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Abstract

Previous research has found a link between theory of mind and cooperation. The aim of this study is to deepen into this relationship, to identify which theory of mind skills are more related to the cooperative ability on a referential communication task. A total of 50 children from first and fifth grade completed a battery of theory of mind tasks, and also a cooperative task where children worked in pairs to build block models. Each pair was composed by a builder and a guide, who gave instructions to his partner about how to build a replica of the model. The results show a significant relationship between the theory of mind skills and cooperation. Specifically, we found that the second-order false-belief task was the variable most related to cooperation after controlling the effect of age. In addition, we observed that the mentalist skills were more important for cooperation in the builders than in the guides. Finally, we discuss the findings of this study and make suggestions for the future.

Keywords: Theory of mind, cooperation, referential communication.

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¿A tu Izquierda o a la Mía? Habilidades Mentalistas Implicadas en la Cooperación

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Resumen

Estudios previos han encontrado una relación entre la teoría de la mente y la cooperación. El objetivo del presente trabajo consiste en profundizar en esta relación, intentando delimitar qué habilidades de TM están más relacionadas con la capacidad cooperativa en una tarea de comunicación referencial. Un total de 50 niños y niñas de primero y quinto de primaria completaron una batería de tareas de teoría de la mente, y también una tarea de cooperación en la que por parejas debían reproducir modelos con piezas de construcción. En cada pareja había un constructor y un guía, quien daba las instrucciones a su compañero para construir una replica del modelo. Los resultados muestran una relación importante entre las habilidades de teoría de la mente y de cooperación. Más específicamente, se halló que la tarea de creencia falsa de segundo orden era la más vinculada con la cooperación, habiendo controlado el efecto de la edad. Además, se observó que las habilidades mentalistas fueron más importantes para la cooperación en los constructores que en los guías. Finalmente, se discuten los hallazgos de este estudio y se plantean futuras líneas de trabajo.

Palabras clave: Teoría de la mente, cooperación, comunicación referencial.

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The ability to cooperate is an essential characteristic of human beings that is present in many of our daily routines. Authors like Tomasello (2009) argue that what makes human culture different is based on a set of specific skills and motivations to cooperate. In education, cooperation has been linked to a form of learning (Dillenbourg, 1999; Johnson & Johnson, 1979) and a teaching methodology which claims that learning is enhanced when students develop cooperative skills (Cabero, 2003). Research on cooperative learning has focused on testing its effectiveness compared to competitive or individualistic learning, showing its potential to boost students' social development and learning level (Arvaja, Salovaara, Häkkinen, & Järvelä, 2007). However, research also indicates that the positive effects of cooperative learning are not achieved spontaneously as a result of assembling the students in groups, but it is necessary to understand the complexity of the interaction process and to study the fundamental mechanisms supporting its effectiveness (Arvaja et al., 2007).

On the other hand, the ability to cooperate has been declared by European authorities as one of the core competencies that any citizen must acquire in order to face the challenges of a globalized world (OECD, 2002). From this viewpoint, cooperation becomes a personal competence and its development a priority, since it is considered an individual capacity that allows people to be successful in teamwork. In this sense, the cooperative competence may be defined as the set of individual knowledge, skills and attitudes necessary for working effectively in teams. In this line, the present study aims to deepen the knowledge about the influence of intraindividual factors related to cooperation. More specifically, about the relationship between cooperation and certain skills related to social cognition, namely, the mentalistic or theory of mind (ToM) skills.

By ToM we refer to the ability to attribute (represent, reason and conceptualize) mental states in oneself and others, as well as to understand that other people may have beliefs, desires and intentions different from their own. It is therefore a fundamental ability in humans that develops progressively from birth. In fact, children's understanding of mental states is a crucial cognitive development that has been studied intensively in the last years (Bryant, Coffey, Povinelli, & Pruett, 2013). ToM skills may be understood as a system of concepts and inferences that allows people to attribute beliefs, desires, intentions and feelings to other beings and, in that

way, to understand their behaviour. It also enables the understanding of deception, lies and false beliefs about reality, in addition to the communication and cooperation with others. In fact, people with problems to develop mentalistic skills, as for instance people with autism spectrum disorders, show significant social and communication difficulties (Olivar & Belinchon, 1997; Rivière & Nuñez, 1996).

