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Development and Aging

The behavioral effects of cooperative and competitive board games in preschoolers

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Traditional board games are a common social activity for many children, but little is known about the behavioral effects of this type of game. The current study aims to explore the behavioral effects of cooperative and competitive board games in four-to-six-year-old children (N = 65). Repeatedly during 6 weeks, children in groups of four played either cooperative or competitive board games in a between-subject design, and shortly after each game conducted a task in which children's cooperative, prosocial, competitive, and antisocial behavior were observed. The type of board game did not have an effect on cooperative, prosocial or antisocial behavior. Cooperative and competitive board games elicited equal amounts of cooperative and prosocial behavior, which suggest that board games, regardless of type, could have positive effects on preschoolers' social behavior. Our results suggest that children may compete more after playing competitive board games; but the measure of competitive behavior in particular was unreliable. Preschoolers enjoyed playing cooperative board games more than competitive board games, which may be one reason to prefer their use.

Key words: Antisocial behavior, board games, competition, cooperation, preschoolers, prosocial behavior.

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INTRODUCTION

During their preschool years, children undergo an intense period of social development. The educational environment plays an important role in fostering this development (Schonert-Reichl, Smith, Zaidman-Zait & Hertzman, 2012) by offering a variety of opportunities for children to socialize with peers (Sandberg & Ottoson, 2010) and to engage in and display a range of different social behaviors, including cooperative and prosocial behaviors. Educators can promote children's social skills by using play materials that encourage cooperation (Barbarin & Wasik, 2009; Garaigordobil & Aliri, 2010).

Educators also have the opportunity of detecting children who display social difficulties early on and to take preventive actions (Bagdi & Vacca, 2005; Hemmeter, Ostrosky & Fox, 2006). To support educators in this preventive work, it is important to develop cost-effective and simple methods that teachers can use to promote socially desirable behavior and reduce adverse social behavior in children. In Sweden, preschools have a legal obligation to provide children at psychosocial risk with extra help and support for their social development (Sandberg & Ottoson, 2010). It is crucial that social interventions are implemented early before more serious social problems develop, to avoid costly interventions in later stages (Benitez, Fernandez, Justicia, Fernandez & Justicia, 2011; Hemmeter *et al*., 2006).

The ability to cooperate and behave prosocially is essential in order to function well in society (Tomasello, 2009) and a large body of research has confirmed the evolutionary and societal benefits of cooperation and other prosocial behaviors (e.g., Tomasello, Melis, Tennie, Wyman & Herrmann, 2012) such as collaboration and sharing. Promoting cooperation and collaborative group work in school enhances children's problem-solving abilities (e.g., Fawcett & Garton, 2005), cognitive functioning, as well as social and academic performances (see for example Van Velsor, 2017).

In contrast, studies have shown that competition can have adverse effects on children's academic development and peer relationships (Lam, Yim, Law & Cheung, 2004; Pappert, Williams & Moore, 2017; Tassi & Schneider, 1997). Competing for resources can lead to antisocial behavior, such as aggression and coercive behavior (e.g., Hawley, 1999), and antisocial behavior can, in turn, lead to defiant and disobedient behavior, peer-relation problems and difficulties in school (e.g., Webster-Stratton & Reid, 2004). As a result, it has been argued that antisocial behavior ought to be counteracted as early as possible within the school environment (e.g., Benitez *et al*., 2011; Çolak, Tomrisb, Diken, Arikan, Aksoy & Çelik, 2015; Hemmeter *et al*., 2006) and that a cooperative learning climate in the classroom should be encouraged in favor of an individualistic or competitive one (e.g., Johnson & Johnson, 2009). However, some researchers (Rosol, 2012; Sheridan & Williams, 2006) have also stressed the potentially positive effects of competition in the classroom.

Studies have suggested that a successful way to decrease antisocial behaviors within the school environment is to teach children social skills, that is, other-oriented behaviors such as cooperation and prosocial behaviors (Frey, Lingo & Nelson, 2008). Consequently, a battery of different types of cooperative games have been used in a variety of different studies, ranging from extensive school and home-based social intervention programs (see Benitez *et al*., 2011; Çolak *et al*., 2015) to experimental studies. These studies have shown that cooperative activities and games can promote cooperative and prosocial behaviors in children, sometimes in ways that generalize to other

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activities (e.g., Foster, Behrens, Jager & Dzewaltowski, 2010; Garaigordobil, 2008; Garaigordobil, Maganto & Etxeberria, 1996; Orlick, 1981).

However, although multiple studies have shown that cooperative activities may promote other-oriented behaviors, not all such studies have successfully trained children to behave more cooperatively (e.g., Paulson, 1974; Sagotsky, Wood-Schneider & Konop, 1981). There are numerous reasons why generalization or transfer effects should not be taken as given, as illustrated by studies taking developmental psychological (Chandler, Lubeck & Fowler, 1992), clinical (Abikoff, 2009; Carruthers, Pickles, Slonims, Howlin & Charman, 2020) and educational (Beach, 1999; Packer, 2001) perspectives.

