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Preschoolers understand the normativity of cooperatively structured competition

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ABSTRACT

Human institutional practices often involve competition within a cooperative structure of mutually accepted rules. In a competitive game, for instance, we not only expect adherence to the rules of the game but also expect an opponent who tries to win and, thus, follows a rational game-playing strategy. We had 3- and 5-year-olds ($N = 48$) play for a prize against an opponent (a puppet) who played either rationally (trying to win) or irrationally (helping the children to win) while either following or breaking the rules of the game. Both age groups performed costly protest against an opponent who followed the rules but played irrationally by helping the children to win. When facing a rule-breaking opponent, 3-year-olds protested only the rule breaches of an irrational opponent but not irrational play. Five-year-olds also protested the rule breaches of a rational opponent, but in contrast to the 3-year-olds, they protested irrational behavior even in the context of rule breaches. Moreover, many children, in particular 3-year-olds, refrained from protesting. These findings suggest that 5-year-olds, but not 3-year-olds, fully understand the dual-level normative structure of cooperatively regulated competition.

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Introduction

Human social and institutional life is peculiar in that it is capable of reconciling two *prima facie* opposing categories of social interaction: cooperation and competition (Searle, 1995). More specifically, many human activities presuppose a mutually accepted cooperative structure but go beyond this fundament and put a competitive layer (i.e., opposing goals) on top. For instance, even violent activities, such as dueling, may be governed by a set of agreed-on rules; economic activities, such as companies competing for customers, are subject to legal rules; and in competitive games, such as chess, opponents cooperatively adhere to a set of rules that make the very activity of "chess" possible in the first place—often referred to as *constitutive rules* and based on the formula "X counts as Y in context C" (Rawls, 1955; Searle, 1969, 1995).

Jointly intending to compete in a cooperatively regulated way

Competitive game playing, however, is not exhaustively described by merely referring to the constitutive rules of the game such as that in chess pawns may capture "en passant" and that some state of affairs counts as winning in a particular game (Raz, 1999; Rescorla, 2007; Roversi, 2010; Schwyzer, 1969). For example, someone could "play" chess but with the intent to throw the game—a "trifler" as coined by Suits (1978/2005). All of the trifler's moves could be in perfect accord with the constitutive rules, but this would not be an act of competitive game playing because it violates the common ground assumption that individuals who enter a competitive game play rationally and try to win. This psychological attitude—or even value—of trying to win is constitutive of competitive game playing as a cultural practice (Raz, 1999; Rescorla, 2007; Roversi, 2010; Schwyzer, 1969; Suits, 1978/2005). Thus, the goal of winning is not a constitutive rule but rather an inherent part of voluntarily engaging in competitive games in the first place. This does not mean that players need to care strongly about winning and be disappointed about losing; rather, it means that playing with the goal to win makes it possible for "us" to play the game at all. More generally, the constitutive rules of a competitive game are not ends in themselves but only means to the end of engaging in competition (i.e., having opposing goals) within a set of mutually accepted rules.

The normative dimension of the goal of winning becomes more obvious when we leave aside the common assumption that people typically try to win and take the perspective of two individuals who intend to play a competitive game. When entering a competitive game (a shared intentional activity à la Bratman, 1992, 2014; Searle, 1995), we form the *joint intention to compete in a cooperatively regulated way*. Thus, we expect that our game partner—who voluntarily entered the cooperatively structured social practice—not only adheres to constitutive rules but also pursues his or her goal to win and, therefore, employs a rational game-playing strategy as opposed to intending to lose. Otherwise, "we" would not actually be playing a competitive game and the trifler would ruin the game. Obviously, throwing a game would be irrational—not only when there is the prospect of winning a prize but also, more fundamentally, if one voluntarily entered a competitive game because it would mean not to have the goal (to win) that is integral to the very activity in which one intends to engage.

Children's understanding of the normative aspects of competitive games

Most basically, understanding that "we compete in a cooperatively regulated way" in a competitive game requires skills for collective intentionality (Searle, 1995), enabling participants not only to jointly accept the constitutive rules but also to jointly intend to compete. But what do young children understand about these two aspects of competitive games (i.e., constitutive rules and rational game playing)?

Regarding constitutive rules, recent research has mostly investigated cooperative games (i.e., goals are aligned, not opposed, and each player performs the same action) and found that children understand and care about the normative dimension of such games by around 3 years of age (for reviews, see Rakoczy & Schmidt, 2013; Schmidt & Rakoczy, 2016; Schmidt & Tomasello, 2012). That is, children protest and criticize third parties who do not perform simple game acts in prescribed ways

(e.g., Rakoczy, Warneken, & Tomasello, 2008). To our knowledge, however, there has been no investigation of young children's understanding of the second aspect, namely that all players in a competitive game follow a rational (competitive) game-playing strategy and try to win. Importantly, this attitude is necessary for jointly engaging in competitive game playing as based on the joint intention to compete in a cooperatively regulated way.

Regarding competition, research has found that from around 3 to 3.5 years of age, children show signs of differentiating between winning and losing in a simple competitive task (e.g., a race in building a tower as fast as possible). For instance, they correctly state that they have won or show more positive emotional expressions when winning as compared with merely finishing the task (Heckhausen, 1984; Stipek, Recchia, McClintic, & Lewis, 1992). Albeit important, this behavior does not amount to understanding competitive games that are cooperatively self-regulated because it could be based on merely representing one's own goal to "win" as related to the other's performance (i.e., to be the first in building a tower).