Although many of the studies on ToM have placed special emphasis on the study of deception or Machiavellian capacity, it is noteworthy the importance of ToM in the cooperative mind. Indeed, this research suggests that people with limited mentalistic abilities have difficulty to cooperate and perform altruistic behaviours (Sally & Hill, 2005; Liebal, Colombi, Rogers, Warneken, & Tomasello, 2008), in the same way that they struggle to understand deception or pretence.

While there is much research about ToM skills and their development (see Serrano (2012) for a revision), there are few studies about the role of ToM skills in cooperative contexts. Yet, some results, such as those obtained by Paal and Bereczkei (2007), directly relate ToM with cooperation skills, rather than with Machiavellianism. Now it is important to note that in this study with adults they didn't use a cooperative situation, but a scale to assess the cooperation level and a test to assess the level of Machiavellianism. On the other side, Takagishi, Kameshima, Schug, Koizumi and Yamagishi (2010), in a study with preschoolers, found a significant relationship between the understanding of false belief and making a fair proposal of sweets distribution in the ultimatum game. According to the authors, children who had not developed the ability to infer how other children would react to their actions, behaved more selfishly, because they did not understand that other children could be angry at them and punish their unfair behaviour. From this view, understanding and anticipating other people's behaviour may encourage cooperative behaviour and adaptation to social rules.

A large part of the studies linking ToM with cooperation have focused on communication skills, using referential communication situations as cooperative tasks. One example is the study by Resches and Pérez-Pereira (2004), who found that ToM skills influence the type of communication resources children use in a referential communication task. This study showed the relationship between ToM skills and the ability to communicate effectively to cooperate on a task with a shared goal. Likewise, Maridaki-Kassotaki and Antonopoulou (2011) found that some referential communication skills were related to the understanding of first-order false beliefs. Using a similar task, Olivar, Flores and de la Iglesia (2004) found a

relationship between the capacity to understand second-order false beliefs and the quality of the sender's message.

In addition to the understanding of false belief, other mentalistic skills have been associated with referential communication abilities. For example, Happé (1993, 1994) found that children's performance in batteries of ToM tasks is a good predictor of figurative language understanding (irony, joke, metaphor...). Also Krych-Applebaum, Law, Jones, Barnacz, Johnson and Keenan (2007) found that ToM skills were related to communicative task. In this study they found that obtaining high scores on the Mind in the Eyes test (Baron-Cohen, 2003) was related to effective communication, but only in the case of the speaker and not the receiver.
Finally, we must bear in mind that the ToM can be conceived not as a unit capacity, but as a capacity composed of various processes or dimensions (Tirapu-Ustarroz, Pérez-Sayes, Erekatxo-Bilbao, & Pelegrin-Valero, 2007) that despite being interdependent enough to form a general ability, they can also be manifested as separate skills. The same would occur in other human abilities, such as language, which is composed of different components or levels (phonological, semantic, syntactic...). In the case of the ToM this is controversial, and their fundamental components (if exist) have not yet been identified. Nevertheless, we believe that to further the study of the relationship between ToM and cooperation it is important to evaluate ToM with a battery of tasks assessing several of its processes, and not just one of them, as in some of the abovementioned studies.

In short, ToM skills are linked to the effectiveness of cooperative tasks. However, there is a shortage of studies on that subject, along with methodological differences in the measurement of the ToM, primarily in terms of the tasks used. Therefore, it seems reasonable to further study what ToM skills are related to cooperation. In this sense, the objective of this research focuses on investigating the influence of mentalistic skills of different types and complexity in a cooperative task of referential communication. Additionally, considering the study by Krych-Applebaum et al. (2007), we created two distinct roles, the guide (speaker) and the builder (receiver), to study which mentalistic skills are more linked to cooperation in each role.

