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First and Second-Order Theory of Mind as Predictors of Cooperative Behaviors in Preschool and School Children

Teoría de la Mente de Primer y Segundo Orden como Predictores de Conductas Cooperativas en Niños Preescolares y Escolares

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Prosocial behavior in childhood has been widely studied over the last decades. However, the cognitive processes underlying the development of these behaviors and how children understand each other are still not entirely clear. The concept of Theory of Mind (ToM) has become particularly relevant in the study of the development of social abilities in childhood. In this study, we hypothesize that the cognitive processes of first and second-order ToM are able to predict prosocial behaviors in a differentiated manner. A total of 40 children aged 3 to 7 years old (M = 5.075; SD = 1.248) were evaluated on different tasks to measure both ToM skills, as well as prosocial behaviors such as helping (Instrumental Help; IH) and cooperating (measured through Cooperative Problem Solving and Cooperative Gaming; CPS & CG respectively). Cooperative behavior-related tasks were performed under two conditions: Firstly, a condition of General Behavior (GB) where the task was performed normally. Then, a condition that included an Interruption Period (IP) where the task was abruptly interrupted to assess if the prosocial behavior was resumed autonomously by the child. Our findings enable us to propose a potential framework where first-order ToM predicts basic helping behaviors, while second-order ToM predicts more complex cooperative behaviors. These results also demonstrate that first and second-order ToM skills can differentially predict the complexity of children's prosocial behavior and that helping and cooperative behaviors could be regulated by differential processes.

Keywords: theory of mind, prosocial behavior, instrumental help, cooperative behavior

El comportamiento prosocial en la infancia ha sido ampliamente estudiado durante las últimas décadas. Sin embargo, los procesos cognitivos que subyacen al desarrollo de este comportamiento aún no están del todo claros. El concepto de Teoría de la Mente (ToM) se ha vuelto relevante en el estudio del desarrollo de las habilidades sociales en la infancia. En este estudio, hipotetizamos que los procesos cognitivos de ToM de Primer y Segundo orden son capaces de predecir comportamientos prosociales en niños de manera diferenciada. Un total de 40 niños de 3 a 7 años (M = 5,075; DE = 1,248) fueron evaluados en diferentes tareas para medir tanto las habilidades de ToM como las conductas prosociales de ayudar (Ayuda Instrumental; IH) y cooperar (medido a través de la Resolución Cooperativa de Problemas y Juego Cooperativo; CPS y CG respectivamente). Las tareas de conducta cooperativa se realizaron bajo dos condiciones: una de Comportamiento General (GB) donde la tarea se realizó normalmente, y una condición que incluía un Período de Interrupción (IP) donde la tarea se interrumpía abruptamente, y esta podía ser reiniciada nuevamente. Nuestros hallazgos nos permiten proponer un marco donde las habilidades de ToM de primer orden predicen conductas básicas de ayuda, mientras que las de segundo orden predicen conductas cooperativas más complejas. Estos resultados también demuestran que las habilidades de ToM pueden predecir de manera diferencial la complejidad del comportamiento prosocial de los niños, y que la conducta de ayuda y cooperación podrían estar reguladas por procesos diferenciales.

Palabras clave: teoría de la mente, comportamiento prosocial, ayuda instrumental, comportamiento cooperativo

The origins and development of human prosocial behavior have long been a focus of social, cognitive, and developmental psychology research. This interest has been concentrated on early childhood, as it appears that mechanisms such as empathy and gratitude are beginning to develop at this age (Roth-Hanania et al., 2011). Generally, prosocial behavior is defined as behavior that benefits others, whether they are individuals or groups. However, any action taken in collaboration with others with the intention of achieving a common goal and mutual benefit is also considered pro-social (Hamann et al., 2012; Olivar, 1998). Pro-social behavior

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is characterized by the fact that it emerges as a result of social interaction that promotes a bond of positive reciprocity between those involved (Padilla-Walker & Fraser, 2014). Humans have been shown to be capable of detecting and responding prosocially to the needs and requirements of others in a variety of situations (Dunfield et al., 2011; Taylor & Signal, 2005; Warneken & Tomasello, 2009).

Prosocial behavior manifests itself in a variety of ways, including help, sharing, cooperation, and comfort (Eisenberg-Berg & Hand, 1979). Collaborative behaviors are primarily concerned with two of these dimensions: helping and cooperating. Helping is typically a physical response of prosocial behavior, also referred to as Instrumental Help (IH) behaviors (e.g., helping someone in the search for an object; bringing food out of reach). On the other hand, cooperation is demonstrated through the use of personal and environmental resources to accomplish a goal or complete an activity shared by members of a group for mutual benefit. Cooperation can be observed in a variety of contexts, including Cooperative Problem Solving (CPS) (e.g., tandem bicycle riding) and Cooperative Gaming (CG) (e.g., jumping rope with two or more people; building with blocks with others) (Garaigordobil, 2008; Warneken & Tomasello, 2007).

