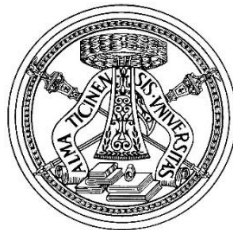# UNIVERSITA' DEGLI STUDI DI PAVIA

## Dipartimento di Scienze del Sistema Nervoso e del Comportamento

DOTTORATO DI RICERCA IN "PSICOLOGIA, NEUROSCIENZE E STATISTICA MEDICA"

Ciclo XXXI



## Theory of Mind and peer relationships in middle childhood: The role of social behaviour and social anxiety

Tesi di

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# Index

# Abstract

Theory of Mind (ToM) is defined as the ability to predict and interpret others' behaviour in term of mental states (beliefs, intentions, desires) (Wellman, 1992). The study of how ToM develops in childhood has interested developmental researchers for the last nearly 40 years. Notably, although this area of investigation has largely focused on ToM development during the preschool or early school years, it has recently started to expand its interest to include the study of middle childhood (developmental period ranging from 8 to 13) (Hughes, 2016). Research in this field has shown important progressions, as well as individual differences, in children's ToM skills across middle childhood and, such acknowledgments, have generated a number of questions regarding, for example, the nature of ToM development, as well as the correlates of individual differences in children's performance on advanced ToM tasks in this developmental period. Importantly, one of the intriguing questions relates to the social predictors and consequences of ToM development and individual differences at this age. The rationale for this interest builds on the idea that ToM is likely to be a foundational component of social competence (Hughes & Leekan, 2004) and, therefore, it might play an important role in children's social relationships as they move into primary school and spend more and more time with peers. Moreover, both theoretical accounts (e.g., Carpendale & Lewis, 2004) and empirical works conducted on early (Meins, Fernyhough, Wainwright, Das Gupta, Fradley, & Tuckey, 2002; Ruffman, Perner, & Parkin, 1999) and middle childhood (Banerjee, Watling, & Caputi, 2011) suggest that social understanding builds within the context of social relationships. Thus, the increased complexity of children's social life during the school years might

contribute to ToM advancements in middle childhood. Despite being an interesting topic, to date only one study has explored the developmental interplay between ToM and peer relationships in middle childhood (Banerjee et al., 2011). Moreover, given that this study showed a significant association between ToM and peer relationships at school, further studies are needed to deeply investigate the specific mechanisms underpinning such association. The present thesis fits within this very recent topic of investigation with the aim of exploring more in depth the nature of the association between ToM and peer relationships in middle childhood. In doing so, it adopts a longitudinal approach and investigates the potential developmental mechanisms through which ToM could affect, as well as being affected by, children's peer relationships at school.

The present thesis is made up of three studies. Each study capitalizes on a sample of Italian children (N = 247), who were met three times over a period of 1-year, and tackles different questions. The first study (chapter 1) answers to a methodological need, that is exploring the validity and reliability of a composite ToM measures made up of two different tasks: Happè's (2004) Strange Stories task and Devine & Hughes' (2013) Silent Films task. Then, the following studies (chapter 2 and chapter 3) adopt such a composite ToM battery to investigate two main research questions: a) Does children's social behaviour with peers mediate the bidirectional link between ToM and peer relationships? (study 2); b) does ToM facilitate children's social adjustment after the transition from primary to secondary school by reducing children's feeling of social anxiety over time? (study 3). More detailed, the first study focuses on the first two time-points of data collection and adopted Confirmatory Factor Analysis (CFA) to evaluate the psychometric properties of a ToM composite battery made up of items from the Strange Stories