Here we investigate whether commercially available traditional board games can be used as a tool to moderate social behavior. The overall aim is to investigate whether cooperative board games – in comparison to competitive board games – have the potential to promote preschoolers cooperative and prosocial behaviors as well as reducing competitive and antisocial behavior, in social situations outside the game situation. We adopted this goal because although board games are popular and are sometimes marketed to care-givers as improving social development, there are few developmental psychology studies which focus purely on board games and their potential to moderate social behavior in typically developing children. This relative lack of studies is despite their suggested methodological advantages (Barton *et al*., 2018; Bay-Hinitz, Peterson & Quilitch, 1994; Fang, Chen & Huang, 2016) and successful use within other research areas. For example, board games have been used as a tool to enhance children's mathematical skills (Elofsson, Gustafsson & Samuelsson, 2016; Ramani, Siegler & Hitti, 2012), cognitive performance (Cecilia, Di Giacomo & Vittorini, 2015) and executive function (Kim *et al*., 2014), and to enhance social skills in children with special needs (Davis-Temple, Jung & Sainato, 2014) and disabilities (Barton *et al*., 2018). It has also been argued that board games can be a powerful learning tool because of their particular combination of enjoyment and learning (Hromek & Roffey, 2009).

Three recent reviews have summarized the overall effects of board games. Lai, Ang, Por, and Liew (2018), focused on how non-digital games influence cognitive, psychomotor and/or communicative development in four-to-nine-year-olds. The authors conclude that non-digital games can stimulate cognitive development in preschoolers. Bayeck (2020) concluded that board games enable and motivate learning in various areas and facilitate understanding of more complex concepts. Noda, Shirotsuki, and Nakao (2019), concluded that board games improve motivation and understanding of knowledge, as well as interpersonal relationships among participants. All three reviews stress that more research is needed in order to draw definitive conclusions about the effects of board games, with Bayeck (2020) emphasizing that more research is needed on commercially available games (only 4 of 45 studies included in their systematic review used commercially available games).

We now focus on the different effects of competitive and cooperative board games on children's social behavior. Peppler, Danish, and Phelps (2013), investigated how playing a competitive or a collaborative educational board game (teaching children advanced science) affected social dynamics in children aged six-to-nine-years. They found that when playing competitively, children made more negative comments towards their peers and gazed away from the game and their co-players more often. It also took longer to finish the game in the competitive condition. In contrast, when playing collaboratively, children made more positive comments to others and were more focused on the game. Bay-Hinitz *et al*. (1994) investigated four-to-five-year-old children's cooperative and aggressive behavior during gaming sessions and in subsequent free-play sessions. Children were divided into four groups and played cooperative and competitive games using a multiple baseline and reversal design. Their results showed that overall, playing cooperative games increased cooperative behavior and decreased aggressive behavior during board-gaming sessions and in subsequent free-play sessions. In contrast to this, playing competitive games increased aggressive behavior and decreased cooperative behavior.

However, not all four groups in Bay-Hinitz *et al*. (1994) followed this behavioral pattern, and the method focused on physically active games as well as board games. In response, Zan and Hildebrandt (2003) investigated first graders' social interactions during cooperative and competitive board gaming. They found that children negotiated and shared experiences more often during cooperative board gaming, but in contrast to Bay-Hinitz *et al*. (1994), children were not more aggressive during competitive board gaming.

Current study

The results from Bay-Hinitz *et al*. (1994), Zan and Hildebrandt (2003), and Peppler *et al*. (2013) suggest that cooperative board gaming increase cooperative and prosocial behaviors in preschoolers and first graders. However, Bay-Hinitz *et al*. (1994) also used other game types and based their results solely on descriptive statistics with no inferential hypothesis testing, and Zan and Hildebrandt (2003) and Peppler *et al*. (2013) only coded behavior during game sessions making it impossible to draw any conclusions about how board games affect behavior in subsequent social situations. Thus, it still remains unclear whether cooperative board games have the ability to decrease competitive and antisocial behavior and if competitive board games increase antisocial behavior in ways that generalize outside the gaming session. To fill these knowledge gaps, this study aims to further explore the behavioral effects of cooperative and competitive board gaming in preschoolers.

In this study, generalization is defined as the behavioral effects the previous situation (cooperative and competitive board games) has on children's cooperative, prosocial, competitive, and antisocial behavior in new situations (behavioral tasks). We predict that children who play cooperative board games, in comparison to children who play competitive board games, will behave more cooperatively and prosocially and less competitively and antisocially in subsequent play tasks. Because previous studies (e.g., Paulson, 1974) have shown that generalization of cooperative behavior from one situation to another may be context dependent, we include both free tasks and structured game-like tasks to increase the likelihood that we will detect short-term generalization effects.

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The current study is conducted in preschools mainly for practical reasons, but also because board gaming is a common activity within the preschool environment and is promoted by manufacturers as increasing cooperation. This study is thus intended to lead to more knowledge about the potential benefits and practical use of commercial board games within the preschool environment.

Although the study is primarily practically rather than theoretically motivated, we note that (notwithstanding above-mentioned caveats about the non-universality of transfer and generalization effects) there are theoretical reasons to predict generalization in this context. Generalization is a central aspect of children's development (Carruthers *et al*., 2020) and the ability to generalize starts to emerge during the first months in life (Bahrick, 2002). Numerous simpler or more complex processes can result in generalization. In the current context, we suggest schema learning may be important, specifically role schemas, referring to proper behavior and role expectations in a given situation, and event schemas, referring to the processes, practices and actions in specific situations (Seel, 2012). Because the context in which children play the games in this study is similar to the context in which they are tested, cooperative or competitive role or event schemas acquired in the gaming situations may be generalized to the test situations.