So, to engage in competitive game playing by *jointly* intending to compete in a cooperatively regulated way, a child not only needs to focus on his or her goal to win but also needs to appreciate the opponent's point of view—that is, to understand the opponent's goal to win that is diametrically opposed to the child's own goal to win (Perner & Roessler, 2010; Priewasser, Roessler, & Perner, 2013). If the child egocentrically focuses on his or her own goal only, then the child should applaud an opponent who intends to lose. But if the child understands and desires a competitive game, then the child should expect and desire the opponent to try to win, which requires the child to inhibit his or her immediate goal of winning. In this case, the child should protest against an irrational opponent who helps him or her to win, which might be particularly challenging when there are prospects of rewards for the winner. Note, however, that normatively expecting and desiring an opponent to *try* to win does not mean that one *wants* the opponent to actually win—only to play the game, within the rules, rationally. Hence, such normative expectations need not conflict with the child's desired outcome of the joint activity.

Recent work suggests that 3-year-olds understand that two agents (a third-party situation) or they themselves (first-party) and another agent can have conflicting desires in a simple game where participants want different (mutually incompatible) things to happen (Rakoczy, Warneken, & Tomasello, 2007). In such tasks, first-party (but not third-party) performance is correlated with executive function (i.e., inhibitory control and working memory) (Rakoczy, 2010; see also Fizke, Barthel, Peters, & Rakoczy, 2014, for a study with 4-year-olds). One explanation for this relation is that personal involvement requires the inhibition of one's own conative state (e.g., a goal) in order to appreciate another individual's conative state—a general problem of understanding different perspectives (Rakoczy, 2010). Priewasser and colleagues (2013) argued, however, that children in these tasks do not need to simultaneously represent opposing (subjective) goals in interrelated ways (e.g., that someone's goal pursuit is at the same time detrimental to another's goal accomplishment) but might merely understand another's goal as different from, but unrelated to, their own goal. More generally, on the "symmetry account" (Perner & Roessler, 2012; Perner, Zauner, & Sprung, 2005), understanding subjective conative and epistemic states requires the (domain-) general capacity to understand conflicting perspectives regarding the same state of affairs, which is not present in children under 4 years of age (who, thus, are thought to be unable to understand why two players in a competitive game act the way they do when pursuing opposing goals; Perner & Esken, in press; Perner & Roessler, 2010). On the "asymmetry account" (Rakoczy, 2010; Rakoczy et al., 2007; Wellman, 1990), however, children come to understand subjective conative states earlier (at around 3 years of age) than subjective epistemic states.

Overall, our question is whether children normatively expect their opponent to try to win as evidenced by a rational (competitive) game-playing strategy as opposed to an irrational strategy (i.e., helping the child to win). We were interested in whether children form such expectations even at a personal cost (i.e., given the prospect of winning a prize) and how their opponent's following or breaking of constitutive rules influences their expectations (e.g., children could take advantage of an irrational opponent whose constitutive rule breach works in their favor). The findings reported above suggest that even 3-year-olds possess some basic abilities (understanding constitutive rules, inhibition of one's own conative state, and recognition of another's divergent goal) for developing normative expectations about rational game playing. But they might not understand and integrate the two levels

involved. For example, they might represent the opponent's individual goal to win without realizing that it is contradictory to their own goal (or that one can see the opponent's goal from different perspectives; Perner & Roessler, 2010; Priewasser et al., 2013). Only if children were able to flexibly form and coordinate normative expectations about both rational game playing and constitutive rules would they demonstrate a full understanding of the dual-level normative structure of cooperatively regulated competitive games.

Because children's executive function skills improve considerably between 3 and 5 years of age (Garon, Bryson, & Smith, 2008; Zelazo & Müller, 2002), and because competitive games require vigilance about both constitutive rules and the opponent's game-playing strategy at the same time, it is plausible to assume that 5-year-olds might show a fuller understanding of competitive games than 3-year-olds who often have difficulty in coordinating different perspectives regarding the same state of affairs (Perner & Roessler, 2012; Perner et al., 2005; Priewasser et al., 2013). Therefore, a comparison of 3- and 5-year-olds' understanding of the normative aspects of competitive games would be instructive.

The current study

To investigate whether children expect an opponent to follow a rational game-playing strategy, we adapted a simple competitive game designed by Benenson, Nicholson, Waite, Roy, and Simpson (2001; see also Priewasser et al., 2013; Weinberger & Stein, 2008). In our study, 3- and 5-year-olds played against a puppet, and each player could collect disks on his or her stand (henceforth called "tower"). The winner was the player who built the highest tower, and the constitutive rules were that each player rolled the die (outcomes: 1 or 2) to determine how many disks he or she could take either from the opponent's tower (a *strategic* act given that the opponent's loss is the proponent's gain) or from a neutral ("communal") tower (a *non-strategic* act).

In the *main task,* we manipulated the puppet's behavior in a 2×2 within-participants design regarding *constitutive rules* (rule-following or rule-breaking) and the puppet's *game-playing strategy* (rational or irrational). Thus, with respect to constitutive rules, the puppet was either following (i.e., rolling a 2 and taking two disks) or breaking (i.e., rolling a 1 but taking two disks) the rules of the game. As for the game-playing strategy, the puppet either played rationally (i.e., put disks on the puppet's tower, thereby providing evidence for trying to win the game) or irrationally (i.e., put disks on the child's tower, thereby helping the child to win the game). We measured children's protest against the puppet regarding constitutive rules (*rule protest,* e.g., protest responses that refer to the number of disks that may be taken) and against the puppet's game-playing strategy, that is, the puppet's choice of a tower (*goal protest*). Importantly, to create a particularly challenging context for expectations about rational game playing, children were told that the winner of the game would receive a prize (stickers). Hence, any protest against an irrational opponent could be considered costly and speaks against a purely egocentric stance given that an irrational opponent helps the child to achieve his or her individual goal to win the game.