While researchers tend to agree on the emergence and development of prosocial behavior in childhood, there are multiple theoretical approaches to its origin (Farrant et al., 2011; Paulus, 2014). Authors like Zahn-Waxler propose that prosocial behavior in children is the result of their cognitive capacity to empathize, comprehend, and collaborate with others (Zahn-Waxler et al., 1992). According to Roessler and Perner (2015), the emergence of prosocial behaviors reflects an understanding of how others behave based on one's own behavior. In this regard, cognitive mechanisms such as mental state representation stimulate and guide social behavior. These cognitive mechanisms are integral to what is referred to as Theory of Mind (ToM) (Baron-Cohen et al., 1985).

ToM is critical for comprehending the cognitive phenomena underlying social interaction, as the capacity of humans and certain primate species to identify, reproduce, recognize, and perceive their own and others' mental states and has been demonstrated to be essential for the study of social behavior. These mental states include, but are not limited to, thoughts, beliefs, knowledge, desires, and intentions (Baron-Cohen, 2001; Premack & Woodruff, 1978; Sylwester et al., 2012). Numerous studies have indicated the existence of a cognitive subsystem of ToM composed of conceptual and inferential support that is responsible for predicting and interpreting human behavior (Happé, 2003; Juillerat et al., 2015; Morales-Bader et al., 2020; Rivière et al., 1994). Prior research indicates that ToM has at least two dimensions: first-order ToM, which is associated with the ability to infer another person's mental states ('I believe that you believe'), and second-order ToM, which is associated with the ability to infer another person's mental states in relation to a third party ('I believe that you believe that someone believes') (Duval et al., 2011; Wimmer & Perner, 1983). While first-order ToM is more fundamental and acquired early in development, second-order ToM develops later and is considered to be more complex in cognitive and meta-representational terms (Morin, 2006).

The study of ToM has been linked to contemporary research on social behavior, demonstrating its role in social cognition and the subsequent development of interactions and collaborative behavior (Waltz et al., 2009). This relationship is not limited to inference, but also to the capacity for prediction and explanation generation within a context (Malle, 2002). The interest with ToM in children's social behavior stems from a similar vein. Beginning at the age of one, children exhibit certain behaviors that indicate an intention to engage in coordinated activity with others. At the age of two, this behavior evolved into the first cooperative activity centered on a common goal (Eckerman et al., 1989; Mueller & Brenner, 1977). Thus, one could argue that the quality of prosocial behavior expression is improving significantly as a result of human development as measured by levels of intentional detection and chronological age (Eisenberg et al., 1987). However, when it comes to explaining prosocial behavior, the ability to detect intentionality should be far more important than simply increasing children's chronological and mental ages (Baron-Cohen et al., 1985).

According to authors such as Frith and Frith (2005), ToM does not fully develop until the age of five. At this age, children can demonstrate a thorough understanding of situations and articulate precisely why others do not share their beliefs. On the other hand, Onishi and Baillargeon (2005) argue that children, even those with limited language skills, can predict the behavior of others based on mental representations. To better understand this, it is necessary to keep in mind that ToM operates in two forms: One that is implicit and other that is explicit. While the implicit function refers to a rapid, unconscious mode of communication that does not require the use or development of verbal skills, the explicit mode of communication is slower and requires a deliberate effort to consider the mental states of others (Apperly & Butterfill, 2009; Clements & Perner, 1994; Heyes & Frith, 2014; van Overwalle & Vandekerckhove, 2013). The latter distinction implies

that ToM is reflected not only in conscious reasoning about the beliefs of others, but also in the capacity of human beings to generate mental representations without explicit intention (Schneider et al., 2015).

Along with the ability to comprehend the intentions of others, this inferential component is a skill that would facilitate the onset of strictly prosocial behavior in early childhood (Imuta et al., 2016). There is evidence of ToM's behavioral impact in studies such as Lalonde and Chandler (1995) and Lonigro et al. (2013), which found that ToM's overall performance was positively associated with the prosocial tendency. These findings emphasize the critical nature of developing ToM-related sociocognitive skills during childhood in order to facilitate the onset of pro-social behaviors. As a result, ToM skills are crucial for collaborative behavior and social competence, acting as a moderator in social interactions (Jenkins & Astington, 2000; O'Connor & Evans, 2019).

In the same vein, studies have found a positive correlation between performance on ToM tasks and the maintenance of positive relationships with family and peers (Meins et al., 2002; Hughes & Dunn, 1997). As a result, it is clear that mental representation and the capacity for accurate interpretation are necessary for the performance of appropriate social behavior (Conte et al., 2018). Thus, the significance of ToM in social behavior is determined not only by cognitive abilities and functions, but also by the way it facilitates social interaction with others (Caputi et al., 2012).

