLIGHTS

- Taxing behavioral control reduces subsequent sharing and costly punishment but leaves fairness perception and emotions unchanged.
- Taxing emotion regulation increases subsequent anger in response to unfair offers but does not influence decisions to punish.
- Behavioral control specifically plays a key role in altruistic behavior in children.

## 1 | INTRODUCTION

Why humans invest time, money and effort in others without the chance of repeated encounters and low reputation gains remains an evolutionary puzzle. Such altruism, defined as behaviors which incur a personal cost to benefit another in some way (Fehr & Fischbacher, 2003), already occurs early in development (Warneken & Tomasello, 2006). In children altruistic behaviors are manifold and include deciding to help (Warneken & Tomasello, 2006), to comfort (Svetlova, Nichols, & Brownell, 2010) and to share (Schmidt & Sommerville, 2011). While prior research has focused on describing these phenomena across development (Paulus, 2014), less is known about their underlying processes. In particular, the psychological mechanisms of altruistic decisions like sharing remain elusive, especially in middle childhood. The present study investigates the underlying mechanisms of altruistic decisions in children aged 6–9 years and addresses the question whether sharing and costly punishment require effortful self-regulation The development of altruistic behavior is critical for creating and sustaining personal relationships as well as for maintaining a functioning society. Understanding the underlying mechanisms of altruistic behavior can help support and encourage its development.

  

Altruistic behavior entails incurring a cost. As a result, the study of altruistic decisions has been dominated by a debate between two prevailing and competing explanations. Some claim that altruistic decisions in adults occur automatically, intuitively and effortlessly (Rand, Greene, & Nowak, 2012; Zaki & Mitchell, 2013), while others argue that this requires effort and self-restraint, without which behavior would be exclusively selfish (Knoch, Pascual-Leone, Meyer, Treyer, & Fehr, 2006; Rachlin, 2002). While there is direct evidence in support of both views, findings from developmental psychology have also been invoked to arbitrate between the two perspectives, under the assumption that the developmental origins of altruistic mechanisms can shed light on their operation later in life (Rand et al., 2012; Zaki & Mitchell, 2013).

Developmental studies have shown that infants begin to share around 15 months (Schmidt & Sommerville, 2011) and that infants, toddlers and even 5-year-olds seem to find sharing candies inherently rewarding (Aknin, Broesch, Hamlin, & Van de Vondervoort, 2015; Aknin, Hamlin, & Dunn, 2012). In combination with other forms of early altruistic behavior such as helping without incentives in 18-month-olds (Tomasello, 2012; Warneken, Hare, Melis, Hanus, & Tomasello, 2007; Warneken & Tomasello, 2006) there appears to be strong evidence that initial forms of altruistic behavior are indiscriminate, automatic and spontaneous.

Around 3 years, children begin to be more selective in their altruistic behavior, however; for instance, helping only those that had previously been nice rather than harmful (Vaish, Carpenter, & Tomasello, 2010). From 5 years of age children are more generous when observed by peers than when alone (Engelmann, Herrmann, & Tomasello, 2012; Leimgruber, Shaw, Santos, & Olson, 2012) and they also begin to discriminate in their decisions to share based on arbitrarily assigned group membership (Dunham, Baron, & Carey, 2011). These findings show that altruistic decisions become increasingly more selective and less automatic possibly as a result of regulatory processes that mediate the decisions depending on contextual variables. While the mechanisms of altruistic decisions such as sharing and helping have been extensively investigated in children 5 years and younger (for a recent review see Martin & Olson, 2015), much less is known about altruistic decisions and their mechanisms in children during middle childhood. Extending the studied age range is especially important, however, because mechanisms underlying altruism early in development do not necessarily correlate with those later in development (Paulus et al., 2015). The present study sheds light on the mechanisms of altruistic decisions, namely sharing and costly punishment in children aged 6–9 years.