We predicted that when facing a rule-following opponent, children at both ages would be able to take the opponent's perspective and expect the opponent to follow a rational game-playing strategy, performing more goal protest against an irrational versus rational opponent. When the opponent violated constitutive rules, we predicted that 5-year-olds would protest both the constitutive rule breach and the opponent's irrationality, whereas 3-year-olds would focus more on the violation of constitutive rules given evidence that 3-year-olds are eager to enforce norms based on constitutive rules and their limited capacity to simultaneously handle different perspectives on the same state of affairs as well as their less developed executive function skills.

A secondary aim of the current study was to assess children's own game-playing strategy in a *supplementary task,* that is, whether children would play strategically (take disks from the opponent's tower) or non-strategically (take disks from the communal tower). To this end, we sought to simplify the paradigm as compared with the game of Priewasser and colleagues (2013), who found that only 26% of children's moves were strategic. That is why we introduced two towers, a communal tower and the puppet's tower, from which the child could take disks (in contrast to a bowl vs. a tower as in Priewasser et al.'s game), and we included a warm-up session in which children could take disks from the puppet's tower in a

cooperative game context. Given Priewasser and colleagues' finding that false belief task performance was positively correlated with children's tendency to make strategic moves, we expected 5-year-olds (who typically pass false belief tasks; Perner & Roessler, 2012) to profit more from these procedural modifications than 3-year-olds, thereby predominantly acting strategically.

Method

Participants

A sample of 48 children participated in the study: 24 three-year-olds (M = 42.5 months, range = 40–44; 12 girls) and 24 five-year-olds (M = 66.2 months, range = 64–68; 13 girls). Children came from mixed socioeconomic backgrounds from a mid-sized German city and were recruited via urban day-care centers (in which testing took place). Parents provided written informed consent. An additional eight children were excluded from the final sample due to experimenter error (n = 6) or uncooperativeness (n = 2).

Design

In a within-participants design, all children first took part in a warm-up session (playing with a ball and three warm-up tasks), followed by the supplementary task pre-phase (four trials), the main task (four trials), and the supplementary task post-phase (two trials). The order of these tasks was constant. The main task followed a 2 (constitutive rules: rule-following or rule-breaking) × 2 (game-playing strategy: rational or irrational) design, and the order of condition was counterbalanced using a Latin square design.

Materials

In the warm-up session, a ball and three warm-up tasks (see below) were used. In the supplementary and main tasks, a small box with stickers, three wooden stands (two with round bases and one with a quadratic base), a ribbon (put underneath one base of a stand), 32 soft Styrofoam disks, and a die (with two outcomes: 1 dot or 2 dots) were used. In addition, a hand puppet (∼1 m tall) was used.

Procedure

Two experimenters conducted the study; E1 led the session, and E2 controlled the hand puppet "Max." The child, E1, and E2 sat at a table. The purpose of the warm-up session was twofold. First, we sought to familiarize each participant with the puppet and the fact that mistakes can happen and the child may intervene. Second, the child was familiarized with the constitutive rules of the upcoming competitive game (rolling the die and taking disks accordingly) in a cooperative game context in which the child and the puppet collected disks from the puppet's tower and the child's tower whose purpose was to counteract a potential reluctance to take disks from another individual's tower.

The child, the puppet, and E1 played with a ball, followed by two warm-up (instrumental) tasks in which E1 modeled an action that the child, and then the puppet, could reproduce. One task was to draw something. Here, the puppet made an instrumental mistake (i.e., holding the pencil upside down) and the child had the opportunity to intervene and correct the puppet's act. The final warm-up task was a cooperative game (i.e., the child and the puppet had the same goal and acted together) and included a basket, a die with two outcomes, and three wooden stands (towers) filled with disks. The procedure was to roll the die and to remove disks (matching the number rolled: 1 or 2) from a tower and put them into the basket. First, E1 demonstrated the procedure with her own tower. Thereafter, the child and the puppet played this game successively with the child's tower and the puppet's tower (order counterbalanced). For each tower, the child and the puppet took turns rolling a die and removing disks (with E1 commenting the die rolls, e.g., "A 2! You can put two disks into the basket.")—and the tower stood close to the respective "owner" (child or puppet).

Table 1
Overview of main and supplementary tasks, including the measures recorded.

Task (number of trials)	Description	Dependent measure
Supplementary, pre-phase (4)	Child's turn: The child rolled the die (outcome: 1 or 2) and could take disks (one disk = one "move") either from the communal tower (non-strategic move) or from the puppet's tower (strategic move).	Proportion of strategic moves
Main (4)	Puppet's turn: The child watched as the puppet rolled the die and acted according to condition based on a 2 × 2 within-participants design (see Table 2). The child was given the opportunity to spontaneously intervene and protest against the puppet's behavior.	Protest
Supplementary, post-phase (2)	Child's turn (see pre-phase).	Proportion of strategic moves

General introduction to the competitive game

Table 1 gives an overview of the competitive game tasks and dependent measures recorded.