and Silent Films tasks. Moreover, it capitalizes on measurement invariance technique (Putnick & Bornstein, 2016) to stress the configural and metric invariance of this ToM battery across time and to test stability of individual differences in children's performance over a period of 5-months. Results from this first study support previous findings on the validity and reliability of the Strange Stories and Silent Films tasks (Devine & Hughes, 2016) and extend them to an Italian sample. Moreover, results from this first study add to previous research literature on ToM ability in middle childhood (Banerjee et al., 2011; Lecce, Zocchi, Pagnin, & Palladino, 2010) by showing high stability of individual differences in children's performance on these advanced ToM tasks over 5-months. Taken all together, results from the first study allowed us to confidently adopt the Strange Stories and Silent Films tasks to investigate our main research questions. The second study focuses on the longitudinal interplay between ToM, social behaviour and peer relationships in middle childhood over a 1-year period adopting a cross-lagged modelling approach. This statistical approach allows to investigate reciprocal pattern of association between variables across time, over and above their longitudinal stability (Selig & Little, 2012). Specific aim of this second study was investigating the role of aggressive and prosocial behaviours as potential mediators in the expected bidirectional association between ToM and peer relationships in the school context. Main results from this study showed that children's aggressive behaviour mediated a bidirectional association between ToM and peer rejection, especially in children younger than 11. That is, early peer rejection negatively affected later ToM development by increasing aggressive behaviour over time and, viceversa, early advanced ToM prevented later peer rejection by reducing aggressive behaviour over time. Notably, besides reducing aggressive behaviour

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over time, ToM significantly moderated the negative impact of early peer rejection on later aggressive behaviour. That is, peer rejection led to increased aggressive behaviour over time for low and medium (but not high) levels of ToM. Finally, results showed that prosocial behaviour predicted ToM development over 5-months. On one hand, the finding that both aggressive (negatively) and prosocial (positively) behaviours predicted ToM development across time allows interesting insight into the specific nature of peer relationships that could be relevant for ToM development in middle childhood. On the other hand, the finding that ToM prevented peer rejection by reducing children's engagement in aggressive behaviours over time, as well as moderated negative behavioural consequences of peer rejection, suggests that social cognition may play an important protective role in children's social adjustment at school. The third study further investigates this latter idea by focusing on the period of transition from primary to secondary school. Moreover, it builds on empirical evidences suggesting a link between ToM and social anxiety (Banerjee & Henderson, 2001; Muris & Broeren, 2009), as well as between social anxiety and peer relationships (Tilfors, Persson, Willén, & Burk, 2012) in middle childhood to test the role of social anxiety as potential mediator in the longitudinal association between ToM and peer relationships during this transition period. Results showed that individual's ToM skills reduced children's feeling of anxiety 5-months after children's transition to secondary school and, consequently, facilitated children's social adjustment over a 1-year period (in terms of either increased acceptance and reduced rejection). In conclusion, results from the present thesis contribute to the field of investigation on ToM and peer relationships in middle childhood both theoretically and practically. From a theoretical perspective the present results support the idea that ToM can shape and

being shaped by social relationships at school. In addition, they shed some light on the potential mechanisms underpinning such bidirectional association in middle childhood. On one hand, the finding that social behaviour mediated the association between early peer rejection and later ToM suggests that children may play an active role in conveying the impact of negative peer relationships on their social cognitive development (see chapter 2). On the other hand, the finding that behavioural and emotional facets of children's social experience mediated an *indirect* association between early ToM and later peer relationships suggests that rather than being directly related to variation in the quality of children's peer relationships, individual differences in ToM may be more proximally related to the way children behave within, and emotionally experience, social relationships. Then, children's behaviours and emotional experiences are likely to influence their social experience with classmates. Notably, this idea may provide an explanation to the weak or inconsistent direct association between ToM and peer relationships commonly found in previous literature (see Slaughter, Imuta, Peterson, & Henry, 2015 for a meta-analysis). Finally, from a practical perspective, the finding that ToM moderated the impact of early peer rejection on later aggressive behaviour, as well as reduced children's social anxiety development after the transition from primary to secondary school, suggests that individual's ToM skills may play a protective role for children's social adjustment in middle childhood. Although further works are surely needed to replicate our findings and to experimentally stress the causal association between variables, results from the present thesis are promising. Indeed, by protecting children's peer relationships, individual's ToM skills may have widespread positive effects on children's well-being and long-term adjustment later on in development, since peer relationships at school are known to

have a crucial influence upon children's further socio-emotional, cognitive and academic adjustment (Rubin, Bukowski, & Parker, 2006).