While in preschoolers there is some initial evidence of a link between self-regulatory processes such as inhibitory control and decisions to share (Aguilar-Pardo, Martinez-Arias, & Colmenares, 2013; Paulus et al., 2015), this is much less clear in middle childhood. Because altruistic decisions become more selective and subject to contextual variables by middle childhood, it was hypothesized that self-regulation abilities would play a prominent role during this developmental period. So far, some studies have shown a positive correlation between sharing and inhibitory control (Blake, Piovesan, Montinari, Warneken, & Gino, 2015) while others have not (Smith, Blake, & Harris, 2013). Given the purely correlative nature of the current evidence, its validity has been questioned more generally (Buckholtz, 2015; Zaki & Mitchell, 2013).

To generate more reliable evidence of a mechanistic relationship between effortful self-regulation and altruism in childhood, the present study employed a well-established procedure typically used to uncover whether self-regulation plays a role in specific behaviors. Thus, it has been shown that having to regulate oneself in some form (i.e., inhibiting prepotent or overlearned responses; regulating emotions; diverting attention from distractors) can have deleterious effects on subsequent tasks requiring the same mental operations (Hagger, Wood, Stiff, & Chatzisarantis, 2010; Kurzban, Duckworth, Kable, & Myers, 2013). This procedure lends itself to testing whether altruistic behavior in childhood requires self-regulation, whereby reductions in altruistic decisions after engaging in effortful self-regulation would indicate that self-regulation is indeed required. This has already been successfully done in adults whereby taxing self-regulation led to a subsequent decrease in sharing (Achtziger, Alos-Ferrer, & Wagner, 2015; Halali, Bereby-Meyer, & Ockenfels, 2013).

In two studies, 124 children aged 6–9 years were tested to see if altruistic behavior would decrease as a function of prior engagement in two types of self-regulation, namely behavioral control (Study 1) and emotion regulation (Study 2). Altruistic behavior was measured through proposer behavior in the Dictator Game (DG) and responder behavior in the Ultimatum Game (UG). In the DG, altruism is indicated by the extent to which children give up a valuable resource and share out of 6 monetary units (MUs) with an anonymous child (Beneson, Pascoe, & Radmore, 2007; Fehr & Fischbacher, 2003; Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010). In the UG, altruism is indicated by whether children reject unfair offers (1 out of 6 MUs) from an anonymous child. Because the rejection of offers in the UG leads to neither party receiving anything, such an action indicates a willingness to forego rewards in order to altruistically sanction another's behavior (Fehr & Gachter, 2002; Knoch et al., 2006). Both the DG and the UG have been used extensively in children of this age range (Beneson et al., 2007; Harbaugh, Liday, & Krause, 2003; Steinbeis, Bernhardt, & Singer, 2012).

To test specific hypotheses about the nature of the self-regulatory process required for altruistic decisions, two types of self-regulation strategies were chosen, namely behavioral control (Study 1) and emotion regulation (Study 2). Behavioral control has been linked to both behavior in the DG (Blake et al., 2015) as well as responder behavior in the UG (Crockett, Clark, Lieberman, Tabibnia, & Robbins, 2010). It was therefore expected that taxing behavioral control in the first study would lead to a subsequent decrease in altruism as indicated by lower offers in the DG and fewer rejections of unfair offers in the UG. To test for the potential specificity of a behavioral control mechanism in altruistic behavior, in a second study self-regulation was taxed by asking children to regulate their emotions or not. Emotion regulation is one of the most frequently used tasks to tax aspects of self-regulation and has been shown to work effectively, at least in adults (Hagger et al., 2010). Further, both behavioral control and emotion regulation have been shown to draw on the same neural circuitry (Berkman, Burklund, & Lieberman, 2009). A potential effect in the DG and the UG following emotion regulation would speak for a more general role of self-regulation in bringing about altruism in development, as opposed to a specific effect of behavioral control.

In a first study, 62 children were divided into two groups. In one group behavioral control was taxed by means of a task requiring inhibition of motor responses, whereas the other group performed the same task but without taxing behavioral control. Subsequently both groups played a DG and a UG, which were counterbalanced across participants. To control for potential differences on fairness understanding and emotional experience, children also rated the fairness of the four resource distributions possible with 6 MUs as well as their emotional experience after seeing the unfair offer in the UG. In a second study, 62 children were also divided into two groups; however, instead of taxing inhibitory behavioral control, one-half of the children were asked to regulate their responses to emotional images while the other half could respond as they wished. As in Study 1, children then played a DG and a UG and gave fairness ratings and indications of their emotional experience.