Before the supplementary task pre-phase, E1 presented a small box with stickers to the child and the puppet and announced that only one of them (puppet or child) could win the stickers in the next game. First, E1 put two towers on the table and gave one tower to the puppet ("This tower is yours, Max.") and one to the child ("And this tower is yours, [child's name]."), marking the child's tower with a sticker and a ribbon (put underneath) to make it distinct. Then, each player received eight disks to stack onto his or her tower. After the players put all disks onto their towers, E1 emphasized that both towers were of equal height and then put a third tower with eight disks (a communal tower) on the table ("There are further disks on this tower of the game."). Thereafter, E1 pointed to each tower ("Max, this is your tower; and [child's name], this is your tower; and there are further disks on this [communal] tower.") and emphasized that all towers were of equal height but that the winner would be the one who builds the highest tower. E1 then described the opposing goals of the players, "When it's Max's turn, he attempts [to make] his tower higher than yours. And when it's your [the child's] turn, then you attempt [to make] your tower higher than Max's," followed by the constitutive rules of the game: "When you roll a 1, you can take one disk. When you roll a 2, you can take two disks. You can take the disks either from that [communal] tower or from Max's tower" (order counterbalanced). Then, the pre-phase began.

Supplementary task

E1 announced that it was the child's turn and put the three towers on the table, such that the child faced the communal and puppet towers centrally (counterbalanced: communal left or right), whereas the child's tower was positioned to the child's right or left (counterbalanced). E1 emphasized that the child could win the stickers only when the child's tower was higher than Max's tower. Max then said, "I want to win the stickers! When it's my turn, I attempt [to make] my tower higher than yours." After that, the first trial of the supplementary task pre-phase began and the child could roll the die. After the child rolled the die, E1 repeated (only on the first trial) that the child could take the disks from the communal tower or from Max's tower (order counterbalanced). E1 then noted, "And you can always put the disks on your tower. You want to win, right?" Then, the child could take disks while E1 was turned away from the table in order not to pressure the child in any way and to have the child decide autonomously. The child received no feedback on his or her choice, and E1 introduced the next trial ("Okay, your turn again.") and put the die close to the child. After the fourth trial, the main task began, after which children received the supplementary task post-phase. Before the post-phase began, E1 put additional disks on the communal tower so that it was in its initial state (eight disks). On the first trial of the post-phase, E1 repeated that the child could take the disks from the communal tower or from Max's tower (order counterbalanced).

Main task

E1 announced that it was Max's turn now and, if necessary, put additional disks on the communal tower so that it was in its initial state (eight disks). E1 put the three towers on the table such that the

Table 2
Overview of puppet's behaviors in the four conditions.

	Condition			
	Rule-following		Rule-breaking	
	Rational	Irrational	Rational	Irrational
Puppet rolls a:	2	2	1	1
Puppet takes two disks from:	Child's tower	Communal tower	Child's tower	Communal tower
Puppet puts the two disks on:	Puppet's tower	Child's tower	Puppet's tower	Child's tower

child could see all towers and the puppet faced the communal and child's towers centrally, whereas the child's tower was positioned closer to the child. E1 explained to the puppet that he could take disks either from the communal tower or from the child's tower (order counterbalanced). Then, E1 turned away from the table to write something down (in order to give the child the opportunity to autonomously intervene), and the puppet acted according to condition taking one disk at a time (see Table 2 for an overview of the puppet's acts) and hummed during his action to draw the child's attention to the puppet. The child's spontaneous responses to the puppet's acts were recorded in four consecutive trials. E1 introduced the following trials by "Okay, your turn again, Max" and putting the die close to the puppet. After the main task, the child received the supplementary task post-phase (see above).

Coding and dependent measures

All sessions were recorded, transcribed, and coded from videotape by a single observer. A second independent observer, blind to the hypotheses and conditions of the study, transcribed and coded a random sample of 20% of all sessions for reliability.

General introduction and supplementary task

Children's spontaneous competitive attitude was coded via three observations in which children could receive a 1 for uttering a competitive phrase or a 0 for uttering an irrelevant phrase or making no comment. The first observation was when E1 announced that only one player can win the stickers (competitive utterance, e.g., "I will win the stickers!"), the second was when both players initially filled their towers with disks (e.g., "I was faster!"), and the third was when the puppet said that he wanted to win the stickers (e.g., "No, I will!"). Thus, children received a competitive attitude score ranging from 0 to 3. Interrater reliability was very good, Cohen's $\kappa = .87$. For each move (i.e., taking one disk), it was coded whether children took the disk from the puppet's tower (*strategic move*) or from the communal tower (*non-strategic move*); interrater reliability: $\kappa = 1$. Note that for each trial, the number of moves (i.e., disks) could vary depending on whether the child rolled a 1 or a 2. Thus, for the statistical analyses, we used the proportion of strategic moves out of the total number of moves for each child. A total of eight trials were excluded due to there being zero disks on one of the towers and so a lack of alternatives ($n = 6$) or because the child did not take any disks from either tower ($n = 2$).

Main task

Two mutually exclusive main coding categories served to classify children's spontaneous verbal and behavioral interventions within each trial: (a) *rule protest,* that is, children's protest referring to the constitutive rules of the game (e.g., "You may only take one disk!"); and (b) *goal protest,* that is, children's protest referring to competitive aspects of the game, in particular to actions at one of the towers (e.g., "You should put the disk on your tower!"). For each trial, the final codes for the two categories were independent and dichotomous (0 or 1) based on whether children received the corresponding code at least once. Interrater reliability was very good, Cohen's $\kappa = .88$. These types of protest included normative utterances (i.e., including deontic terms such as "should," "right," and "wrong," e.g., "He's not doing it right!"), generic statements (e.g., "It's about winning!"), imperatives,

tattling, behavioral prevention (i.e., preventing the puppet from taking/putting a disk from/onto a tower), and informing the puppet about his behavior (e.g., "But you have rolled a 1!" for rule protest; "That's my tower!" for goal protest). Furthermore, goal protest was categorized as *egocentric* (i.e., utterances related to the child's goal to win the game such as "Take from that [communal] tower!", "Put it on my tower!") or *alterocentric* (i.e., utterances related to the puppet's goal to win the game such as "Put it on your tower!"); interrater reliability: $\kappa = .84$. These two sub-categories were independent, such that each child received a dichotomous score (0 or 1) for alterocentric and egocentric goal protest for each trial.