We hypothesized that higher scores on ToM tasks will be associated to higher scores on a cooperative task. We also considered the possibility that some ToM

skills would be more strongly related to cooperative success than others, and that these relationships could depend on the role of the participants.

Methods

Participants

The sample consisted of a total of 50 children from first and fifth grade. The young group consisted of 24 participants aged 6 (M = 6;6, SD = 0.03; range: 6;0 to 6;11; 12 girls) while the older group consisted of 26 children aged 10 (M = 10;08, SD = 0.03; range: 10;0 to 10;11; 12 girls).

Procedure

Data collection

Data were collected in two sessions. In the first session ToM and intelligence were assessed. It lasted between 30 and 45 minutes, and was conducted during school hours in a quiet room of the child's school. The second session took place one week later, and participants conducted a cooperative task in pairs. This session was audio-visually recorded, so permissions from the school administration and families were obtained.

Materials and scores

The tasks administered and the scores used are described below (see also Appendix A). In all ToM tasks the raw score was transformed to a score of 0-3 points with the purpose to match their weight in the total score in ToM, which ranged from 0 to 18 points.

a. First-order false belief

The first task was a version of the original unexpected content task proposed by Perner, Leekman and Wimmer (1987). In the first part of this task the

participants were shown a closed tube of Lacasitos® sweets and were asked what they thought there was inside. Then they were showed the actual contents of the tube (pebbles). After children had seen the actual contents of the tube, they were asked about their previous false beliefs about these contents, and also were asked about the actual contents of the tube. In the second part of the task participants were asked about the false belief that a partner would have when shown the tube for the first time. They were also asked to justify their response. Finally, children were asked a control question to ensure that they really knew their partner had not seen the contents of the tube.

Participants' answers about their own previous false belief and that of a companion were scored with a 0 or 1 each, considering that responding all control questions was a prerequisite for obtaining the points. Thus, the maximum score in this task was 2 points (converted to 3).

b. Second-order false belief

The understanding of the second-order false belief was assessed using a version of the change of location task from the Developmental Neuropsychological Assessment II (NEPSY - II Korkman, Kirk, & Kemp, 2007). After introducing the main characters of the story (John and Mary), it was explained that John decided to go to one attraction (the wheel) and Mary to another (the carousel). Participants were then told that John finally decided to go to the haunted house, because there was a long queue at the wheel, and they were asked to predict where Mary would look for him, and why she would look for him there. Afterwards, participants were told that Mary had actually seen John going to the haunted house, though John didn't know. At this point, participants had to predict where John thought Mary would look for him, and justify their response. Finally, two control questions were asked. One point (transformed to 3 points) was given to the participants who correctly answered all questions, including control questions and justifications.

c. Deception

To assess the understanding of deception it was used a version of the task by Filippova and Astington (2008). Participants were told the story of two brothers: Marta, who never tells the truth, and his brother Peter, who knows that. In the story Peter can't find his soccer ball and knows that Marta has hidden it either in the closet or under the bed. Then participants were told that when Peter asks Marta where she has hid the ball, she answers under the bed. Next, participants were asked why Peter goes to get the ball in the closet (and not under the bed) and where Marta said she had hid the ball. One point was given to participants (transformed to 3 points) who answered correctly to both the test and the control questions.

d. Metaphor

The metaphor task of the NEPSY-II (Korkman et al., 2007) was administered, following the test procedure. First, participants were shown a picture of two twin sisters, and were explained that their mother says: "they are like two drops of water". Subsequently, participants were asked about the meaning of this expression. One point was given to participants who answered the test question correctly (converted to 3 points).