While evidence exists for an association between ToM and prosocial behavior (Imuta et al., 2016), many studies examine ToM as a whole entity, without distinguishing its components or levels of expression. The purpose of this study is to determine whether first and second-order ToM levels are associated with IH and cooperative behavior as measured by CPS and CG. We hypothesize that first-order ToM will be sufficient to predict performance on the IH tasks alone, but that predicting performance on the CPS and CG tasks, due to their increased complexity, will require both first and second-order ToM abilities, with the latter being more important. Given that ToM abilities seem to be at least partially dependent on age, we hypothesize that is the ToM abilities, rather than subjects' chronological ages, which are more closely associated with IH and cooperative behaviors.

Method

To address this hypothesis, we conducted a study with preschool and elementary school children. Their language abilities were assessed first, followed by tasks that assessed ToM and prosocial behavior. Only children with an acceptable level of language were assigned to the ToM and prosocial behavior measurement phases.

Participants

This study enrolled 87 preschool children aged three to seven years old from an urban area in Chile. All measurements were conducted in a Gesell room that was adapted for each experimental phase. Each caregiver received a copy of a previously approved informed consent form from the University's Scientific Ethics Committee. The first phase assessed the language abilities of all 87 participants. Given that the current study required children to demonstrate comprehensive and well-developed language skills, as well as consistency in their responses, a total of 47 children (54.02%) were eventually excluded. This resulted in a final sample of 40 participants (M_{age} = 5.075, SD_{age} = 1.248).

Measures

a) Test for Auditory Comprehension of Language Revised (TACL) Chilean Adaptation

This instrument was originally developed by Elizabeth Carrow (Carrow, 1985). In our study, we used the Chilean adaptation of the TACL (Pávez, 2013), which consists of 41 items for vocabulary, 48 items for morphology, and 12 items for syntax, for a total of 101 items. The test requires the child to listen to auditory stimuli and respond to the identification of a picture on a sheet, making it a fairly straightforward test appropriate for children aged 3 to 10. The test was administered by experimenter number one (E1), and the child's response was recorded by experimenter number two (E2).

b) Modified Sally-Anne Task

This test is a widely used paradigm for assessing humans' ability to detect false beliefs, a necessary condition for ToM (Carlson et al., 2005; Lind & Bowler, 2009; Brambring & Asbrock, 2010; Scott et al., 2012; Wang et al., 2014; Grueneisen et al., 2015). This task for determining explicit first-order ToM involved a modification of Baron-Cohen et al. (1985)'s original 'Sally-Anne' scheme. The explicit second-order ToM task was modeled after one conducted by Núñez Bernardos (1993). Both assess the child's response, which may be verbal or nonverbal, such as a finger pointing to the target location.

c) Violation of Expectation (VOE)

This task is an adaptation of the experiments conducted by He et al. (2011). It has the ability to measure implicit ToM through the understanding of false beliefs. The test is made up of four different conditions: false belief, knowledge, ignorance, and a second-order false belief, which are assessed by two experimenters (E1 and E2). In order to verify whether the child has developed ToM skills, the eyes of the child are examined under various conditions by measuring the direction in which children look more closely and for a longer period of time when a transgression of their expectations occurs.

d) Instrumental Help Task

This task is used to assess Instrumental Help (IH). It consists of six replications of Warneken and Tomasello (2007)'s original experiments for assessing IH. The experiments are called 'clothespin', 'marker', 'paper ball', 'flap', 'books' and 'cabinet'. Each task includes an experimental and a control condition, as well as a variety of tests. For all tasks, the assessment is made on the child's behavior in response to the experimenter's actions

e) Instrumental Cooperation Task

This task consists of two experiments designed to assess children's cooperative behavior. The first one corresponds to the Cooperative Problem Solving (CPS) task referred to as 'tube with handles.' The objective of this task is to retrieve a toy concealed inside a two-part tube. The tube containing the toy is 110 cm long and is contained within a slightly wider tube. Each component includes a handle at the end. The second is a Cooperative Game (CG) task referred to as a 'trampoline'. The objective is to interact with a structure composed of two hoses connected in a circular shape. These are clothed and used as a small trampoline. These tasks have been replicated from those conducted by Warneken et al. (2006), and Warneken and Tomasello (2007). Both tests were performed under two conditions: a General Behavior Period (GB) and an Interruption Period (IP). The experimenter undertakes the test normally in the GB condition. If the child is capable of completing the task properly, it is considered successful. In the IP condition, the experimenter pauses the task in the hope that the child can resume it. If the child is able to return to the task voluntarily and perform it properly, it is considered successful.

Procedure

The tasks were assigned to two experimenters (E1 & E2) per child. E1 was primarily responsible for administering the tests, while E2 was responsible for scoring, filming, and other auxiliary procedures. The first phase involved administering the TACL test. This phase lasted approximately 20 to 30 minutes per child and was used to identify children who perform at or above the national average in expressive and comprehensive language.