Statistical analysis

Statistical analyses were run in R Version 3.0.2 (R Core Team, 2013). An analysis of variance (ANOVA) is not appropriate for dichotomous response variables. To account for non-independence of observations due to our within-participants design (each child participated in each condition), we used generalized linear mixed models (GLMMs) with binomial error structure and logit link function that allow for the inclusion of both fixed and random effects (Baayen, 2008; Bates, Maechler, Bolker, & Walker, 2013). All GLMMs included participant identification (ID) number as a random effect to allow intercepts to vary across participants.

Our approach for the main analysis on children's protest was as follows. First, the combined significance of the predictor variables (age, constitutive rules, game-playing strategy, and type of protest as well as their interactions) was tested by comparing the fit of the full model with the fit of a null model that contained only the random effect participant ID number using a likelihood ratio test (Dobson, 2002). Second, in case this full–null model comparison was significant, we tested for specific effects by comparing the fit of a full model (including the predictor variables of interest and the random effect) with the fit of a reduced model that did not contain the predictor of interest using a likelihood ratio test. The full–null model comparison was significant. The approach of testing the overall full model against a null model helps to protect against Type I error inflation arising from models comprising more than one predictor variable (Forstmeier & Schielzeth, 2011). Unstandardized parameter estimates (b), standard errors, 95% confidence intervals (CIs), and odds ratios (*OR*s) were obtained from the respective full model. For non-parametric tests, we computed the generic effect size $r_{\text{equivalent}}$ (Rosenthal & Rubin, 2003). Preliminary analyses found no effects of gender or of the difference between the number of disks the child collected and the puppet collected on children's protest behavior in the main task.

Results

Main task

Fig. 1 depicts the proportion of children performing protest (rule or goal) in each condition as a function of age.

Our main question was whether children would expect their opponent to follow a rational game-playing strategy. We hypothesized that both age groups would form such expectations when facing a rule-following opponent. However, when facing a rule-breaking opponent, we predicted that older, but not younger, children would be able to focus on the opponent's game-playing strategy given that there are two aspects (rule breach and irrational game-playing behavior) that one can consider at the same time in this latter context. In our analysis, the dependent measure was children's protest (yes or no), and we ran a GLMM with the predictor variables age, constitutive rules (rule-following or rule-breaking), game-playing strategy (rational or irrational), and type of protest (rule or goal) as well as their interactions. There was a significant four-way interaction among age, constitutive rules, game-playing strategy, and type of protest, $\chi^2(1) = 8.66$, $p = .003$, suggesting that the two age groups differed in their protest behavior (rule or goal) as a function of the opponent's game-playing strategy and the opponent's adherence to the constitutive rules of the game. Based on our differential predictions for

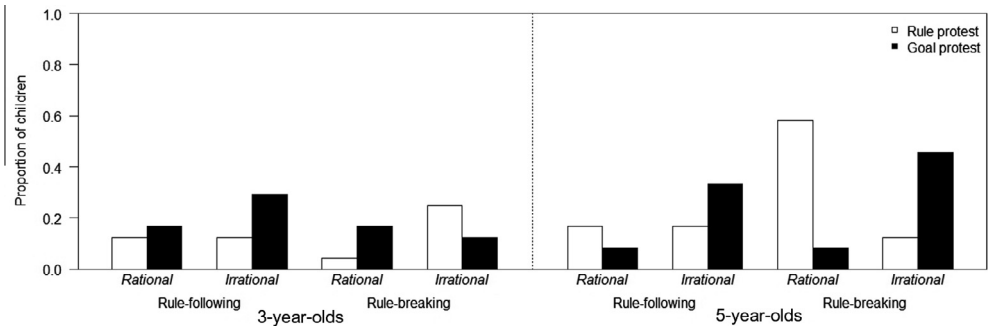

Fig. 1. Proportion of children performing protest (rule or goal) as a function of condition and age.

the rule-following and rule-breaking contexts, we looked at children's protest behavior separately for when the opponent followed versus violated constitutive rules.

Rule-following conditions

We found that, irrespective of age, children performed more goal protest (e.g., "You should put it on your tower!") when the opponent played irrationally than when he played rationally (main effect of game-playing strategy: $\chi^2(1) = 8.77$, $p = .003$, $b = 1.99$, $SE = 0.75$, CI [0.52, 3.46], $OR = 7.30$; main effect of age: $\chi^2(1) = 0.01$, $p = .93$, $b = 0.12$, $SE = 1.02$, CI [−2.13, 1.89], $OR = 1.13$; age by game-playing strategy interaction: $\chi^2(1) = 1.25$, $p = .26$, $b = 1.64$, $SE = 1.59$, CI [−1.48, 4.77], $OR = 5.16$). The same pattern of results was found for children's alterocentric goal protest (game-playing strategy: $\chi^2(1) = 16.56$, $p < .001$, $b = 3.43$, $SE = 1.31$, CI [0.87, 6.00], $OR = 30.97$; age: $\chi^2(1) = 0.79$, $p = .37$, $b = 0.36$, $SE = 0.40$, CI [−0.42, 1.15], $OR = 1.44$; age by game-playing strategy interaction: $\chi^2(1) = 0.81$, $p = .37$, $b = 2.41$, $SE = 8.62$, CI [−14.48, 19.30], $OR = 11.13$). Against an irrational opponent, children performed predominantly alterocentric goal protest (25% of 3-year-olds and 33% of 5-year-olds) rather than egocentric goal protest (8% of 3-year-olds and 8% of 5-year-olds). Against a rational opponent, however, children performed predominantly egocentric goal protest (17% of 3-year-olds and 8% of 5-year-olds) rather than alterocentric goal protest (0% of 3-year-olds and 4% of 5-year-olds). This suggests that children's goal protest was related to the opponent's goal to win the game for an irrational opponent but to their own goal to win the game for a rational opponent.