e. Faux-pas

Understanding of *faux-pas* situations was assessed with one of the stories designed by Baron-Cohen, O'Riordan, Stone, Jones and Plaisted (1999). In the story Cristina gives a plane as a birthday present to Manuel, and some months later, when the two children are playing with the plane, Cristina accidentally breaks it. Cristina apologizes to Manuel and he says: "Do not worry. I never liked this plane. Someone gave it to me for my birthday". Then three questions were asked: "In the story, did anyone say something they shouldn't have said or something awkward?" "Who said it?" and "What did he/she say?" If participants answered correctly to all three questions they

were given 1 point. A second point was given if they remembered that Manuel did not have a malicious intention and another point if they attributed the correct emotion to Cristina. Thus, the maximum score was 3 points.

f. Emotional attribution

The contextual task of the NEPSY-II (Korkman et al., 2007) was used to evaluate the ability to identify the emotions of characters in different contexts. The task shows different black and white pictures in which a girl is turned back, and participants have to indicate, from four possibilities, which face the girl would show in a given situation. Six different situations were administered after a trial. Participants obtained 1 point for each correct situation, so the maximum score was 6 points (converted to 3 points).

g. Intelligence quotient

Participants' IQ was assessed through the Kaufman Brief Intelligence Test (K-BIT) elaborated by (Kaufman & Kaufman, 1994) with Spanish scales. This test consists of two scales: one verbal and one nonverbal. From the verbal scale, 6-year-olds received the expressive vocabulary task, while 10-year-olds were administered both the expressive vocabulary and definitions tasks. Both groups were also administered the nonverbal matrices task. To analyse the results we used the percentile scores of the IQ composite score (which includes verbal and nonverbal scores).

Cooperation task

The procedure was based in the task used by Krych-Appelbaum et al. (2007) in which children work in pairs to make a copy of a model constructed by blocks of Lego Duplo® (see Appendix B). In each pair one of the participants takes the role of the guide and the other the builder. In the 6-year-old group a total of 12 pairs of children were formed: 6 of the same sex (3 boy-boy and 3 girl-girl) and 6 of the opposite sex. In the 10-year-old

group a total of 13 pairs were formed: 7 of the same sex (4 boy-boy and 3 girl-girl), and 6 of the opposite sex.

Participants sat facing each other with an opaque screen between them, so that they could not see the working area of their partner. The guide had a model, and the builder, following the instructions of the guide and provided with 45 construction blocks, was expected to build a replica of the model. After a pilot test, one 4-block trial model was designed, as well as three 6-block test models of increasing complexity. The blocks could vary in four dimensions: color, size, shape and position in the coordinate axis (see Table 1).

Table 1
Dimensions considered in each model

Model	Colour	Size	Shape	Axis
Trial	√	√		x, y, z
Model 1	√	√		x, y
Model 2	√	√	√	x, y, z
Model 3	√	√	√	x, y, z

The first model to be constructed was a trial model. When participants considered that they had constructed a replica of it, the opaque screen between them was removed, so they could see how they had built the model and discuss it. After that, they were asked to construct the 3 test models, but in these cases the opaque screen was not removed and they were not allowed to talk. They just could see the result of their work.

Each of the 3 test models was scored from 0 to 6 points. Therefore, the maximum score in the cooperation task was 18 points, which were awarded

as follows, considering both the correct choice of the blocks and their location: 0.5 points if all blocks had the correct color; 0.5 points if all blocks had the correct shape and size; 0.5 points if the first piece was located correctly; and 1 point for each of the remaining pieces located in the right place (or 0.5 points if they were placed incorrectly solely due to the incorrect location of the previous block).

In some parts of the results section participants are divided into two groups: (a) participants with a "high scores on cooperation" (those who had a score equal or above the median, which was of 6 points); and (b) participants with "low scores on cooperation" (median score lower than 6). In spite of the fact most children from the younger group had a low score on cooperation, two pairs of 6-year-olds obtained a high score. Plus, two pairs of 10-year-olds obtained a low score. Therefore, the division of the cooperation results in high and low does not entirely correspond to the groups of age.