The second phase involved the assessment of ToM skills. Implicit ToM was assessed for the preschool group, while explicit ToM was for the children in school. Each child was measured for both first and second-order skills. The VOE test was used to evaluate implicit ToM. For implicit second-order ToM, we developed a fourth task based on its conceptual description. Thus, we measured the children’s second-order abilities using the false belief that a second individual holds about a third individual. Four successful pilots were conducted to ensure that the test was operating properly. The modified Sally-Anne task was used to determine the explicit ToM. The children underwent a familiarization phase and a testing phase for both first and second-order abilities. E1 ensures that the child remembers the name of each object used in the task during the familiarization trial using a game described in the Familiarization Game Protocol (Appendix).

In the testing phase for first-order ToM, E1 tells a story to the child about the bear and the pig. The bear and the pig are depicted in the story playing with a ball. The bear becomes exhausted, stuffs the ball into a chest, and exits the scene. While the bear is gone, the pig retrieves the ball from the chest and conceals it in a box. When the bear reappears, E1 introduces the first-order critical question, "Where does the bear think his ball is?" along with two control questions about the actual location of the ball and its initial location. The child is expected to point to the chest in response to the critical question. E1 tells a slightly different version of the story during the testing phase for second-order ToM. The bear and the pig are playing with a ball. When the bear becomes tired, he stows the ball in his chest and exits the scene but continues to watch without attracting the pig's attention. The pig then extracts the ball from the chest and conceals it in a box. Then, when the bear returns, E1 introduces the second-order critical question: "Where does the pig think the bear will go looking for his ball?"

Six tasks based on situations involving a specific object were used to assess IH abilities: a clothes hanger, a marker, paper balls, a box cover, some books, and a cabinet. Each task was assigned a unique experimental and control condition. The six tasks in experimental conditions were based on a situation in which E1 implicitly required the child to perform an IH behavior. The same situation occurred in the control conditions, but there was no implicit or explicit requirement for assistance. CPS was assessed using a task that required the use of a tube with handles. The tube, which contained a toy, could only be opened by simultaneously pulling both handles on both ends. The tube is long enough so that it is physically impossible for a child to do it alone.

The tube task is first demonstrated by E1 and E2, releasing an object (bell) inside the tube by opening the tube by pulling the handles. The task has four trials. In the first two trials, E1 picks up one of the ends of the tube by the handle while the other is on the ground. E1 implicitly invites the child to participate. If the child does not start the task in the first 30 seconds, then E1 explicitly invites the child to participate by vocalizing “the handle”. The trials are successful if the child cooperates with E1 by lifting the other half of the tube and pulling the handle to open it, releasing the bell inside. The last two trials are variations of the first two trials which include an Interruption Period. In these trials, E1 lets the tube fall when the child takes the handle. E1 then puts their hands on the ground for 15 seconds. After this period, E1 will try to resume the task. The trials are successful if the child resumes the cooperative behavior by lifting the other half of the tube and pulling the handle to open it, releasing the bell inside.

E1 and E2 demonstrate the CPS task by releasing an object (bell) inside the tube and pulling the handles. The task consists of four trials. E1 picks up one of the tube ends by the handle in the first two trials, leaving the other on the ground. E1 implicitly invites the child to participate. If the child does not initiate the task within the first 30 seconds, E1 invites the child to participate explicitly by vocalizing "the handle". The trials are successful if the child assists E1 by lifting the other half of the tube and pulling the handle to open it, thereby releasing the bell inside. The final two trials are variants of the first two, incorporating the Interruption Period condition. In these trials, E1 allows the tube to fall during these trials when the child grasps the handle. Then, for 15 seconds, E1 places their hands on the ground. Following this time period, E1 will attempt to resume the task. The trials are considered successful if the child resumes the cooperative behavior by lifting the other half of the tube and pulling the handle to open it, thereby releasing the bell inside.

Results

Based on the sample size and the nature of the data, nonparametric tests such as Mann-Whitney’s U (*U*), Wilcoxon (*W*) as well as Ordinal Logistic Regression (OLR) were used. Data analysis was performed using IBM SPSS Statistics v26.

Performance in prosocial behavior tasks

Table 1 shows the descriptive statistics for preschool and school children. First, we tested the difference between the two main conditions for cooperative behaviors: General Behavior (GB) and the Interruption Period (IP) through a Wilcoxon test for paired samples. Results show significant differences between the two conditions for all variables ($p < .05$). Effect size and power analysis are detailed for every test in Table 2.

Table 1
Descriptive Statistics for Preschool and School Children

Variable	Preschool (n = 25)		School (n = 15)	
	M	*SD*	*M*	*SD*
Age	4.200	0.792	6.400	0.507
IH	1.760	1.012	1.930	0.961
CPS_{GB}	2.240	0.969	2.533	0.639
CPS_{IP}	1.440	1.044	1.400	0.737
CG_{GB}	2.280	1.061	2.267	1.033
CG_{IP}	1.280	1.100	1.400	1.056

Note. IH = instrumental help; CPS = cooperative problem solving; CG = cooperative gaming; GB = general behavior condition; IP = interruption period condition.