For rule protest, we found no significant effects (main effects of age and game-playing strategy, $ps > .82$; age by game-playing strategy interaction, $p = 1.00$). These results suggest that when the opponent adhered to the constitutive rules of the game, children at both ages differentiated between a rational and an irrational opponent and that they adapted their protest behavior (focusing on alterocentric goal protest) when confronted with an irrational opponent.

Rule-breaking conditions

When the opponent violated the constitutive rules of the game, 3- and 5-year-olds' protest behavior differed as indicated by a significant three-way interaction among age, game-playing strategy, and type of protest, $\chi^2(1) = 20.31$, $p < .001$. For 5-year-olds, we found a significant interaction between game-playing strategy and type of protest, $\chi^2(1) = 26.26$, $p < .001$ ($b = 6.67$, $SE = 1.49$, CI [3.63, 11.08], $OR = 784.62$), such that 5-year-olds performed more rule protest than goal protest against a rational opponent, $\chi^2(1) = 15.97$, $p < .001$ ($b = 4.19$, $SE = 1.17$, CI [1.89, 6.49], $OR = 66.23$), but that they performed more goal protest than rule protest against an irrational opponent, $\chi^2(1) = 7.13$, $p = .008$ ($b = 2.03$, $SE = 0.79$, CI [0.47, 3.58], $OR = 7.60$). Five-year-olds' alterocentric goal protest versus rule protest against irrational behavior showed the same result given that all 5-year-olds who performed goal protest did perform alterocentric goal protest (i.e., 46% of 5-year-olds; there was hardly any egocentric goal protest, 4% of 5-year-olds). There was little goal protest against a rational opponent, and it was

egocentric (17% of 3-year-olds and 8% of 5-year-olds) rather than alterocentric (0% of 3-year-olds and 0% of 5-year-olds).

Three-year-olds tended to show the opposite pattern of protest behavior, as indicated by their significantly larger likelihood to perform rule protest against an irrational versus rational opponent, $\chi^2(1) = 4.57$, $p = .03$ ($b = 2.04$, $SE = 1.13$, CI [0.15, 5.02], $OR = 7.67$), and a non-significant interaction between game-playing strategy and type of protest, $\chi^2(1) = 3.39$, $p = .066$ ($b = 2.37$, $SE = 1.40$, CI [−0.15, 5.68], $OR = 10.73$). For 3-year-olds, goal protest against an irrational opponent was both alterocentric (8% of 3-year-olds) and egocentric (8% of 3-year-olds). These results suggest that when the opponent violated the constitutive rules of the game, 5-year-olds protested against those rule violations for a rational opponent but focused on the opponent's game-playing strategy (performing more alterocentric goal protest than rule protest) for an irrational opponent. Three-year-olds tended to show the opposite protest pattern and focused more on the constitutive rules when facing an irrational versus rational opponent.

Supplementary task

Fig. 2 depicts the proportion of strategic moves (i.e., the number of disks taken from the opponent's tower divided by the total number of disks taken) for each age group as a function of phase (pre or post). The size of the bubbles indicates the number of children performing 0 to 100% strategic moves. The distribution of children acting strategically was approximately bimodal for both age groups (see Fig. 2). In particular, many children consistently performed either non-strategic moves or strategic moves in the pre-phase (non-strategic moves: 63% of 3-year-olds and 42% of 5-year-olds; strategic moves: 29% of 3-year-olds and 29% of 5-year-olds) and post-phase (non-strategic moves: 38% of 3-year-olds and 29% of 5-year-olds; strategic moves: 33% of 3-year-olds and 38% of 5-year-olds).

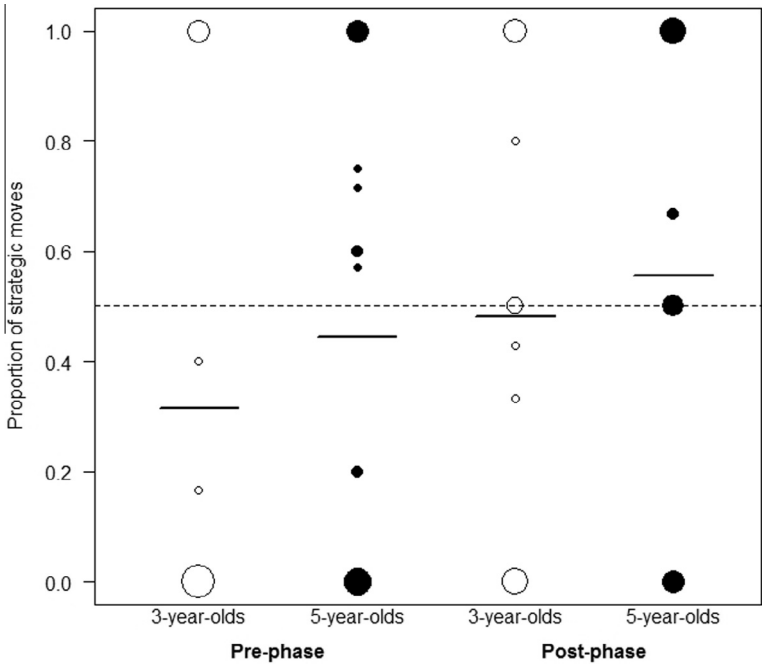

Fig. 2. A bubble plot depicting the proportion of strategic moves as a function of phase and age. The size of the bubbles is proportional to the number of children. The smallest bubble represents 1 of 24 children, and the largest bubble represents 15 of 24 children. Solid and dashed horizontal lines represent mean proportions and chance level (50%), respectively.