Participants' cooperative, prosocial, competitive, and antisocial behavior were screened for prior to board gaming using single-item teacher ratings. The ability to inhibit impulses has been related to children's cooperative (Ciairano, Visu-Petra & Settanni, 2007; Giannotta, Burk & Ciairano, 2011), prosocial (Hughes, White, Sharpen & Dunn, 2000), competitive (Huyder & Nilsen, 2012) and antisocial behavior (Hughes *et al*., 2000) in previous studies, thus we also controlled for the effect of children's interference control on measured behaviors. Finally, studies have indicated that children enjoy cooperative games more than competitive games and that children are sensitive to wins and losses (Orlick, 1981). Other studies, however, have suggested that children enjoy competitive games more than non-competitive games (Foster *et al*., 2010). Thus, due to inconsistency in previous findings, we explore enjoyment of cooperative and competitive board games and if enjoyment differs according to whether the game is won or lost.

METHOD

Participants

A total of 65 children between four and six years (31 girls, M = 5.39 years, SD = 0.62 years) participated in this study. They were recruited from four Swedish preschools with a total of seven classrooms. Teachers who rated participating children received a gift-card with a value of 100 SEK. The study was approved by the regional ethics board and parents gave written informed consent before the study began. Participants were verbally informed about the procedure prior to all pre-tests and experimental tasks. Prior to board-gaming sessions, participants could choose freely whether to play board games. If experimenters perceived that a child, verbally or non-verbally, did not want to participate or answer questions, no further attempt was made to encourage the child to participate.

General design

A pre-test phase (including teacher ratings and individual pre-tests) and an experimental phase (including board-gaming sessions in which participants played either cooperative or competitive board games in groups of four with eight subsequent behavioral tasks) were conducted (see Fig. 1). Participants were first matched in pairs based on individual tendencies to compete (a composite variable consisting of the mean of z-transformed values of teacher-rated competitiveness and pre-test measured competitive behavior). Each matched pair was then randomly split between two conditions and allocated to a group within that condition (cooperative board games, N = 34, or competitive board games, N = 31). Within-condition groups were balanced based on age, gender, and sociometric scores. The slight participant imbalance between conditions was due to logistical reasons.

Participants played board games approximately two to three times per week during a 6-week period. On average, participants played board games six times (M = 6.2 game sessions, SD = 2.5) and participated in approximately the same number of behavioral tasks (M = 5.5 tasks, SD = 2.4). Behavioral tasks were distributed equally across conditions. Our intention was for each child to take part in as many of the different tasks as possible given logistic constraints.

Pre-test phase

Teachers who were most familiar with participant, rated their cooperative, prosocial, competitive, and antisocial behavior (see Supplementary information). Competitiveness was measured using a modified version of an anonymous social values task (Domino, 1992; Knight & Kagan, 1977; McClintock, Moskowitz & McClintock, 1977, see Supplementary information). Participants distributed marbles to themselves and another child anonymous to the participant. The participant was asked to choose one of two cards with a different amount of round black dots on them (ranging from two to six), and was told that the number of dots on the side closest to the participant represented the amount of marbles that the participant would receive in that trial. The competitiveness score from the social values task was the number of trials out of 12 in which the participant chose an option which resulted in them obtaining more marbles than the anonymous child. The social values task was modified by only including measures of competitiveness (leaving out choices measuring primarily egalitarian, altruistic and individualistic behaviors) because the primary interest of measuring individual tendencies to compete.

Popularity was measured using a sociometry task (Dunnington, 1957). The participant was shown a class photograph (with all the other participating children). The participant was then asked the following questions; "Do you have a best friend in here?", "Is there anyone else that you enjoy playing with?", until the participant had nominated three children. Thereafter, they were asked "Is there anyone in here that you don't enjoy playing with?", "Is there anyone else that you don't enjoy playing with?", until the participant said no or had nominated three children.

Interference control was measured using a modified "day-night" Stroop task (Gerstadt, Hong & Diamond, 1994) (hereby referred to as Stroop task). The participant was shown a total of 48 cards with different symbols (that were each other's symbolic opposite) and instructed to verbally state for each symbol its opposite (e.g., to say "day" when exposed to a moon, the symbol for "night"). The Stroop task was modified by using eight pairs of opposites instead of four and distributing these cards in two rounds; with four pairs in the first round and eight pairs in the second round creating different degrees of difficulty. This modification was motivated by the relatively large age span in our sample (See Supplementary information for more details about the different pre-tests).

Experimental phase

Board game sessions, which were conducted two to three times per week for 6 weeks, consisted of three cooperative board games (*Granny's House*®, *Secret Door*® and *Mr. Troll*® from Family Pastimes Co-