## 2 | EXPERIMENT 1

### 2.1 | Method

#### 2.1.1 | Participants

Sixty-two participants aged 6–9 years old were tested (mean = 7.6 years ± 1.107, range = 6.0–9.39 years, 32 females). Half the children (*N* = 31; 16 female) were assigned to a condition in which they had to react as fast as they could to a visual stimulus (a blue square). The other half was assigned to a condition which taxed their behavioral control. This was achieved by asking them to inhibit responding to the first visual stimulus when this was followed by a second visual stimulus (green triangle). Children were recruited from schools in the area. The study was approved by the local Ethics Committee (E029-11-24012011) and written parental consent was provided for all subjects. Sample size was determined using the average sample size for studies using comparable designs as reported in a recent meta-analysis (Hagger et al, 2010). This was further increased by an additional 10% due to anticipated data loss and attrition as is common in developmental studies. Data collection stopped as soon as this sample size was reached. Children were recruited from a database of parents in a middle-sized town, who had volunteered their children to participate in child development studies. Although no specific demographic data were collected, participants came from mostly middle-class backgrounds, and approximately 98% of the population from which the sample was drawn were native German.

#### 2.1.2 | Reaction time task

To manipulate whether children's behavioral control was taxed or not, a Stop-signal-reaction-time task was administered (SSRT; Logan, Schachar, & Tannock, 1997). Children were seated in front of a computer and were presented with 120 trials of blue squares (ITI approximately 4000 milliseconds). On 30 of those trials the blue square was shortly followed by a green triangle. Half of the children were asked to press the space bar as soon as the blue square appeared in the middle of the screen irrespective of whether a green triangle was presented or not ('react' condition). The other half of the children were also asked to respond as fast as they could to the appearance of the blue square, but to inhibit the response if a green triangle appeared shortly after the blue square ('control' condition). Trials with a triangle began with a 150 ms delay between seeing the blue square and the green triangle. To ensure that inhibitory behavioral control was maximally taxed in the control group, the stop signal delay was increased or decreased by an increment of 50 ms per trial depending on whether the response was successfully inhibited or not. The threshold was thus dynamic and ensured that behavioral control was maximally taxed for every individual in this group.

#### 2.1.3 | Economic games

Prior to the tasks, children were shown a table stacked with rewards such as games and toys that would be of interest to their age group. The rewards were arranged from left to right by increasing attractiveness as determined through extensive previous piloting with this age range (Steinbeis et al., 2012; Steinbeis, Bernhardt, & Singer, 2015; Steinbeis, Haushofer, Fehr, & Singer, 2016; Steinbeis & Singer, 2013). The children were told that they were going to play some games during which they could win poker chips (henceforth monetary units), which they could subsequently trade in for one of the rewards. Depending on how many chips they had, the larger was the range of rewards from which they could choose.

To test for children's willingness to share and the extent of their costly punishment, they played one round of the Dicator Game (DG) in the role of the proposer and one round of the Ultimatum Game (UG) in the role of the responder, respectively. Every child played both games and the order of games was counterbalanced across children.

In the DG, children were given 6 monetary units (MUs) and shown two round boxes marked with differing colors, one of which belonged to the participant and the other to another child that was anonymous. Children were told they could divide the poker chips whichever way they wanted between the two boxes.

In the UG, children were shown a third and again differently colored box and told that whatever was inside was the offer from another anonymous child, who had initially received 6 MUs. This offer was always 1 MU, which would be considered unfair by most (Steinbeis et al., 2012). Children were informed that they could say either 'Yes' (accept) or 'No' (reject) to the offer. In the case of a 'Yes', everything would be shared as offered by the proposer who had initiated it. In the case of a 'No', however, no one would obtain anything.

For both games it was ensured that all children had fully understood the instructions. This was checked by means of control questions pertaining to the number of MUs children were endowed with, who they thought they were playing with, which of the two boxes was for whom and in the case of the UG what would happen in the case of acceptance and rejection. If children responded incorrectly on any of the questions, the instructions were reiterated up to two times. As a result all children were graded on their understanding of the task with deductions for having had the instructions reiterated. All children understood the instructions and the nature of the game at least after one repetition.