# Introduction

Theory of Mind (ToM) is defined as the ability to infer others' mental states (beliefs, intentions, emotions, desires) and use such mental states to explain and predict others' behaviours (Wellman, 1992). In other words, ToM is the socio-cognitive ability that allows humans to think about other's thinking and, thus, to go behind visible actions to grasp their mental world. Giving this definition, ToM might be considered an essential component of social understanding and a prerequisite for individuals' capability to participate in daily-life social exchanges (Hughes, 2011). Accordingly, deficits in ToM skills have been consistently associated with impaired social functioning in diverse clinical disorders, including Autistic spectrum disorders (ASD) (Baron-Cohen, 2000), schizophrenia (Langdon, Siegert, McClure, & Harrington, 2005), conduct disorder (Happeˊ & Frith, 1996), social anxiety disorder (Hezel & McNally, 2014). Moreover, research studies conducted on typically developing samples have shown that individual differences in ToM are associated with variation in children's social competence and social success during the preschool years (Caputi et al., 2012; Hughes & Dunn, 1997; Slomkowski & Dunn, 1996; Watson, Nixon, Wilson, & Capage, 1999). Nevertheless, despite both theoretical and empirical works support the importance of ToM skills for children social life and development, a clear understanding of the nature of the association between individual differences in ToM and those in children's social relationships is far from being accomplished (Hughes & Devine, 2015). Indeed, little is known about *whether* and *how* individual's variation in ToM influence and/or are influenced by children's social relationships, especially when children grow older and spend more and more time with peers in the school setting.

The present thesis fits within this very recent field of research to investigate the developmental interplay between children's ToM skills and their peer relationships in middle childhood, with a specific interest on the potential mechanisms underlying such association over time.

**Research on ToM in the preschool years**

How children come to appreciate others' perspectives and learn to use mental states (beliefs, intentions, knowledges, desires) to explain and predict others' behaviours has attracted developmental researchers' interest for nearly 40 years (Wellman, 2014). Extensive theoretical and empirical work in this field has centred at first on the developmental period between 3 and 5 years of age. Indeed, during this period children manifest a visible developmental shift in their understanding that other's behaviours are driven by other's own beliefs, even when such beliefs are false compared to reality. Accordingly, the False-Belief task (Wimmer & Perner, 1983) has become "the litmus test for crediting children with having a Theory of Mind" (Hughes & Leekam, 2004, p. 591).

The False-Belief task assesses children's ability to recognize that an agent has a mistaken belief when an object that he/she has put in a location is then moved to another location in his/her absence. Children are asked to predict agent's behaviour (where she/he would look for the object) according to the agent false belief. Research evidences set between 3 and 5 the age at which children usually pass the False-Belief task (Wellman, 2001) and, therefore, the age at which a typically developing child is likely to achieve such an important milestone of his/her developing ToM. Interestingly, studies conducted during these early years of research on ToM have also highlighted a link between variation in the time at which children pass the False-Belief task and children's social functioning, in both

clinical and normative samples. For example, research in this field have shown that children with Autism spectrum disorders (ASD) lag typically developing children on the False-Belief task and contributed to the generation of a socio-cognitive account for the marked social impairments associated with ASD (Baron-Cohen, Leslie, & Frith, 1985). Moreover, in typically developing samples, False-Belief comprehension have shown to express in diverse social competences, such as the ability to share pretence (Hughes & Dunn, 1997; Youngblade & Dunn, 1995), communicate with others (Slomkowski & Dunn, 1996) and be sensitive to criticism (Cutting & Dunn, 2002). Interestingly, longitudinal studies have also contributed to underline the importance of early social experiences within the family context as predictors of the variation in the time children understand the false belief (Meins et al., 2002; Ruffman et al., 1999). Notably, these evidences, together with results pointing to the relevance of false belief understanding in young children's ability to participate in reciprocal social exchanges with others, contributed to introduce the idea that "theory-of-mind skills transform and/or are transformed by children's close relationships" (Hughes & Leekam, 2004, p. 590). In sum, these first years of rich investigation on children's ToM development have set the scene for the future abundance of research in this field.