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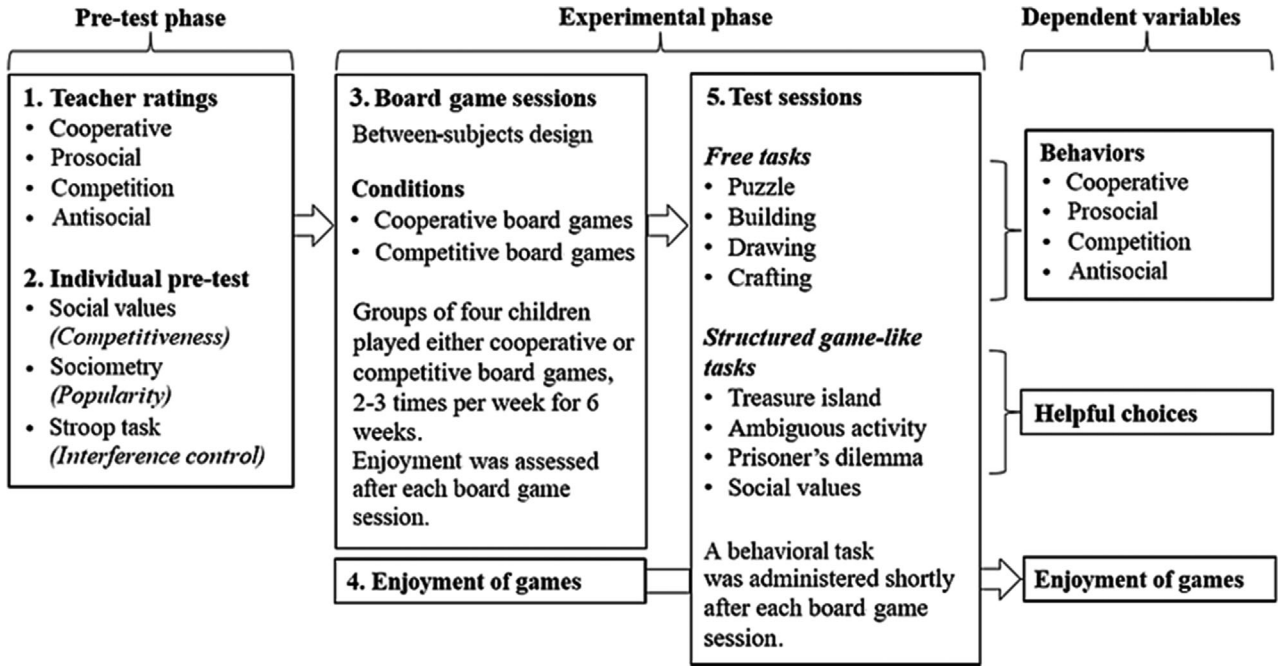

Fig. 1. Flow chart of the general design and procedure of the study.

operative Games™) and three competitive board games (*Spooky Stairs* from Enigma, *Mato* from Competo and *Feed the Kitty*™ from Gamewright). All board games were converted into a cooperative and competitive version with corresponding rules, resulting in a total of twelve board games. The purpose of converting the games was to eliminate superficial game-feature differences between conditions. Enjoyment of each board game was assessed immediately after each board game session, measured with a five-point Likert scale (Orlick, 1981). The scale consisted of a piece of paper with five smiley faces that represented different feelings of enjoyment, ranging from "very boring" (very sad smiley) to "very fun" (very happy smiley).

Test sessions, performed after each board-game session (except the first one which was an introduction session), consisted of eight different behavioral tasks. Four of them were more "free" in their nature and four were more structured and game-like. During free tasks, children in groups of four children built either a jigsaw puzzle (Arterberry, Cain & Chopko, 2007), a house for a stuffed animal (Ramani, 2006), drew a picture of a castle (Paulson, 1974), or crafted "monsters" together.

In the puzzle task, each participant was instructed to build one of the four seasons that was a part of a complete circular puzzle representing all four seasons (i.e., spring, summer, fall and winter). Each participant received six pieces, but were told that the pieces could accidently have been mixed with other participants' pieces (i.e., four pieces belonged to the participants' season, while two pieces belonged to the seasons' of two other participants).

In the building task, participants were told that a mouse (stuffed animal) wanted a house with two rooms and some windows and they were instructed to build that house together with building blocks (from *Mega Bloks*®). Each participant received identical white boxes containing 25 building blocks in different shapes and colors.

In the drawing task, participants were instructed to draw a castle together on a paper with a tower and a king and a queen living in the castle. A crayon with a specific color was handed to each participant. In the crafting task, participants were instructed to create "fun monsters" together and were given one bag each containing different kinds of crafting materials. They also had access to shared material.

In the four structured game-like tasks, children took part in a novel "treasure island" task, a modified prisoner's dilemma task (Matsumoto, Haan, Yabrove, Theodorou & Carney, 1986), a non-anonymous social values task (Domino, 1992; Knight & Kagan, 1977; McClintock, Moskowitz & McClintock, 1977), and a novel "ambiguous activity" task.

In the treasure island task, participants were instructed to collect "treasures" in a setting constructed out of building bricks. Each treasure represented one marble and each participant could obtain eight treasures and switch them for marbles. The setting consisted of an "ocean" with "islands" and the "treasures" were small colored LEGO® bricks. To collect the treasures on the islands, participants had to use their planks (flat bricks) and build bridges to help their LEGO® figures get across the ocean. To build a bridge to reach their own individual islands participants needed a two-plank-long bridge, in order to reach the communal island they needed to cooperate (requiring a five-plank-long bridge).

In the prisoner's dilemma task, we used a simplified version from Matsumoto *et al*. (1986). Each group of four children was divided into two dyads and was instructed that they would engage in an activity in which they could collect marbles. Each participant was then given a card with one dot on one side and two dots on the other side, and was told that each dot on the cards represented one marble. In ten rounds, the experimenter picked up two marbles in front of the two participants and asked each of them how many marbles they wanted. Participants answered this question by putting their card on the table, with the side representing the number of marbles that they wanted to receive, upwards. Participants were instructed to think about their choice by preparing under the table in their lap which side of the card to show. Participants were also encouraged to talk to each other about their choices and told that discussing their choices would increase their chances to receive marbles. They were further instructed that if both participants wanted one marble, they would receive one marble each. However, if both participants wanted two marbles, the experimenter kept both marbles and the participants would receive zero marbles. If one participant wanted one marble and the other participant wanted two marbles, the latter would receive two marbles (and vice versa).