On average, 3-year-olds produced strategic moves nearly one third of the time in the pre-phase (M = .32, SD = .46) and roughly half of the time in the post-phase (M = .48, SD = .44). Five-year-olds made strategic moves roughly half of the time in both the pre-phase (M = .44, SD = .44) and post-phase (M = .56, SD = .42). We were interested in whether children's proportion of strategic moves was significantly different from chance (50%). Thus, we conducted planned exact one-sample Wilcoxon signed-rank tests and found no significant effects in the pre-phase (3-year-olds: T^+ = 94.5, p = .07, $r_{equivalent}$ = .36; 5-year-olds: T^+ = 127, p = .50, $r_{equivalent}$ = .14) or post-phase (3-year-olds: T^+ = 99, p = .86, $r_{equivalent}$ = .04; 5-year-olds: T^+ = 97.5, p = .54, $r_{equivalent}$ = .13). Moreover, we asked whether 5-year-olds were more strategic than 3-year-olds. We found no significant age differences in performance in the pre-phase (exact Mann–Whitney U test, U = 240.5, p = .29, $r_{equivalent}$ = .16) or post-phase (U = 256.5, p = .50, $r_{equivalent}$ = .10).

Furthermore, we assessed associations between children's spontaneous competitive attitude before the game began and their tendency to make strategic moves (collapsed across phase). For both age groups, children were categorized as competitive (score of 1 or higher) or non-competitive (score of 0) based on their competitive attitude score. Both competitive (n = 9) and non-competitive (n = 15) 3-year-olds acted strategically roughly one third of the time (M_{comp} = .38, SD = .33; $M_{non\text{-}comp}$ = .35, SD = .43), exact Mann–Whitney U test, U = 59.5, p = .64, $r_{equivalent}$ = .10. However, competitive (n = 10) 5-year-olds acted more strategically than non-competitive (n = 14) 5-year-olds (M_{comp} = .65, SD = .30; $M_{non\text{-}comp}$ = .38, SD = .32), U = 34.0, p = .03, $r_{equivalent}$ = .43, suggesting that spontaneous competitive attitudes were related to children's later strategic action for 5-year-olds only.

Discussion

The present findings suggest that young children's understanding of competitive games goes beyond representing their individual goal to win or appreciating simple constitutive rules (i.e., the cooperative basis of competitive games); children expected their opponent to follow a rational game-playing strategy, and so they protested when their opponent's behavior was conducive to their own goal to win the game even though such protest was costly because the irrational opponent helped children to get closer to winning the game and, thus, the prize.

Importantly, however, we predicted and found that older and younger children differed in their ability to focus on the opponent's game-playing strategy and, thus, to truly understand the dual-level normative structure of competitive games by flexibly forming and coordinating normative expectations about both constitutive rules and rationality. Five-year-olds flexibly protested irrational game-playing behavior when facing both a rule-breaking opponent and a rule-following opponent. Interestingly, and against our hypothesis, when their opponent both acted irrationally and violated constitutive rules, their protest clearly focused on the opponent's irrationality, somewhat neglecting the constitutive rule breach. Nevertheless, they strongly enforced constitutive rules when their rule-breaking opponent acted rationally.

Three-year-olds, however, protested irrational game-playing behavior only when the opponent followed constitutive rules. When facing a rule-breaking opponent, 3-year-olds focused on the rule breach more for an irrational versus rational opponent. This suggests that very young children might not be able to focus on more than one aspect of competitive games at a time and, thus, do not experience the joint activity as a coherent whole, which might be due to their limited ability to coordinate different perspectives regarding the same state of affairs or their deficiency in executive function skills (Garon et al., 2008; Perner & Roessler, 2012; Perner et al., 2005; Priewasser et al., 2013). The lack of protest against rule breaches of a rational opponent is somewhat surprising given evidence that young children enforce constitutive rules in a variety of contexts (e.g., Schmidt & Tomasello, 2012); however, in these purely cooperative game contexts, children need only focus on one perspective (the rules) and not on multiple perspectives as in the current experiment. More generally, our findings suggest that 3-year-olds have at best a nascent ability to appreciate competitive games given their apparently limited focus on only one game aspect at a time: (a) the opponent's game-playing strategy (expecting rationality) only when the opponent adheres to constitutive rules, (b) potentially their own goal to win given that children did not enforce constitutive rules when facing a rule-breaking rational

opponent (who impeded their goal achievement), or (c) the constitutive rules when facing a rule-breaking irrational opponent (who helps children to win). One possibility, therefore, is that 3-year-olds understand the joint activity as something like taking turns in following rules and pursuing an individual goal without understanding that the two goals are opposed, interdependent, and perspectival (Perner & Roessler, 2010; Priewasser et al., 2013).