During the last 20 years, research on ToM has expanded its developmental scope to include, on one hand, infancy and early childhood and, on the other and, middle childhood and adolescence. On one hand, although children's appreciation of the false belief represents a key milestone in ToM development, the extension of research interests on ToM into earlier developmental stages has permitted to detect "precursors" of ToM development in infancy, as well as intermediate steps in children's understanding of mental states (e.g., understanding of desires and

knowledge) before they come to appreciate the false belief (Wellman & Liu, 2004).

These findings contributed to broaden the definition of ToM to encompass a wider range of mental states and to consider false belief understanding as an explicit step of a smoother process of development through which children gain progressive knowledge about the mind. On the other hand, the expansion of research interest on ToM into middle childhood is a very recent field of investigation (Hughes, 2016) and frames the research purposes of the present thesis.

**Research on ToM in middle childhood**

The recent branch of research on ToM in middle childhood builds on the recognition that children older than 5 progressively master the False-Belief task with the aim to investigate ToM development beyond the preschool years. So far, the adoption of advanced ToM tasks has revealed important progression in children's understanding of how mental states relate to each other, as well as how mental states can affect behaviours (Banerjee et al., 2011; Devine & Hughes, 2016; Lagattuta, 2014). Furthermore, works in this area have highlighted marked individual differences in the time and quality of such advancement in ToM, just as during the preschool years (Astington & Jenkins, 1999; Hughes et al., 2011). Interestingly, the evidence on both age-related changes and individual differences in ToM in middle childhood has raised two intriguing questions that are guiding the actual research in this field. The first question concerns the nature of ToM development beyond when children pass the False-Belief task. Although advanced tasks can detect changes and interindividual variability in ToM in middle childhood, it is not yet clear which is the underlying nature of such changes (Hughes & Devine, 2015). One of the leading theoretical accounts in this area is that, rather than reflecting new conceptual insights into the nature of mental states, children's

performance on advanced ToM tasks is likely to reflect children's ability to *use* previously acquired knowledge in a more flexible and appropriate way to make sense of their increasingly complex social environment (Hughes & Devine, 2015; Lecce & Bianco, 2018). Accordingly, children might become increasingly better in considering the variety of mental states that occur in complex social scenarios and in integrating them with contextual information to make flexible and appropriate predictions about other's intentions and behaviours in those situations.

The second research question is more relevant to the scope of the present thesis since it concerns the predictors and consequences of individual differences in ToM in middle childhood. Moreover, given the intimate interplay that occur between ToM development and children's social experiences across childhood (Hughes & Leekam, 2004), research interest in this field has been orienting to the understanding of the social predictors and consequences of ToM development in middle childhood, with particular attention on children's relationships with their peers. Indeed, on one hand, peer relationships are likely to play a special role in ToM development as children move into school and spend more and more time outside of the family. On the other hand, individual differences in ToM ability to understand, and reason about, others' mental states are likely to support children's ability to form positive relationships with peers at school.

**ToM and peer relationships in middle childhood**

So far, only one study has investigated the longitudinal interplay between ToM and peer relationships in middle childhood. It is the study by Banerjee, Watling and Caputi (2011), who highlighted a recursive pattern of associations among ToM and peer relationships between 6- and 11-years of age, with poor ToM skills both predicting and being predicted by peer rejection.

The finding that peer rejection can affect ToM development fits within the theoretical formulation proposed by Carpendale and Lewis (2004) about the importance of social relationships for social-cognitive development across the life span. Carpendale and Lewis (2004) builds on the Piaget's co-constructivist view of development as resulting from the active and cooperative interaction between individuals and their social context (Piaget, 1977). More precisely, Carpendale and Lewis (2004) emphasize the construction of social understanding within the context of social exchanges since participating in social exchanges gives to individuals' the opportunity to experience others' perspective and mental states.

Notably, besides providing empirical support to the role of peer relationships for ToM development in middle childhood, the finding by Banerjee and colleagues speak to the importance of ToM for children's peer relationships at school. This result is important and promising given the importance of peer relationships for children's social and cognitive development during the school years (Rubin, Bukowski, & Parker, 2006), as well as for children's long-term adjustment and mental health (Gazelle & Rudolph, 2004; Hay, Payne, & Chadwick, 2004; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006; Tillfors, Persson, Willén, & Burk, 2012) and prompt future research to deeply investigate the mechanisms by which ToM can support children's social functioning in middle childhood.