The non-anonymous social values task was nearly identical to the anonymous social values task conducted in the individual pre-test, but instead of distributing marbles to an anonymous child, participants were paired with another child from the pre-existing board game group.

In the ambiguous activity task (Eriksson, Stenberg & Kenward, 2021; so called because it is unclear whether the purpose is to compete or cooperate) participants each built a caterpillar. The materials consisted of a box with two compartments and four caterpillars with different colors, each allocated to a specific participant. Each participant began with an incomplete caterpillar that needed five pieces of their own color to be completed, which were initially placed in the box. The box compartment

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on the left was referred to as the "window" side (due to a transparent window exposing the inside) and the compartment on the right was referred to as the "curtain" side (due to a black curtain covering the inside). It was explained to participants that it was easier to retrieve your own pieces from the window side and harder to retrieve your own pieces from the curtain side, because pieces could not be seen on the curtain side and were therefore extracted at random. Participants were instructed to collect pieces from the box, taking turns, removing one piece at a time, in order to complete their caterpillars. When a piece was removed that belonged to another child, the participant chose whether to replace it on the window side (for easy removal by the other child) or curtain side (hindering its collection). See Supplementary information for more details about the different tasks.

Dependent variables

In our free tasks, cooperative, prosocial, competitive and antisocial behaviors were measured. (See Supplementary information for more details about how measured behaviors were operationalized.) Cooperative behavior was defined as actively working together to achieve a common goal (e.g., Malti, Ongley, Peplak *et al.,* 2016) or constructively negotiating to create new common goals. We also included an element of negotiating in our definition of cooperation, which partly corresponded to the reciprocal level 2 negotiation strategies found by Zan and Hildebrandt (2003). Note: negotiation strategies that were coercive in their nature were defined as antisocial behavior.

Prosocial behaviors were helping; defined as assisting others to reach their goals, sharing; defined as sharing resources with another child, and comforting; defined as trying to alleviate others' distress (e.g., Malti *et al*., 2016). Additionally, we also included fun and playful interactions, positive physical contact and complements. Helpful choices were measured in structured game-like tasks and defined as making choices that helped another child to maximize their gain (e.g., number of marbles) rather than maximizing one's own individual gain.

Competitive behaviors were defined as behaviors indicating a motivation to increase the relative difference between achievements of own and others' goals (Tsiakara & Digelidis, 2014). Antisocial behaviors were defined as problematic social behaviors that were expected to either violate social norms and rules, or cause discomfort or negative emotions.

General procedure

This study was conducted in preschools and went on for approximately 6 weeks. All measures were piloted in an additional preschool. Experimenters were two female assistants and one doctoral student, each assigned to collect data in one or two preschools. The individual pre-test session took approximately 20 minutes to conduct. Prior to each board-gaming session, the experimenter gathered four participants (from the same condition) around a table in a secluded room inside the preschool facility. Once seated, the experimenter suggested one board game (out of six) to play and after participants had chosen a game, the experimenter explained the instructions and rules of that game.

During board-gaming sessions, experimenters were instructed to promote cooperation or competition by, for example, suggesting cooperative solutions or encouraging participants to compete, as appropriate according to the rules of the game. At least one game and sometimes two was played in each board-gaming session and they took approximately 10–20 minutes to play. Directly after each board-game session, participants were instructed to individually rate how much they enjoyed playing the game by drawing a circle around the smiley that corresponded the most with their own feeling of enjoyment. Board-game sessions were then followed by a test session, with the exception of the first game session which was a condition-introduction session.

Test sessions were conducted in the same room shortly after board gaming (within 10 minutes) and all tasks began with an instruction phase, in which participants were instructed by the experimenter as to how to execute the task. The experimenter withdrew her participation after the instruction phase of puzzle, building, crafting, drawing, and treasure island, but in the ambiguous activity, prisoner's dilemma and social values, the experimenter participated by administering the materials used. Behavioral tasks were chosen prior to each board game session and took approximately 20–30 minutes to conduct. All test sessions were sound and video recorded.

Coding

In the individual pre-test, social values scores were calculated by scoring all 12 rounds for each participant with either "1" or "0" depending on which card the participant chose. If the participant chose a card that minimized the other child's amount of marbles, this choice was regarded as competitive and scored as a "1" Each child could receive a maximum of 12 points. Stroop task scores were calculated by coding participants' answers according to the following alternatives; correct answer ("1"), wrong answer ("2"), self-corrected answer (i.e., when participants corrected their answers before the next card was presented) ("3") and no answer ("4"). Only correct answers were analyzed and participants could receive a maximum of 48 points in both rounds.

Behavior in free tasks was coded with a coding scheme that was developed based on previous work by Paulson (1974), Finlinson, Berghout Austin and Pfister (2000), Ramani (2006) and Tsiakara and Digelidis (2014). The frequency of each participant's target behaviors was coded according to the alternatives in the coding scheme; "Several" which meant two or three and "Many" which meant more than three. The strength of the behavior was rated according to whether the act of a specific behavior was minor or major. Coders used the following coding scheme in which frequency and strength were combined: (0) never, (1) one minor act, (2) several minor acts and/or one major act, (3) several major acts and/or many minor acts, and (4) many major acts. For example, helping and sharing were always coded as major prosocial behaviors whereas complementing another child was coded as a minor prosocial behavior (See Supplementary information for more details about the behavioral coding scheme.)