Thus, our study goes beyond children's understanding of the normativity of cooperative games based on constitutive rules (Rakoczy & Schmidt, 2013; Schmidt & Tomasello, 2012) and indicates that by preschool age children understand something about the dual-level normative structure of human institutional practices, such as games, that regulate competition (i.e., opposing goals) within a cooperative structure (i.e., a set of agreed-on rules). We suggest that the best way to construe the formation of normative expectations at both levels is that game players jointly intend to compete in a cooperatively regulated way implicating that they reciprocally expect their opponent not only to follow the constitutive rules of the game but also to employ a rational game-playing strategy and to try to win (Rescorla, 2007; Roversi, 2010; Schwyzer, 1969; Suits, 1978/2005). The individual goals of trying to win, therefore, are derivative of the joint intention to compete within a cooperative framework, and not trying to win appears to be particularly irrational when extrinsic rewards are involved.

Why did 5-year-olds mainly focus on the irrationality of the opponent and not on the opponent's violation of constitutive rules when both occurred simultaneously? One way to understand this focus is to refer to our notion that players "jointly intend to compete in a cooperatively regulated way." If children detect that "you" are not intending to compete, then "we" are not intending to compete and the "competitive" game is practically over; any further rebuke regarding the constitutive rule breach might be considered unnecessary. Another way to make sense of this pattern is that constitutive rules are clearly arbitrary (they could be changed if all agree), whereas the goal to win—based on the joint intention to compete—is inherent to the practice of competitive game playing (Rescorla, 2007; Roversi, 2010) and, thus, is more fundamental and non-arbitrary (if one were to change this aspect, one would abolish the whole practice of cooperatively regulated competition). Evidence from a different strand of research suggests that young children find non-arbitrary norms (e.g., moral norms prohibiting harming others) to be more objective and wider in scope than more arbitrary norms (e.g., conventional norms; Killen & Smetana, 2014; Schmidt, Rakoczy, & Tomasello, 2012; Smetana, 1981; Turiel, 2006; but see Rhodes & Chalik, 2013). Future research could assess to what extent young children understand rational game playing as unalterable and objective just like (prototypical) moral norms even though moral violations are presumably considered more severe (Dahl & Kim, 2014; Turiel, 2006). Moreover, an interesting question is whether children think that a trifler who intends to throw the game is acting unfairly because the trifler's behavior impedes any fair competition under equal conditions (with each player giving his or her best).

Could it be that children understood the irrational opponent's behavior as violating constitutive rules of the game (i.e., what "we" do in the game context)? What speaks against this possibility is that it was never explicitly forbidden to put disks on the opponent's tower (the experimenter merely told children that they could put disks on their tower and described the discrepant goals of the players regarding the towers). Moreover, it is inevitable that children needed to switch perspectives when disks were put on their tower by the opponent (irrational game playing regarding the opponent's goal to win) versus by themselves (rational game playing regarding children's goal to win) because opposing goals are inherent to competition. So, it does not seem to be the case that children merely thought that "we don't put disks on my tower." In contrast, for simple constitutive rules regarding die rolls and taking disks, a perspective shift is not necessary; these apply permanently for all players from a joint "we" perspective.

Another finding of this study was that many children, in particular many 3-year-olds, refrained from protesting. For example, roughly one third of 3-year-olds performed goal protest against an irrational, rule-following opponent. However, uttering spontaneous protest and critique is demanding, and most studies using this measure find a considerable number of children who do not show any protest behavior, which could be due to shyness (e.g., Rakoczy et al., 2008; Schmidt, Rakoczy, & Tomasello, 2013; Wyman, Rakoczy, & Tomasello, 2009). Another possibility in our specific study is that some children refrained from protesting against irrational behavior (despite finding it objectionable) because of the costs involved given that the irrational opponent helped children to win the prize.

Therefore, future work could investigate whether children would perform more protest against irrational play when there is no prospect of winning a prize.

A second question of the current study was whether our procedural changes (compared with Priewasser et al., 2013) would enhance children's tendency to produce strategic moves themselves (i.e., to take disks from the opponent rather than from a neutral communal tower). Although we found an overall somewhat higher proportion of strategic moves than Priewasser and colleagues, (2013), the major findings were that 3- and 5-year-olds' strategic behavior did not differ and that most children consistently made either strategic or non-strategic moves. It is possible that the lack of direct turn taking in our task led many children to perseverate in their initial choice of a tower. In addition, the tendency of older children, but not younger children, to make strategic moves was correlated with their spontaneous competitive attitude before the game had started. What this might suggest is that 5-year-olds do understand how to play strategically but that they also need to be motivated to do so and perhaps overcome reluctance to take disks from the opponent; however, 3-year-olds might not understand the difference between a strategic move and a non-strategic move in terms of the efficiency of their goal achievement, again possibly due to a deficiency in appreciating different perspectives (the opponent's and their own) on the same state of affairs or executive limitations (Garon et al., 2008; Perner et al., 2005; Priewasser et al., 2013).

Taken together, our results suggest that preschoolers, and to some extent even young children, expect their game partner to follow a rational game-playing strategy even when such normative expectations result in costly protest behavior given that an irrational opponent helps children to get closer to winning the game (and, thus, a prize) and could potentially be exploited. Importantly, 3-year-olds do not genuinely understand competitive games given that they seem to focus on only one aspect of the activity at a time (i.e., their individual goal to win, the constitutive rules, or their opponent's rationality) without integrating everything into a coherent whole. However, 5-year-olds flexibly form and coordinate normative expectations about both constitutive rules and their opponent's rationality, suggesting significant developmental change between 3 and 5 years of age. Hence, although 3-year-olds can, in limited ways, focus on more than simple constitutive rules (that apply symmetrically to all players from a joint "we" perspective), it is only by 5 years of age that children have developed an understanding of competitive games that truly entails some appreciation of the dual and nested existence of competition and cooperation that is paradigmatic for many human social and institutional practices. We propose that what allows children to develop an understanding of the normative aspects of competitive games is to form the joint intention to compete in a cooperatively regulated way.

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