Results

Cooperative abilities and theory of mind

As shown in the last row of Table 2, participants obtained an average score of 7.24 points (SD = 4.43) in the cooperation task. In ToM, the average of the total score was 13.44 (SD = 3.81). If we consider the score on each of the ToM tasks, we observe that the best scores were obtained in the unexpected content task, followed by the tasks of deception, emotional attribution, metaphor, *faux-pas* and change of location.

When we look at the performance in ToM and cooperation as a function of the grade of the children, we observe that fifth-graders obtained higher scores than first-graders.

Table 2

Mean (and standard deviation) in the cooperation and ToM tasks in the total sample and as a function of grade

Grade	COOP	First-order false belief	Second-order false belief	Deception	Metaphor	*Faux-pas*	Emotional Attribution	Total ToM score
First	4.42 (2.83)	2.75 (0.57)	.75 (1.32)	2.13 (1.40)	1.75 (1.51)	1.44 (1.36)	1.92 (0.50)	10.73 (2.82)
Fifth	9.85 (4.04)	2.83 (.49)	2.88 (.59)	2.77 (0.82)	2.54 (1.10)	2.36 (1.14)	2.56 (0.48)	15.94 (2.76)
All the Sample	7.24 (4.43)	2.79 (0.53)	1.86 (1.47)	2.46 (1.16)	2.16 (1.36)	1.92 (1.32)	2.25 (0.58)	13.44 (3.81)

Note: range of the cooperation task = 0-18; range in each ToM task = 0-3; range of the total ToM score = 0-18

Correlations between cooperative abilities and theory of mind

In order to analyse the correlation between the ability to cooperate on a referential communication task and ToM skills, we performed partial correlations (controlling for age), both for the total sample, and as a function of the role in the cooperative activity.

For the total sample the correlation was only significant ($p < .05$) between cooperation and both ToM total score (r = .34, $p = .016$) and change

of location score (r = 0.36, *p* = 0.011), being both correlations of low intensity (see Bisquerra, 2004).

When we took into account the role of the participants in the cooperative activity we observed no significant correlations in the group of guides (*p* > .05), whereas in the group of builders we found a correlations of moderate intensity between cooperation and the following tasks: change of location (r = .45, *p* = .027), deception (r = .41, *p* = .049), and ToM total score (r = .50, *p* = .013).

Theory of mind skills, role of the participants and success in the cooperative activity

As the following analysis will compare the performance of the participants as a function of the role played in the cooperative activity (guides and builders) and depending on the success in this activity (high and low scores on cooperation), we first considered whether there were differences between these groups in relation to age and IQ.

We compared builders guide as to IQ (guides: M = 57.48, SD = 26.10; builders: M = 45.32, SD = 27.50) and the differences were not significant (Mann-Whitney: *p* > .05). In this case we did not analyse the effect of age because the pairs were formed by participants of the same grade and thus, in both groups of guides and builders half of the participants are from the first grade and half of the fifth grade.

If we compare the age of the participants with high and low cooperation scores (high score: M = 119.58, SD = 18.13; low score: M = 86.79, SD = 19.99) and their IQ (high score: M = 47.46, SD = 26.82; low score: M = 55.67, SD = 27.60), we found differences in terms of age (Mann -Whitney: Z = -3.50, *p* = .000) but not in terms of IQ (*p* >. 05).

In Table 3 we show the scores of the participants in the cooperation and ToM tasks in terms of the role of the participants and their high or low scores on cooperation. We observed that guides outperformed builders in the

tasks of deception, metaphor and *faux-pas*, as well as in the total ToM score. On the other side, builders showed better results on the unexpected content and change of location tasks. However, the contrasts were only significant (p <.05) in the *faux-pas* task.