Helpful choices in structured game-like tasks were coded as each participants' number of planks towards the common island in treasure island; as number of rounds in which the participant, after making the agreement to help each other, chose to maximize the common result in prisoner's dilemma; as number of replacements on the side in which it was easier to retrieve your own piece in the ambiguous activity; and as number of rounds in which the participant chose to maximize their partner's number of marbles in social values. For analysis, each count was expressed as the proportion of all the individual's choices in the task that were helpful choices. (See Supplementary information for more information about the different tasks.) Enjoyment of board games was coded by converting the smiley faces into a five-point Likert scale, ranging from 1 ("very boring/sad smiley") to 5 ("very fun/happy smiley").

Behavioral coding was conducted by two external coders that at all times were blind to the conditions. To control for agreement between coders, double coding for 12 participants were obtained. The intra-class-correlation coefficients (ICC) for this sample were 0.95 for cooperative behavior, 0.79 for prosocial behavior, 0.88 for antisocial behavior and 0.36 for competitive behavior. The low ICC for competitive behavior is not adequate and problematized in the discussion section. The same two external coders also coded helpful choices in treasure island and prisoner's dilemma, but helpful choices in the ambiguous activity task were coded by one of the experimenters that collected data. Helpful choices in the social values task were documented by the experimenter as the task was conducted.

Data assessment

Of the 65 children that participated in this study, 61 were included in our parametric analyses: 60 in our behavioral analyses and 54 in our helpful choices analyses (not all participants engaged in each task type). Four children did not participate in our experimental phase. Teachers rated children as highly cooperative (M = 4.67, SD = 0.78) and prosocial (M = 4.84, SD = 0.89) and less competitive (M = 3.71, SD = 1.75) and

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antisocial (M = 2.21, SD = 1.25) prior to board gaming. A few cases of missing data were present in teacher-rated behavior and in pre-test social values.

All outcome variables were visually inspected for skew prior to parametric analysis. Coder-rated competitive behavior was right skewed and therefore a positive constant of 1 was added before performing a log transformation. The enjoyment of games variable was heavily left skewed and thus reversed and reciprocally transformed, 1/(6-Score). Although this variable was still somewhat skewed after this procedure, parametric tests are still preferred over the non-parametric equivalents (Norman, 2010). Proportion data were arcsine-square root transformed prior to analyses.

A mean value of each participant's behavioral scores and proportion of helpful choices across tasks was calculated in order to perform Pearson correlations and *t*-tests (see Table 1 for *t*-tests). In addition to *p*-values we also report Bayes factors, which have the advantage of providing evidence for as well as against H_0, which the *p*-value does not permit. This is particularly valuable when presenting non-significant results. BF_{01} specifies the ratio between the evidence provided by the data for hypothesis H_0 relative to the alternative H_1. That is, a finding of BF_{01} = 3, means that the data are three times more likely given H_0 compared to H_1, and so BF_{10} = 1/3, meaning that data are about 0.33 times more likely given H_1 compared to H_0. We used the convention provided by Wagenmakers *et al*. (2018) to label the strength of evidence provided by a Bayes factor as "extreme" (BF > 100), "very strong" (30 < BF < 100), "strong" (10 < BF < 30), "moderate" (3 < BF < 10), "anecdotal" (1 < BF < 3), or "none" (BF = 1). Bayes factors, using the Jeffreys–Zellner–Siow default prior (JZS) with the r-scale parameter set to 0.707, were calculated online from: http://pcl.missouri.edu/bayesfactor (Rouder, Speckman, Sun, Morey & Iverson, 2009).

RESULTS

Statistical procedures and initial analyses

To control for the effect of random and fixed factors on outcome variables, we conducted linear mixed model (LMM) analyses. In our analysis of coded behavior in free tasks, participant was included as a random factor (to control for the inclusion of multiple test sessions per individual); age, gender, condition (cooperative and competitive board games) as fixed factors; and interference control and social values (in our analysis of competitive behavior) as a covariate. The same applied to the analysis of helpful choices in structured tasks, but in this analysis, pre-test social values task scores was also added as a covariate; this pre-test task was intended to control for individual variation in competitive behavior. One separate model was created for each outcome variable (i.e., each of the four behaviors in our free tasks and proportion of helpful choices in the structured tasks). Differences between the two conditions regarding dependent variables were additionally investigated by conducting independent samples *t*-tests of participants' mean values across tasks, reporting *p*-values and Bayes factors. Furthermore, in order to explore enjoyment of board games (transformed variable) and how it was moderated by game outcome (i.e., wins/losses) we conducted a LMM analysis and investigated the main effects of condition, game and game outcome as fixed factors and the interaction effect of condition and game outcome. Participant was included as a random factor.

The effect of condition

We predicted that children who played cooperative board games, in comparison to children who played competitive board games, would behave more cooperatively and prosocially and less competitive and antisocially in subsequent behavioral tasks. The results from the LMM analyses showed that condition was a significant predictor for competitive behavior ($F_{1,5}$ = 4.91, p = 0.028) with children competing more after playing competitive board games (β = 0.42, 95% CI for beta [0.04, 0.79]). Condition was not a significant predictor for cooperative behavior (p = 0.681, β = −0.09, 95% CI for beta [−0.56, 0.37]), prosocial behavior (p = 0.844, β = 0.04, 95% CI for beta [−0.36, 0.45]), antisocial behavior (p = 0.862, β = 0.04, 95% CI for beta [−0.43, 0.52]) or helping choices (p = 0.476, β = −0.05, 95% CI for beta [−0.22, 0.10]). However, we found a gender difference in prosocial behavior ($F_{1,4}$ = 4.67, p = 0.032) in which girls behaved more prosocially in our tasks (β = 0.47, p = 0.032, 95% CI for beta [0.04, 0.91]). Interference control and social values did not have an effect on measured behaviors.