To ensure that not too much time would be taken up through the instruction of the games and wipe out any effect of the previous manipulation on behavior, participants were first instructed on the economic games, then performed the SSRT either with or without inhibition, and then they played the games immediately after.

#### 2.1.4 | Fairness ratings

After having played the DG and the UG, children were asked to indicate whether the four different ways in which 6 MUs could be shared (6:0; 5:1; 4:2, 3:3) were fair or not. To do so they were given a sheet with the four distributions depicted and asked to tick a Yes box or a No box if they considered the distribution fair or not. Note that there was no indication that these were the result of decisions with a proposer or a responder; children were merely shown four distributions and asked to rate whether they thought the distributions were fair or not.

#### 2.1.5 | Emotion ratings

After having played the DG and the UG, children were asked to rate how they felt when seeing the offer in the UG. They were presented with three scales denoting happiness, sadness and anger. Each scale was marked with a representative drawing of a face depicting the relevant emotion. Each scale was flanked by a large and a small version of the depicted image, in each case indicating how weak or strong the specific emotion was felt. Children could indicate on a line going between the small and the large face how they felt. Fairness and emotion ratings were counterbalanced across participants.

Correction for multiple testing is achieved by using a False Discovery Rate approach (FDR; Benjamini & Hochberg, 1995). This method controls for the expected proportion of rejected null hypotheses that were incorrectly rejected.

### 2.2 | Results

Reaction times (RTs) in response to targets were taken as a proxy for whether children had attempted to inhibit their motor impulses. These should be significantly increased in the group that had to inhibit responses to stop signals compared to the group only responding to the target. This was confirmed in that RTs were significantly greater for the behavioral control (RT = 557 ms) group than the reaction time group (RT = 379 ms; $t(60) = 7.715$; $p < .001$; $d = 1.97$).

Comparison of the two groups' sharing in the DG shows that children whose behavioral control had been previously taxed shared fewer MUs (1.25 MUs) than those whose behavioral control had not been taxed (1.9 MUs). Using a one-way ANOVA with condition as between-subjects factor, this difference was significant ($F(1, 60) = 4.468$; $p = .039$; $d = 0.56$; Figure 1A). This effect remained significant after controlling for the factors gender, age and order of games played ($F(1, 57) = 4.304$; $p = .043$). Further, there were differences in the acceptance of unfair offers in that children who had to inhibit previously now accepted unfair offers more often (77%) than children who merely reacted previously (48%; $\chi^2 = 5.599$; $p = .017$; Figure 1B). Interestingly, while both sharing and costly punishment were affected by taxing children's behavioral control, fairness ratings of offers of varying sizes were left unchanged (all $\chi^2 < 1.5$; $p > .3$; Figure 1C). Also, when asked retrospectively to evaluate their emotional experience in response to seeing unfair offers in the UG, there were no differences in terms of experienced happiness, sadness or anger as assessed by means of one-way ANOVAs ($F$-values < 1.4; $p > .24$; Figure 1D). There was only a main effect of age on happiness ratings in that older children reported feeling less happy than younger children when seeing unfair offers ($F(1, 57) = 11.05$;