Analysing the relation between high/low success in the cooperative task and ToM scores (see Table 3), we observed that participants with low scores on cooperation outperformed the group with high scores in unexpected content task, but the differences were not significant (p > .05). In the rest of ToM tasks, as well as in the total ToM score, participants with high scores on cooperation outperform their peers with low scores. These differences were statistically significant for the following tasks (p < .05): change of location, deception, metaphor, emotional attribution and total ToM score.

Table 3

Mean (and standard deviation) in the cooperation and ToM tasks as a function of the role of the participants and the level of success in the cooperative task

	COOP	**First-order false belief**	**Second-order false belief**	**Deception**	**Metaphor**	***Faux-pas***	**Emotional Attribution**	**Total ToM score**
Guides N = 25	7.24 (4.47)	2.76 (0.56)	1.80 (1.50)	2.64 (.99)	2.28 (1.31)	2.34 (1.15)	2.24 (0.50)	14.06 (3.27)
Builders N = 25	7.24 (4.47)	2.82 (0.50)	1.92 (1.47)	2.28 (1.31)	2.04 (1.43)	1.50 (1.37)	2.26 (0.66)	12.8 (4.26)
Contrasts	Z = .00 *p* = 1.000	Z = -.40 *p* = .687	Z = -.29 *p* = .773	Z = -1.09 *p* = .274	Z = -.62 *p* = .533	Z = -2.28 *p* = .023 *	Z = -.37 *p* = .710	Z = -.79 *p* = .431
High scores on cooperation N = 26	10.50 (3.64)	2.77 (0.55)	2.77 (0.82)	2.88 (0.59)	2.65 (0.98)	2.25 (1.14)	2.46 (0.49)	15.79 (2.28)
Low scores on cooperation N = 24	3.71 (1.52)	2.81 (0.51)	0.87 (1.39)	2.00 (1.44)	1.62 (1.53)	1.56 (1.43)	2.02 (0.60)	10.90 (3.51)
Contrasts	Z = -6.07 *p* = .000 *	Z = -.29 *p* = .771	Z = -4.55 *p* = .000 *	Z = -2.68 *P* = .007 *	Z = -2.67 *p* = .008 *	Z = -1.74 *p* = .082	Z = -2.62 *p* = .009 *	Z = -4.50 *p* = .000 *

Note: range of the cooperation task = 0-18; range in each ToM task = 0-3; range of the total ToM score = 0-18 (*) means $p = < .05$

Discussion

In sum, the results of our study show that ToM skills are linked to effectiveness in the collaborative task. In addition, they provide more accurate data regarding some aspects of the relationship between ToM and cooperation.

First, the descriptive results from Table 2 show that first-grade participants had higher difficulty in solving all the tasks, except for the unexpected content task, which is usually worked out from the age of 4 years (Wellman and Liu, 2004), and therefore this may be explained by a ceiling effect.

In the rest of the tasks fifth-grade participants scored higher than first-graders. It is especially remarkable the low score on the second-order false belief task (change of location), since results from other studies indicate a higher level of accomplishment at the age of 6, but this could be explained in terms of the task version (see, for example: Perner & Howes, 1992; Wimmer & Perner, 1985). Now, we must take into account that fifth-graders do performance well on this task, so our version seems to discriminate participants adequately according to their abilities. On the other hand, in terms of cooperation abilities, we found that fifth-graders doubled the score of the first-graders.

Regarding our first hypothesis, correlations showed that there is a significant relationship between ToM scores and performance on the cooperative task, though the strength of this relationship is moderate and mainly reflected in the second-order false belief task (change of location). Now, if we take into account the role of the participants, the results were more specific. In the case of the builders, success in cooperation was significantly related to the tasks of deception and change of location (after

controlling age), as well as to the total ToM score. Furthermore, the intensity of the correlations was, in this case, high. On the contrary, in the case of the guides, no correlation between ToM and cooperation as found to be significant (controlling the effect of age). These results suggest that, in the cooperative task used in this research, ToM skills are important mainly in the case of the builders, where participants receive information and have to decide and request which information is necessary to resolve the task. Moreover, the results indicate which ToM skills are involved in the cooperation activity, mainly understanding second-order false beliefs and deception.