Table 2
Wilcoxon Test for Paired Samples

Condition		General Behavior			Interruption Period			Wilcoxon Test			
		M	*SD*	*Mdn*	*M*	*SD*	*Mdn*	*Z*	*p*	*ES*	1-ß
CPS	Preschool	2.240	0.969	3	1.440	1.044	1	-2.723	.006	.545	.842
	School	2.533	0.639	3	1.400	0.737	1	-2.859	.004	.738	.858
CG	Preschool	2.280	1.061	3	1.280	1.100	1	-3.344	.001	.669	.945
	School	2.267	1.033	3	1.400	1.056	2	-2.653	.008	.685	.810

Note. CPS = cooperative problem solving; CG = cooperative gaming; ES = effect size; 1-ß = statistical power.

Differences between preschool and school children were determined using the Mann-Whitney U test for independent samples. Results show that there were no significant differences between preschool and school children in terms of their instrumental help and cooperative behaviors ($p > .48$; see Table 3).

Table 3
Mann-Whitney U Test for Independent Samples

Condition		Preschool			School			Mann-Whitney Test	
		M	SD	Mdn	M	SD	Mdn	*U*	*p*
IH		1.760	1.012	2	1.933	0.961	2	206.000	.619
CPS	General Behavior	2.240	0.969	3	2.533	0.639	3	212.000	.489
	Interruption Period	1.440	1.044	1	1.400	0.737	1	186.000	.978
CG	General Behavior	2.280	1.061	3	2.267	1.033	3	186.000	.978
	Interruption Period	1.280	1.100	1	1.400	1.056	2	200.500	.720

Note. IH = instrumental help; CPS = cooperative problem solving; CG = cooperative gaming.

Consequently, the association between preschool and school children and their ToM abilities was assessed using Chi-square test. The results show that there was no association between school grade and ToM development for both first ($\chi^2 = 1.307$, $p = .253$) and second-order ToM ($\chi^2 = 0.96$, $p = .327$).

Biserial correlation analysis

Given that ToM$_{FO}$ and ToM$_{SO}$ are dichotomized (1 = *sufficiently developed*; 0 = *not sufficiently developed*) their relationship with the rest of the variables is tested through a biserial correlation analysis. The results of the zero-order biserial correlations show a significant relationship between ToM$_{FO}$ and Instrumental Help behaviors (r_b = .573; p < .001, see Table 4), and between ToM$_{SO}$ and Cooperative Game behaviors, both in the General Behavior (r_b = .415; p = .008) and the Interruption Period (r_b = .449; p = .004) conditions. To assess the potential effect of age, partial correlations were also performed. However, the overall results of the analysis did not change after controlling for the participants' age.

Table 4
Zero-Order and Partial Biserial Correlation Matrix

Variable		Zero-order r_b		Partial r_b controlling for age	
		ToM$_{FO}$	ToM$_{SO}$	ToM$_{FO}$	ToM$_{SO}$
Age	r_b	.246	.330		
	p	.125	.038		
	1-ß	-	.577		
IH	r_b	.573	.232	.565	.208
	p	< .001	.151	< .001	.205
	1-ß	.990	-	.988	-
CPS$_{GB}$	r_b	.172	.059	.120	-.039
	p	.287	.719	.466	.815
	1-ß	-	-	-	-
CPS$_{IP}$	r_b	.270	.190	.253	.161
	p	.091	.239	.121	.328
	1-ß	-	-	-	-
CG$_{GB}$	r_b	.113	.415	.091	.399
	p	.488	.008	.581	.012
	1-ß	-	.802	-	.764
CG$_{IP}$	r_b	.063	.449	.015	.404
	p	.700	.004	.929	.011
	1-ß	-	.872	-	.777

Note. ToM = theory of mind; FO = first-order skills; SO = second-order skills; IH = instrumental help; CPS = cooperative problem solving; CG = cooperative gaming; GB = general behavior condition; IP = interruption period condition; r_b = biserial correlation coefficient; 1-ß = statistical power.

These results show that, as we hypothesized, there seems to be a specific relationship between first-order ToM and IH behaviors, and between second-order ToM and more advanced cooperative behaviors such as Cooperative Game in both conditions. These relationships were significant even after controlling the effect of participants' age.

The potential ability of first and second-order ToM to predict Instrumental Help and Cooperative Game behaviors on both conditions was tested through Ordinal Logistic Regression (OLR) analyses. Both ToM levels were entered as predictors (see Tables 5 and 6). For Instrumental Help behaviors the model was able to predict 31 % of its variance ($R^2_{Nagelkerke}$ = .310; *-2logV* = 20.887; χ^2 = 13.371; p = .001), where first-order ToM was the only significant predictor (B = -3.240; *SE* = 1.047; *Wald* = 9.574; p = .002). For Cooperative Game behaviors during the General Behavior condition, the model was able to predict 20.1% of its variance ($R^2_{Nagelkerke}$ = .201; *-2logV* = 21.456; χ^2 = 7.880; p = .019), where second-order ToM was the only significant predictor (B = -1.886; *SE* = .730; *Wald* = 6.672; p = .010). Likewise, for Cooperative Game behaviors during the Interruption Period condition the model was able to predict 22.6% of its variance, and second-order ToM

was the only significant predictor (B = -2.004; SE = .687; $Wald$ = 8.513; p = .004). All three models performed well on goodness of fit test (p > .05).