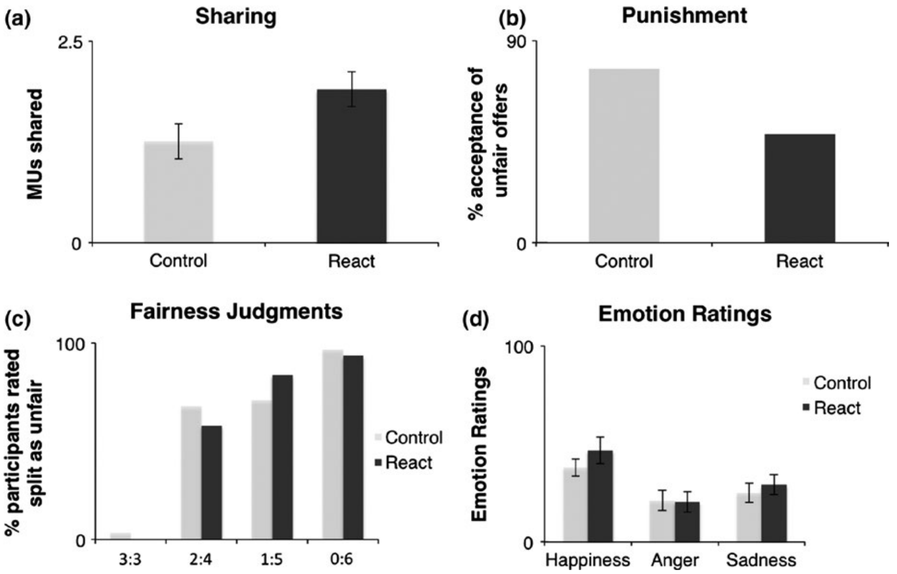


**FIGURE 1** Effects of taxing behavioral control on altruistic behavior in 62 children. Children whose behavioral control had been taxed showed (A) decreased sharing and (B) a greater willingness to accept unfair offers compared to a group of children who did not engage in behavioral control previously. Both groups showed comparable (C) fairness judgments and (D) emotion ratings in response to unfair offers in the UG

$p = .002$). All findings remain significant after controlling for multiple hypotheses using FDR.

These findings suggest that taxing behavioral control leads to a significant decrease in altruistic behavior, both in terms of sharing as well as costly punishment. But are these effects specific to taxing behavioral control or self-regulation more generally? To address this question a second study was conducted using emotion regulation as a means to tax children's self-regulation. If the effects observed in Study 1 are more generally related to self-regulation and not behavioral control, similar effects should be observed in Study 2.

## 3 | EXPERIMENT 2

### 3.1 | Method

#### 3.1.1 | Participants

Sixty-two participants aged 6–9 years old were tested (mean = 7.6 y, range = 5.8–9.6 y, 28 females). Half the children (N = 31; 16 female) were assigned to a condition in which they had to react to the emotional images. The other half was assigned to a condition in which children had to regulate their emotions. Children were recruited from a database of parents in a middle-sized town, who had volunteered their children to participate in child development studies. Although no specific demographic data were collected, participants came from mostly middle-class backgrounds, and approximately 98% of the population from which the sample was drawn are native German. This study was approved by the local Ethics committee (E029-11-24012011), and written parental consent was provided for all subjects.

#### 3.1.2 | Emotion regulation task

To manipulate whether children's emotion regulation was taxed or not, an emotion regulation task was administered. Children were seated in front of a computer and were presented with 20 images depicting social scenes involving humans, ten of which were either pleasant and the other ten of which were unpleasant. Images were presented for 5000 milliseconds. After each image children had 5000 milliseconds to indicate on a visual analog scale of 1 to 10 how they felt in response to what was depicted. Half of the children were asked to just indicate exactly how they felt ('react' condition). The other half of the children were asked to regulate their emotions by imagining that what was depicted was not real and never happened ('regulate' condition).

All other aspects of the experimental procedure were the same as in Study 1.

### 3.2 | Results

Ratings of emotional experience in response to positive and negative images were taken as a measure of whether emotion regulation had taken place or not. These should be significantly reduced in children who have to regulate compared to those who only have to react. Comparison of ratings showed that the regulation group rated images as less emotional (rating = 2.9) than the reactivity group (rating = 4.0; $t = -2.69$; $p = .009$; $d = 0.68$).

Comparing the two groups in terms of their decisions showed that there were no differences in either sharing (1.9 for the regulation and 1.7 for the reactivity group). Using a one-way ANOVA with condition as between-subjects factor, this difference was statistically not significant ($F(1, 60) = 0.321$; $p = .573$; $d = 0.14$; Figure 2A). Similarly, there was no significant difference between the two groups in terms of acceptance of unfair offers (both groups 51%; $\chi^2 = 0.068$; $p = .805$; Figure 2B). A model including the factors gender, age, order of games played, as well as the factor condition yielded neither a main effect of condition on sharing nor any interactions with any other factor (all $p$-values > .27). In addition, fairness ratings were comparable for both groups (all $\chi^2 < 2.3$; $p > .15$; Figure 2C). Interestingly, however, the emotion ratings in response to unfair offers revealed that the group of children which had previously had to regulate their emotions showed