These two abilities have been related by some authors to executive functioning skills (fundamentally with working memory), and could be regarded as part of the more cognitive part of the ToM (Tirapu-Ustárroz et al., 2007), as opposed to a more socioemotional component, which would include skills such as emotional attribution and *faux-pas* understanding.

Concerning the ToM scores as a function of the role of the participants, we observed a significant difference in favour of the guides. However, this difference occurs only in the *faux-pas* task and it is not reflected in the total ToM score. Therefore, overall, there are no differences in ToM scores between guides and builders, or at least not in the more cognitive component of ToM, as the *faux-pas* understanding may be considered as being part of the more emotional or moral component.

Attending to the success in the cooperative task (see Table 3), we observed that participants with high scores on cooperation obtained greater ToM scores than participants with low scores on cooperation. That is, the pairs with greater results in the cooperative activity also obtained significantly higher scores in the ToM tasks, except for the unexpected content task and the *faux-pas* task. In the former, most of the children pass the task, and therefore no differences between groups were observed. In relation to the *faux-pas* task, we had obtained different results for builders and guides, and now we observed differences as a function of cooperative

success. Despite we cannot explain that, these two results could be related. However, it is also possible that the type of skill underlying the *faux-pas* is not directly related to the success in the cooperative activity.

In conclusion, the ToM is strongly related to the ability to cooperate successfully, as already observed in other studies (Paal & Bereczkei, 2007; Takagishi et al., 2010). What's more, in our study we found that to be so regardless of age. Besides, our results suggest that different skills may be involved in this relationship, mainly advanced cognitive ToM skills, as shown by the performance on the second-order false belief task (change of location). Unlike previous studies focused on a single task (Takagishi et al., 2010; Krych-Applebaum et al., 2007), our study highlights the relationship between ToM and cooperation through various ToM tasks (in ages not investigated before), and indicate that the ToM skills needed to cooperate effectively may vary as a function of role of the participants (speaker vs. receiver).

Finally, we suggest that the relationship between ToM skills and cooperation found in this work should be studied in the future through: (a) the design of various cooperative tasks, beyond those of referential communication, (b) the control of the ToM skills of the different participants, in a way that allowed to observe how the interaction of different mentalistic patterns affects the results of cooperative interactions; and (c) the consideration of other variables such as language, executive functions and motivation to cooperate. Then again, there is also a need to deepen the concept of ToM in order to clarify how and to what extent their various components are involved in the ability to cooperate.

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Appendixes

Appendix A

Theory of mind tasks

a. First-order false belief (unexpected content)
The experimenter shows a closed tube of Lacasitos ® and says: "Look, here I have this tube". After showing the tube the experimenter asks: "What do you think there is inside the tube?"

Then the experimenter opens the tube and shows its real content: "Let's see... Look! There are actually pebbles in the tube!"

After that the experimenter closes the tube and asks: "What did you think there was inside the tube before opening it?" Then he also asks a control question: "And what's actually inside the tube?" The experimenter continues explaining: "Imagine that now comes X (a fellow of the participant). X has never seen what's inside the tube. If we show him/her the closed tube as we have it now, what will X think there is inside the tube? "

The child is also asked to justify his/her answer: "Why will X say that?" A final control question is made: "Has X seen what's inside the tube?"

b. Second-order false belief (change of location)
We show the photograph and start explaining: "John and Mary are in the fair. John wants to go on the wheel. Mary does not want to go on the wheel and goes to the carousel. When John sees that the cue for the wheel is very long, he decides to go to the haunted house. When Mary leaves the carousel she goes to look for John."

Then, the experimenter asks: "Where will Mary look for John?"
And "Why will Mary go to that place?”