Table 5
Ordinal Logistic Regression Models for Instrumental Help and Cooperative Game

Condition	Model summary				Goodness of fit		Test of parallel lines	
	-2*logV*	$R^2_{Nagelkerke}$	X^2	p	X^2_{GF}	p_{GF}	X^2_{PL}	p_{PL}
IH	20.887	.310	13.371	.001	2.370	.937	1.832	.767
CG_{GB}	21.456	.201	7.880	.019	2.521	.925	5.370	.251
CG_{IP}	24.610	.226	9.343	.009	6.620	.470	24.610	< .001

Note. IH = instrumental help; CPS = cooperative problem solving; CG = cooperative gaming; GB = general behavior condition; IP = interruption period condition; GF = goodness of fit test; PL = test of parallel lines.

Table 6
Ordinal Logistic Regression Models for Instrumental Help and Cooperative Game

Condition		B	SE	Wald	p	CI (95 %)	
						Lower	Upper
IH	ToM_{FO} (0)	-3.240	1.047	9.574	.002	-5.292	-1.187
	ToM_{SO} (0)	-0.365	0.636	0.330	.566	-1.611	0.881
CG_{GB}	ToM_{FO} (0)	0.083	0.883	0.009	.925	-1.647	1.814
	ToM_{SO} (0)	-1.886	0.730	6.672	.010	-3.318	-0.455
CG_{IP}	ToM_{FO} (0)	0.503	0.864	0.339	.561	1.190	2.195
	ToM_{SO} (0)	-2.004	0.687	8.513	.004	-3.350	-0.658

Note. ToM = theory of mind; FO = first-order skills; SO = second-order skills; IH = instrumental help; CPS = cooperative problem solving; CG = cooperative gaming; GB = general behavior condition; IP = interruption period condition.

These results allow us to conclude that first and second-order ToM were differentially associated with cooperative behaviors in both preschool and school children. While first-order ToM development was able to predict the occurrence of Instrumental Help, second-order ToM predicted the ability to resume Cooperative Game behaviors after an Interruption Period.

Discussion

The purpose of this study was to assess the ability of first and second-order ToM to predict prosocial behavior, as measured by participants' performance on Instrumental Help (IH), Cooperative Problem Solving (CPS), and Cooperative Game (CG) tasks (Warneken & Tomasello, 2007). The children who participated in these tasks ranged in age from three to seven years. We discovered that first and second-order ToM were capable of discriminating between performance on Instrumental Help and cooperative behaviors (as expressed through Cooperative Gaming). This provides a preliminary framework for understanding the effect of ToM-related cognitive processes on the development of prosocial behaviors, where children's performance on Instrumental Help tasks increases in direct proportion to their first-order ToM skills, whereas second-order ToM skills are associated with the ability to engage autonomously in Cooperative Games.

Additionally, our findings indicate that the preschool group has a relatively developed first-order ToM. These findings corroborate those of He et al. (2011), who found that 2.5-year-old children possessed basic first-order ToM abilities. While the development of first-order ToM skills was relatively consistent across children in the preschool and school groups, the development of second-order ToM skills appears to have a positive relationship with age, implying some degree of development over time. Additionally, we discovered

that children generally perform worse on second-order ToM tasks than on first-order tasks. This is primarily due to the difference in the complexity of the two tasks, with second-order ToM implying a greater degree of representational difficulty (Núñez Bernardos, 1993). Second-order ToM is particularly relevant to the study of prosocial behavior because it enables the interpretation of reality through an understanding of communicative interactions and social decision-making (Hsu & Cheung, 2013; Verbrugge et al., 2018).

Concerning our primary findings, it is critical to note that first and second-order ToM can predict pro-social behavior even after adjusting for the potential effect of participants' age. These results suggest that both components function relatively in an independent manner, at least in terms of their interactions with prosocial behavior and possibly with social behavior in general. Previously published research has established that second-order ToM develops later and independently of first-order ToM, even in children aged 6 and over (Gregory et al., 2002; Perner & Wimmer, 1985). As a result of this research, we have evidence that the development of first and second-order ToM skills can predict Instrumental Help and Cooperative Gaming behaviors. Additionally, we present empirical evidence that these two dimensions of ToM are differentially associated with these prosocial behaviors. Furthermore, we demonstrate that it is not chronological age, but rather well-developed ToM skills that predict performance in pro-social behaviors such as Instrumental Help and Cooperative Gaming.