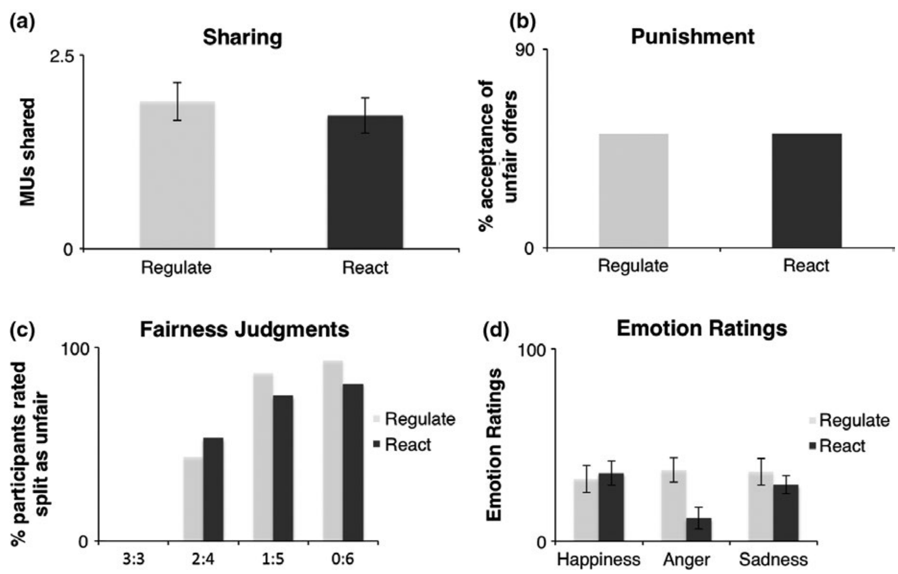


**FIGURE 2** Effects of taxing emotion regulation on altruistic behavior in 62 children. Children whose emotion regulation had been taxed showed (A) comparable sharing and (B) a comparable willingness to accept unfair offers compared to a group of children who did not engage in emotion regulation previously. While both groups showed comparable (C) fairness judgments, children who had had to regulate their emotions previously (D) showed greater anger in response to unfair offers in the UG

greater anger in response to unfair offers than the group which merely reacted to the stimuli as assessed by means of a one-way ANOVA ($F(1, 61) = 8.630$; $p = .005$; $d = 0.68$; Figure 2D), while happiness and sadness were left unchanged ($F$-values < 0.8; $p$-values > .37). The effect of condition on experienced anger remained significant after controlling for gender, age and order of games played ($F(1, 57) = 9.217$; $p = .004$). These findings indicate that even though emotion regulation clearly worked in terms of taxing the ability to regulate emotions, altruistic behavior was not affected.

In a final step. decisions between the two groups whose self-regulation had been taxed in Experiments 1 and 2 were compared. If behavioral control has a unique role in bringing about altruistic decisions then we should see a significant difference between the behavioral control and the emotion regulation group. Comparing the two groups using a one-way ANOVA showed reduced offers in the DG for the behavioral control group compared to the emotion regulation group ($F(1, 59) = 4.279$; $p = .043$; Cohen's $d = 0.53$). There was also a greater willingness to accept poor offers in the UG for the behavioral control group compared to the emotion regulation group, albeit marginally significant ($\chi^2 = 3.918$; $p = .062$). The direct comparison of emotion ratings using a one-way ANOVA showed a significant difference only for anger whereby the emotion regulation group felt significantly angrier than the behavioral control group ($F(1, 59) = 4.27$; $p = .043$; Cohen's $d = 0.45$). All findings remain significant after controlling for multiple hypotheses using FDR.