Several non-significant results were obtained from the LMM analyses; we therefore estimated Bayes factors in an attempt to measure the strength of evidence for the null results using simple *t*-tests. Again we obtained a significant difference in competitive behavior (transformed variable) between the two conditions, *t*

Table 1. *Descriptive statistics, effect sizes (Cohen's d), t-values, p-values and Bayes factors for dependent variables, separated by conditions*

	Cooperative games			Competitive games			Difference			
Measures/scale	*n*	*M*	*SD*	*n*	*M*	*SD*	*d*	*T(X)*	*p*	BF_{01} (BF_{10})
Behaviors, free tasks										
Cooperative, 0 to 5	31	2.38	1.03	29	2.44	0.88	0.07	T(58) = 0.27	0.783	3.69 (0.27)
Prosocial, 0 to 5	31	1.58	1.04	29	1.69	0.58	0.12	T(58) = 0.48	0.632	3.45 (0.29)
Competitive, 0 to 5	31	0.66	0.70	29	1.21	0.84	0.70	T(58) = −2.7	0.009*	0.19 (5.08)
Competitive (transformed), 0 to 5	31	0.18	0.17	29	0.31	0.16	0.77	T(58) = −2.9	0.005*	0.12 (8.61)
Antisocial, 0 to 5	31	1.26	0.92	29	1.51	0.99	0.25	T(58) = 0.97	0.333	2.56 (0.39)
Helpful choices, structured tasks										
Distribution (mean proportion)	30	0.51	0.19	24	0.47	0.16	−0.20	T(52) = −0.72	0.473	2.92 (0.34)
Distribution (mean proportion, transformed)	30	0.56	0.27	24	0.50	0.19	0.24	T(52) = 0.87	0.389	2.65 (0.38)

Note: *p < 0.05.

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(58) = 2.94, $p = 0.005$, and a moderate $BF_{10} = 8.61$ in support for a difference; cooperative board-gaming ($M = 0.187$, $SD = 0.176$, 95% CI [0.12, 0.25]) and competitive board-gaming ($M = 0.315$, $SD = 0.161$, 95% CI [0.25, 0.37]). No significant difference was obtained between the two conditions regarding cooperative ($p = 0.783$), prosocial ($p = 0.632$) and antisocial behavior ($p = 0.333$), or helpful choices (transformed variable) ($p = 0.389$). The BF_{01} for the differences between these measures provided anecdotal to moderate support for H_0 with BF_{01} ranging from 2.56–3.69 (see Table 1).

The LMM analysis of enjoyment of games revealed a significant main effect of condition ($F_{1,8} = 5.24$, $p = 0.023$), game outcome ($F_{1,8} = 16.6$, $p = 0.000$) and a significant interaction between condition and game outcome ($F_{1,8} = 6.06$, $p = 0.014$) (see Fig. 2). Which board game participants played did not have an effect on enjoyment ($F_{5,8} = 0.92$, $p = 0.467$). Note that in cooperative games, all children either win or lose a game bout together.

DISCUSSION

The aim of this study was to investigate the behavioral effects of cooperative and competitive board games. We predicted that children who played cooperative board games, in comparison to children who played competitive board games, would behave more cooperatively and prosocially and less competitive and antisocially in subsequent behavioral tasks. We also explored enjoyment of cooperative and competitive board games and if enjoyment differed according to whether the game is won or lost.

In contrast to our predictions, children displayed similar amounts of cooperative and prosocial behaviors across conditions (cooperative vs competitive board games). Lack of difference between conditions could potentially reflect multiple types of difficulty in detecting generalization effects (Abikoff, 2009; Beach, 1999; Carruthers *et al*., 2020; Chandler *et al*., 1992; Packer, 2001). For example, it could be that the game learning and test situations are not perceived as sufficiently similar for any acquired role or event schemas to transfer.

In this study, children were rated by teachers as high on cooperative and prosocial behavior, which indicates that our participants were probably relatively skilled cooperators and predominantly prosocially oriented prior to board gaming. Thus,

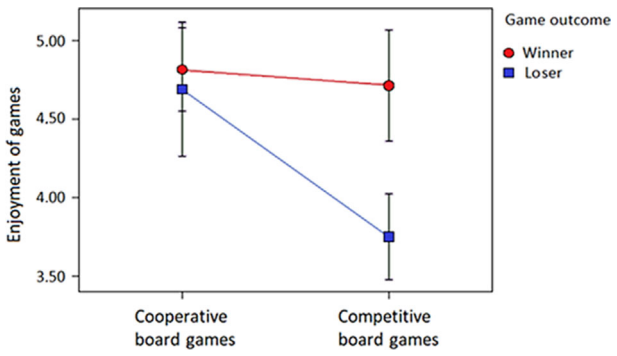

Fig. 2. Estimated means for enjoyment of games (non-transformed) between conditions moderated by game outcome, including 95% confidence intervals. [Colour figure can be viewed at wileyonlinelibrary.com]

the lack of difference between conditions in cooperative and prosocial behavior could also be due to ceiling effects in our sample. However, even though ceiling effects could explain why cooperative games do not promote cooperation, to explain the failure of competitive games to reduce cooperation we have to assume that its influence is too weak to generalize outside the game situation. That we could not detect a difference in helping between conditions in our structured game-like tasks further strengthen the notion that generalization may be hard to achieve.