The importance of studying the development of pro-social behaviors is particularly high in children, as socio-cognitive abilities such as ToM skills typically develop rapidly during early childhood. Because this ability is linked to the concept of social behavior, it has been associated with increased adaptability and academic performance in adulthood (Ladd, 1999; Parker & Asher, 1987; Waltz et al., 2009). It is critical to understand that humans have a natural tendency to assist one another, which scholars believe has contributed to the persistence of cooperative societies (Yamamoto et al., 2009, 2012). Humans have been noted to have a distinct cognition from other animals, owing primarily to their ability to form collaborative relationships with those around them, rather than to their superior intellectual capacities (Tomasello, 1999; Tomasello et al., 1993, 2005).

Prosocial behavior and the capacity to discern intentions are components of what is known as cultural transmission (Tomasello, 1999). This cultural transmission would enable a person born into a community to be equipped with a set of physical and symbolic tools necessary to operate within it. To ensure effective cultural transmission, the child must be willing to engage in social contact. For instance, the child should be able to follow others' gazes, initiate eye contact, imitate their behavior, and fundamentally detect their intentions. As a result, the child should be capable of assisting, cooperating with, and comforting others. We discovered that prosocial behavior is associated with the capacity to detect mental states. However, first-order ToM skills are more closely related to more basic behaviors such as Instrumental Help, whereas second-order ToM skills are capable of predicting more complex cognitively demanding behaviors such as Cooperative Gaming.

Our findings indicate that prosocial behavior appears to be associated with the development of ToM skills. In other scenarios, this relationship appears to be extremely frail or non-existent. Second, it may be prudent to be cautious when asserting that developing ToM skills is a necessary condition for the deployment of prosocial behaviors. Correspondingly, it is possible that ToM skills are required only in certain contexts of social behavior, whereas in other contexts additional skills are needed, such as when information is limited or ambiguous (Toloza-Muñoz et al., 2020). This study has a significant limitation in terms of sample size. This smaller sample size, however, is the result of a rigorous screening process that eliminated a significant number of children who did not meet the minimum requirements for expressive or comprehensive language. In that sense, these findings are only applicable to children with adequate language skills. However, even with a significantly smaller sample size, these findings shed light on how associations might be if a larger sample size of children was studied.

To summarize, this study established that ToM abilities are differentially associated with prosocial behaviors. Children with more developed first-order ToM skills are more likely to engage in prosocial behaviors such as assisting others with simple tasks, whereas children with more developed second-order ToM skills are more likely to engage in cooperative activities. While age was associated with second-order ToM abilities, it was not a significant predictor of either helping or collaborative behaviors. There have been few studies examining the nature of the relationship between first and second-order ToM and prosocial behavior. Future research should examine whether these specific relationships persist in other contexts or

groups, as well as to determine the association between first and second-order ToM and more complex forms of prosocial behavior, such as sharing and comforting.

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Appendix

Familiarization Game Protocol

The first and second-order explicit Theory of Mind (ToM) tasks require the experimenter (E1) to carry out a familiarization trial with the child. This familiarization trial involves playing a game. At least two games are required: One for measuring first-order ToM and other for second-order ToM.

The aim of these games is for the children to learn and remember the names of all the objects involved in the task. E1 is expected to say at least twice the name of each object and then ask the child to remember them. Once the child has memorized them well, the familiarization trial can be concluded.

If the child does not get the names of the objects right on the first attempt, E1 should continue with the familiarization trial by playing the same game again or trying another game included in this protocol.

Below are three familiarization game scripts that experimenters can use with participants: 'Hide and seek', 'Simon says', and 'Guessing'.

1. Hide and seek script

- E1 (friendly): We're going to play a very fun game. It's called "Hide and seek", do you know it? I have several toys on the table. This one is the pig (shows it), and this one is the bear (shows it). I also have this chest, the box and the ball (shows all the mentioned elements one by one).
- E1: Which animal would you like to be for this game? (Waits for the child's answer). Oh, good! Then I'll be ___ (chooses the other animal available).
- E1: This game goes like this: Your animal, the ___ (child's animal) has to face the wall and count to 10. Meanwhile, my animal, the ___ (E1's animal) hides. Your animal must come out and find my animal. When your animal finds mine, it must say "1, 2, 3, I caught the ___ (E1's animal) that is hidden behind the ___ (this element can be the chest, the box or the ball)".

E1 makes an example of the game for the child to understand.

- E1: Did you understand how to play this game? Do you have any doubts on how to play? (If the child has any questions, E1 answers them until the instructions are clear).
- E1: Well, let's start the game!
- E1 (playing): Now, ___ (child's animal). Count to 10 while I hide.

E1 proceeds to hide the (E1's animal) behind one of the elements (chest/box/ball) and encourages the child to find it.

If the child doesn't say "1, 2, 3, I caught the ___ (E1's animal) that is hidden behind the ___ (chest/box/ball)", E1 can reinforce it and then correct it like this:

- E1: All right, you found me! You're doing it very well, but remember that you have to say to me "1, 2, 3, I caught the ___ (E1's animal) that is hidden behind the ___ (chest/box/ball).
- E1 (playing): Now it's the turn of the ___ (child's animal) to hide.