## 4 | DISCUSSION

The results show that behavioral control plays a critical role in bringing about altruistic behavior in 6–9-year-olds. Children whose behavioral control had been taxed were less willing to share and more willing to accept unfair offers compared to children in a control condition. Interestingly, taxing behavioral control did not change the perception of fairness norms or retrospective evaluations of emotional experiences during the decision period. Findings from Study 2 show that emotion regulation had no significant effect on altruistic behavior, but instead impacted the emotional experience in response to unfair offers. Together with the significant difference between the two groups previously taxed in behavioral control and emotion regulation in both sharing and costly punishment, this suggests that the effects of Study 1 are specific to the necessity of behavioral control and not self-regulation per se.

Studies on altruistic behavior have reported a discrepancy between children's knowledge of fairness norms and how they adhere to them when deciding to share (Smith et al., 2013; Steinbeis et al., 2012). Thus children know what a fair split is but do not act on that knowledge (Blake, McAuliffe, & Warneken, 2014). The present findings suggest that behavioral control significantly influences the extent of this gap, whereby a lack of behavioral control will lead to a greater gap between held norms and enacted fairness. The fact that altruistic behavior and not fairness judgments were changed as a function of the previous behavioral control manipulation suggests that the mechanistic role of behavioral control in altruistic behavior in children lies at the level of successfully acting in accordance with held fairness norms. Thus behavioral control in children is relevant to actually behaving altruistically as opposed to saying one thing and doing another.

The findings of this study suggest that sharing and costly punishment require behavioral control during middle childhood. This simultaneously implies that during this developmental period altruistic decisions are not automatic and effortless. A string of findings showing that social behavior and in particular altruistic decisions become increasingly subject to contextual variables, such as moral status of the recipient (Vaish et al., 2010), group membership (Dunham et al., 2011) and influencing one's reputation (Engelmann et al., 2012; Leimgruber et al., 2012), implies the necessity of behavioral control. Such a mechanism allows titrating behavior according to the specific demands of the situation, avoiding the costs of indiscriminate altruism. The present findings, however, also highlight that behavioral control is required for altruism in its purest form by children of this age (i.e., to an anonymous other). One important related issue is the nature of boundary conditions of such a mechanism. Resource allocation can occur in a variety of settings (i.e., windfall vs. earned rewards; Hamann, Warneken, Greenberg, & Tomasello, 2011; collaborative vs competitive settings; Warneken, Lohse, Melis, & Tomasello, 2011). Presumably behavioral control might be required less when rewards are allocated according to merit or following collaboration. Further, given findings that different instances of altruistic behavior (i.e., sharing, helping and comforting) are not correlated in development (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011), the present evidence can only be taken in support of behavioral control playing an important role in sharing. Future studies should test the extent to which behavioral control is a mechanism that extends to other types of altruism. This study highlights the necessity of charting the underlying mechanisms of altruism throughout development before making claims about the similarities of mechanisms of children and adults (Rand et al., 2012; Zaki & Mitchell, 2013).

The joint findings of Study 1 and Study 2 suggest a mechanistic role of behavioral control specifically and not self-regulation per se in bringing about altruistic decisions in children aged 6 to 9 years. The emotion regulation task of Study 2 also constitutes a fair control for more general alternative explanations such as fatigue effects, differences in perceived effort or participants' desire to reward themselves. Such explanations are often made to account for the generally observed effects of self-regulation tasks leading to a performance drop on subsequent self-regulation tasks (Inzlicht, Schmeichel, & Macrae, 2014). While the present set of studies did not obtain subjective reports of fatigue, effort or desire for a reward, two pieces of evidence speak against these alternative accounts. First, the difference in emotion ratings between the two groups in the second study demonstrates that the task clearly taxed aspects of self-regulation for the group that had to explicitly regulate their emotions. Second, the fact that emotion regulation prior to the decision-making period significantly increased subsequent ratings of anger when seeing unfair offers in the UG demonstrates that emotion regulation was in fact taxed sufficiently to lead to changes in subsequent affective experience.