The current findings could also indicate that cooperative and competitive board games are equally efficient at eliciting cooperative and prosocial behaviors in children. That competition may have positive effects (Rosol, 2012; Sheridan & Williams, 2006) and that competitive games include both cooperative and prosocial elements have been noted in previous studies. For example, Kamii and DeVries (1980) argued that competitive games promote cooperation because children have to agree with rules and obey their consequences, as well as taking others' perspective.

This assumption is further supported by the fact that we could not replicate previous findings from Bay-Hinitz *et al.* (1994) suggesting that competitive board gaming leads to more aggression in preschoolers and that competitive board games impedes cooperation. Instead, our results were in line with Zan and Hildebrandt (2003) who showed that first graders were not more aggressive during competitive board gaming. In their study, they hypothesized that groups of children (i.e., classes) that are more cooperative prior to board gaming may be less prone to display aggressive behavior while playing competitive board games. This hypothesis, that a cooperative nature works as an "immune system" to displaying aggressive behavior in a group of children, could very well apply to our results, since our sample of children were rated by teachers as high on both cooperative and prosocial behavior prior to board gaming.

Zan and Hildebrandt (2003) argued that while competitive games can trigger conflicts, which in turn can increase antisocial behavior; these conflicts can also lead to more negotiation. Thus, they coded negotiation strategies on different levels regardless of whether the negotiation took place during cooperative or competitive board gaming. In our study, however, cooperation that had a competitive common goal (e.g., creating alliances) or negotiations and prosocial behaviors with competitive motives (e.g., trying to persuade others to help one to win, or help others to win with the expectation to receive reciprocal help) were not differentiated from non-competitive cooperation, negotiation or prosocial behaviors. That strategical prosocial behavior can be mistaken for prosocial behavior motivated by other-regarding concern has been demonstrated in previous studies. For example, Kenward, Hellmer, Söderström-Winter and Eriksson (2015) showed that four-year-olds who behaved prosocially in a strategical manner by favoring a "rich" experimenter in a candy sharing game, did not spontaneously help a "poor" experimenter in need when the experimenters left the room. Future studies should thus consider investigating competitive forms of cooperative and prosocial behaviors more carefully.

Our results also suggested that children competed more after playing competitive board games, implying that type of board game had an impact on preschoolers' competitive behavior in our

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subsequent behavioral tasks. ICC for double-coded target behaviors were high, except for competition, which had poor reliability. This naturally raises a question to whether the difference between conditions in competitive behavior is reliable. In addition, Bayes factors from the *t*-test based on the difference between the average scores from the two conditions, provided only moderate support for an actual difference. Competitive behavior was a quite rare event in our double-coded sample, which could explain why the ICC for competitive behavior was low.

Additionally, but not part of our initial predictions, our results suggest that girls were more prosocial than boys in our behavioral tasks. Studies have investigated the impact of gender on prosocial behavior and the mediating links to other socio-cognitive skills in preschoolers (Wan, Fu & Tanenhaus, 2018), primary school children (Longobardi, Spataro & Rossi-Arnaud, 2019), and adolescences (Van der Graaff, Carlo, Crocetti, Koot & Branje, 2018). Our result may potentially contribute to the field by adding more knowledge about gender differences in prosocial behavior during other-oriented behavioral tasks.

We also explored enjoyment of cooperative and competitive board games and if enjoyment differed according to whether the game was won or lost. Our results showed that children enjoyed playing cooperative board games more than competitive board games, regardless of whether the games were won or lost, and that they enjoyed competitive board games less if the game was lost. This is in line with previous studies showing that children enjoy cooperative games more than competitive games and that children are sensitive to wins and losses (Orlick, 1981). The reduction in enjoyment that results from losing a game is lessened when the whole group loses together, and this is probably why cooperative games are overall more enjoyable.

Overall, our results indicate that children may benefit socially from playing both cooperative and competitive board games, but that children enjoy playing cooperative board games more than competitive board games. Practical implications from these findings could be that educators use cooperative board games to promote a positive social climate in preschool peer groups.

CONCLUSION

Little is known about the effects of traditional board games on children's social behavior outside the game situation. In this study, we investigated the behavioral effects of cooperative and competitive board games in preschoolers. Our results showed that which type of board game children played had an effect on their competitive behavior, but in contrast to our predictions, type of board game did not have an effect on cooperative, prosocial or antisocial behavior. However, children enjoyed playing cooperative board games more than competitive board games.

From these results, we draw the conclusion that the effects on measured behaviors of cooperative board games are weak, at least in a sample of children who already are cooperative and prosocially oriented. We could not replicate previous findings that competitive board games make children more aggressive, in fact, children displayed similar high amounts of cooperative and prosocial behavior across conditions, which indicates that children benefit socially from playing both types of board game. The benefits of cooperative board games may be primarily that children enjoy them more.

The data that support the findings of this study are available from the corresponding author upon reasonable request. We thank all the participating preschools, children and teachers for their cooperation and research assistants and students Irma Lejlic and Eva Lundgren for their exceptional work efforts. This work was supported by the Swedish Research Council (Vetenskapsrådet) Grant 241-2011-1785 and the European Research Council Grant StGCACTUS-312292.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Supplementary Material

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