E1 counts to 10 while the child hides his animal, then he goes out to look for it. When he finds it he says "1, 2, 3, I caught the ___ (child's animal) that is hidden behind the ___ (chest/box/ball)"

- E1 (friendly): Did you like this game? It was a lot of fun! Now I need you to return me the toys we used so that we can start the task and you can win a prize.
- E1: Can you hand me the chest, please? (E1 waits for the child to give them the object).

E1 repeats this for all the other elements on the table (pig, bear, box, and ball)

- E1: Okay, now I want you to tell me the name of every single thing we played with. What's this called (points to any of the elements)?

E1 repeats this for all the elements on the table (pig, bear, chest, box, and ball).

If the child gets the names of the objects right, move on to the test phase.

If the child does not get the names of the objects right, E1 should continue with the familiarization trial by playing the same game again or trying another game included in this protocol.

2. Simon says script

- E1 (friendly): We're going to play a very fun game. It's called "Simon says", do you know it? I have several toys on the table. This one is the pig (shows it), and this one is the bear (shows it). I also have this chest, the box and the ball (shows all the mentioned elements one by one).
- E1: Which animal would you like to be for this game? (Waits for the child's answer), Oh, good! Then I'll be ___ (chooses the other animal available).
- E1: The game goes like this: Your animal, the (child's animal) has to do everything my animal (E1's animal) asks. Later, your animal can command my animal to do things.

E1 makes an example of the game for the child to understand.

- E1: Did you understand how to play this game? Do you have any doubts on how to play? (If the child has any questions, E1 answers them until the instructions are clear).
- E1: Well, let's start the game!
- E1 (playing): Now... My animal the (E1's animal) asks your animal the (child's animal) to hide quickly inside the box!

E1 can improvise another Simon says round. The most important thing is that it clearly addresses the elements' names (pig, bear, chest, box and ball).

- E1: Now it's the (child's animal)'s turn to be the boss.

If the child is embarrassed or can't think of an action, E1 retakes the game again by asking the child's animal to do some command involving the elements (pig, bear, chest, box and ball).

- E1 (friendly): Did you like this game? It was a lot of fun! Now I need you to return me the toys we used so that we can start the task and you can win a prize.
- E1: Can you hand me the chest, please? (E1 waits for the child to give them the object).

E1 repeats this for all the other elements on the table (pig, bear, box, and ball)

- E1: Okay, now I want you to tell me the name of every single thing we played with. What's this called (points to any of the elements)?

E1 repeats this for all the elements on the table (pig, bear, chest, box, and ball).

If the child gets the names of the objects right, move on to the test phase.

If the child does not get the names of the objects right, E1 should continue with the familiarization trial by playing the same game again or trying another game included in this protocol.

3. Guessing game script

- E1 (friendly): We're going to play a very fun game. It's called "The guessing game", do you know it? I have several toys on the table. This one is the pig (shows it), and this one is the bear (shows it). I also have this chest, the box and the ball (shows all the mentioned elements one by one)'.
- E1: Which animal would you like to be for this game? (Waits for the child's answer), 'Oh, good! Then I'll be ___ (chooses the other animal available).
- E1: The game goes like this: Your animal, the ___ (child's animal) has to cover his eyes and then guess where my animal, the ___ (E1's animal) hid the ball. Later, your animal the ___ (child's animal) can hide the ball while my animal the ___ (E1's animal) covers his eyes.

E1 makes an example of the game for the child to understand.

- E1: Did you understand how to play this game? Do you have any doubts on how to play? (If the child has any questions, E1 answers them until the instructions are clear).
- E1: Well, let's start the game!
- E1 (playing): Now the ___ (child's animal) must cover its eyes.
- E1: Do you have them covered? Very good! Now the ___ (E1's animal) is hiding the ball very well so the ___ (child's animal) won't find it.

E1 encourages the child to cover his eyes while hiding the ball in the chest or box. Then, E1 asks the child to observe the scene and guess where E1's animal hid the ball.

- E1: Ready! You can open your eyes! Now guess where the ___ (E1's animal) hid the ball.

Once the child finds the ball, E1 can do another round. The most important thing is that it clearly addresses the elements' names (pig, bear, chest, box and ball).

- E1: Now it's the (child's animal)'s turn to hide the ball.

If the child is embarrassed or can't think of where to hid it or how to play, E1 retakes the game again by asking the child to close their eyes and hiding the ball once again.

- E1 (friendly): Did you like this game? It was a lot of fun! Now I need you to return me the toys we used so that we can start the task and you can win a prize.
- E1: Can you hand me the chest, please? (E1 waits for the child to give them the object).

E1 repeats this for all the other elements on the table (pig, bear, box, and ball)

- E1: Okay, now I want you to tell me the name of every single thing we played with. What's this called (points to any of the elements)?

E1 repeats this for all the elements on the table (pig, bear, chest, box, and ball).

If the child gets the names of the objects right, move on to the test phase.

If the child does not get the names of the objects right, E1 should continue with the familiarization trial by playing the same game again or trying another game included in this protocol.

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