However, instead of influencing behavior it altered only emotional responses. These findings are important for several reasons. First, they suggest that contrary to the idea that ego-depletion is a general effect (Hagger et al., 2010), specific ways of taxing self-regulation can have specific effects on subsequent outcome measures. Second, the finding that feelings of anger in response to unfair offers increased subsequent to the emotion regulation condition is interesting given that this did not apparently influence the behavior in the UG. Studies in adults suggest that the experience of anger drives rejection rates of unfair offers (Crockett et al., 2010; van 't Wout, Kahn, Sanfey, & Aleman, 2006). The present findings imply instead that even though anger is increased in children whose emotion regulation had been previously taxed, this has no effect on rejections in the UG. Third, the fact that behavioral control influenced both altruistic behavior in the DG and the UG suggests a common mechanistic basis for these decisions in childhood. Whereas in adults it has been shown that these decisions are not correlated (Rand et al., 2014), these findings indicate that this undergoes further differentiation with development.

Whether rejections of unfair distributions truly reflect altruistic tendencies has been debated. Thus some have argued that rejections may be driven by motives such as spite rather than altruistic tendencies (McAuliffe, Blake, & Warneken, 2014). The experience of spite has been shown to have emotional antecedents (Steinbeis & Singer, 2013), where the tendency to feel negative emotions was shown to predict spiteful behavior. Interestingly, the data collected in the present study on emotional experience in response to unfair offers is informative on this issue. Thus, the data from Study 1 indicate that there is no increased anger in the group of children who reject unfair offers more, while Study 2 indicates that there is no increase in rejections of unfair offers in the group of children who report greater anger, a finding already observed previously (Steinbeis et al., 2012). While the present study did not obtain direct measures of spite, the absence of a relationship between its most likely emotional antecedent, namely anger, and rejection of unfair offers does not lend too much support to the notion that spite drives such rejections. The potential discrepancy in findings can be explained by differences in experimental set-up. Thus, whereas in the present study the unequal distribution was offered by the other player, in McAuliffe et al. (2014) this was imposed by the experimenter. This small difference in set-up, however, undermines the necessity to punish any behavior seeing that there is nothing to punish, thus presumably changing the underlying mechanism that drives children's rejection behavior. Future studies should focus on testing the extent to which such decision patterns hold under varying contexts and circumstances.

The present findings have to be discussed with reference to current theories of ego-depletion. Most prominently it has been argued that effects of prior exertion on subsequent tasks occur as a function of a depletion of resources (Hagger et al., 2010). This would imply that reduced altruistic decisions occur because of a reduction in behavioral control resources. Such a view has been criticized of late (Carter, Kofler, Forster, & McCullough, 2015). Instead it has been argued that opportunity costs associated with executive functions such as behavioral control are subjected to cost–benefit analyses, which in turn are experienced as effortful (Kurzban et al., 2013). Accordingly it has been shown that the experience of effort resulting from an effortful first task motivates reduced deployment of executive functions on a subsequent task (Kool, McGuire, Wang, & Botvinick, 2013; McGuire & Botvinick, 2010). This would suggest that the presently observed reduction in altruistic behavior following a behavioral control task occurs from an increased motivation to avoid effortful tasks, implying that sharing and costly punishment are experienced as effortful. Future research will have to determine how children experience behavioral control, sharing and costly punishment to unequivocally establish the role of subjectively experienced effort. One further caveat remains how widely such a mechanism would apply to real-life decisions. While there is good evidence that prosocial decisions made in the lab are predictive of prosocial decisions also in real-life contexts in adults (Benz & Maier, 2008), if this is also the case for children remains to be seen and is an excellent avenue for future research.

The present study provides evidence for a mechanistic role of behavioral control in bringing about altruistic decisions in 6–9-year-olds. Children were less willing to share and more willing to accept unfair offers after behavioral control had been taxed. These findings suggest that children's altruistic acts are effortful. Importantly, these studies speak to a privileged role of behavioral control specifically in bringing about altruistic behavior in children and in bridging the commonly observed knowledge–behavior gap that children display in the context of resource allocation paradigms. These results also have broad implications for designing interventions to promote prosocial behavior early in childhood. Thus, rather than focusing on an awareness of fairness norms, which are already present early in development, the findings indicate that targeting the level of knowledge implementation through increased behavioral control would be the most fruitful approach. Future studies will have to see if behavioral control training can lead to an inverse and beneficial effect compared to the detrimental effect reported here.

## ACKNOWLEDGEMENTS

This work was funded by an Early Career Research Fellowship from the Jacobs Foundation.

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