After that the experimenter says: "But really, when Mary was on the carousel she saw that John was going to the haunted house. John did not see that Mary was watching him".

Then the experimenter asks the second-order false belief question: "Where does John think Mary will look for him?" Why does John think that?"

Finally, three control questions are made: "Did Mary see John going to the haunted house?" "Did John see that Mary was watching?" And "at the beginning of the story, where did John want to go?"

c. Deception

The experimenter starts saying: "Now I will explain a story of two brothers, Marta and Peter. Marta is a liar and his brother Peter knows that Marta is a liar and never tells the truth. One day Martha took, without permission, Peter's ball. Peter was sure Marta had hidden his ball somewhere, but could not find it. Peter was very angry. Then Peter met Marta and asked her: 'Where's my ball? You have hidden my ball either in your closet or under your bed, because I have looked everywhere and I didn't find it. Where is it: in your closet or under your bed?' Then Marta said that the ball was hidden under her bed."

After explaining that story the experimenter asks: "Why will Peter go to get the ball in the closet?" And finally he asks the memory control question: "Where did Marta say she had hidden the ball?"

d. Metaphor

The experimenter shows a photo with two twin sisters and says: "Paula and Ruth are sisters. Her mother says that "they are like two drops of water". Then the experimenter asks: "What does the mother mean?"

e. Faux-pas

The experimenter explains the following story: "Cristina gave Manuel a plane for his birthday. Some months later, Cristina and Manuel were playing with the plane and Cristina accidentally broke the plane. 'Sorry' said Cristina. And Manuel said, "Don't worry. I never liked this plane. Someone gave it to me for my birthday. "

After explaining the story the experimenter asked three questions of *faux-pas* detection: "In the story, did anyone say something they shouldn't have said or something awkward?" "Who said it?" and "What did he/she say?"

The experimenter continued with the following question: "Did Manuel want Cristina to feel bad?"

The next question was: "And, what did Cristina feel like?"

Finally, two control questions were asked: "What did Cristina give Manuel for his birthday?" And "Did Manuel remember that Cristina had given him a plane?"

f. Emotional attribution

The experimenter starts saying: "The images I'll show are images of a girl named Julia. I'll show you some pictures about Julia turned back and about what happens to her. After looking at each of the images we will look at four photographs and you will have to tell me what photograph shows how Julia feels in the situation".

Before administering the six test images, there was a trial item (Julia fell off her bike and got hurt): "Let's make a trial. Look at this picture. This is Julia and here there are the 4 photos with different expressions of Julia. Point to the face that best shows us how Julia feels here".

If the child answers correctly the experimenter says: "Very good ! Now we will look at another picture".

If the child is wrong the experimenter says: "This is not correct. In the picture we see that Julia is hurt. This face shows us how Julia feels when she is hurt".

Afterwards the experimenter administers the 6 items. It is important to say that no feedback is given nor it is explained the situation to the participant, who is shown each of the situations and is asked to indicate the correct photograph. The experimenter only shows each of the test images to the child, and asks him/her about the correct photograph.

Appendix B

Cooperative task

After placing each pair of participants in front of each other, with the opaque screen in the middle, the experimenter said: "A (name of participant) is on this side of the screen and B (name of participant) on this other side. We put this screen in the middle of the table so that you cannot see what the other person is doing. So you cannot lift, or move the screen or show things above the screen. Only, you could see each other's eyes".

Then the experimenter explained the purpose of the task: "A has a model made with building blocks and B has a base and many pieces to build. Without looking at what the other is doing, the two of you will have to build the same model that now A has. You have to build the model as quick as possible. Both of you can talk, but you cannot look. When you finish the model you will have to say "we're done".

Finally, the role of the researcher was clarified: "I will not be able to speak or to help." When participants requested the assistance of the experimenter, she answered them: "you two have to build the same model that now A has. Both of you can talk, but you cannot look".