No other study, to date, further investigated the developmental association between ToM and peer relationships in middle childhood. Moreover, although recent studies have suggested a link between ToM and children's social competence in dealing with classmates (Devine & Hughes, 2016; Peterson et al., 2016), we still know very little about the specific mechanisms by which ToM can shape children's

social experience in the school context. Conversely, it is not clear yet how peer relationships at school can contribute to advancement in ToM in middle childhood.

**The present thesis**

The present thesis fits within this very recent field of investigation and adopts a developmental approach to investigate the potential mechanisms underlying the bidirectional association between ToM and peer relationships in middle childhood. In doing so, special attention has been oriented to investigate the role that both behavioural and emotional features of children's social experience within the school context may have in mediating the developmental association between children's ToM understanding and their peer relationships in middle childhood. Literature, indeed, suggests that children's emotions (Banerjee & Henderson, 2001; Colonnesi et al., 2016) and social behaviour (Caputi et al., 2012; Holl, Kirsch, Rohlf, Krahè, & Elsner, 2018) are proximal correlates of ToM that can both influence (Rubin et al., 2006) and is being influenced by (Gazelle & Rudolph, 2004) children's social relationships.

We adopted a longitudinal design and followed a group of 247 children aged between 8 and 12 years at the first data collection for three times over a period of 1-year. The adoption of a short-term test-retest interval between time-points (approximately 6-months) allowed us to take a fine-grain view on the (expected) developmental mechanisms underlying the association between ToM and peer relationships over time. More specifically, previous longitudinal works have found significant associations between ToM and peer relationships over a period of 1-year (Banerjee et al., 2011; Caputi et al., 2012). Hence, by adopting a 3 waves design with a 6-months test-retest interval over a 1-year period we sought to investigate

more in depth the potential developmental mechanisms underpinning such association.

We assessed children's ToM using two advanced ToM tasks - the Strange Stories task (Happè, 1994) and the Silent Films task (Devine and Hughes, 2013) - that are widely used among children of this age (Meins, 2006; Devine & Hughes, 2013; Lecce & Bianco, 2018) and children's peer acceptance and peer rejection adopting the sociometric peer nomination technique by Coie, Dodge and Capotelli (1982). Finally, in order to explore potential mechanisms underpinning the expected association between ToM and peer relationships, we considered both behavioural (prosocial and aggressive behaviour) and emotional (social anxiety) features of children's daily-life social experience that could mediate the association between children's social cognition and the quality of their relationships with peers. A more detailed rationale for considering the potential mediating role of, on one hand, children's prosocial and aggressive behaviours and, on the other hand, individual's levels of social anxiety, will be provided in the introduction section of study 2 and study 3, respectively.

Notably, we measured all the study variables at each time to be able to control for longitudinal stability in individual differences when testing the effect of predicting variables of criterion variables. We also measured (at first time-point only) children's verbal ability and socioeconomic status to control for their potential confounding effects in our analyses. Indeed, these variables are known to be related to both ToM (Cutting & Dunn 1999; Devine & Hughes, 2016; Milligan, Astington, & Dack, 2007), social relationships (Beauchamp & Anderson, 2010) and social behaviour (Piotrowska, Stride, Croft, & Rowe, 2015). See Appendix A for a summary of all the measures included in the present thesis.

Regarding the structure of the thesis, the first chapter deals with data collected at the first two time-points of data collection to address a foundational methodological issue concerning the validity and reliability of the Strange Stories and Silent Films tasks in the present Italian sample. In more detail, we adopt Confirmatory Factor Analyses (CFA) to stress the psychometric properties of a composite ToM battery made up of items from the Strange Stories and the Silent Films tasks reported in previous studies (Devine & Hughes, 2013; 2016) and to assess stability of individual differences in children's performance on this ToM composite score over a period of 5-months.

The second and third chapters capitalize on these preliminary analyses and investigate the potential mechanisms underlying the expected associations between ToM and children's peer relationships in middle childhood.

The second chapter tests the hypothesis that children's aggressive and prosocial behaviour with peers could mediate the developmental association between children's ToM and quality of their social relationships with classmates. Existing literature on preschoolers shows that prosocial behaviour mediates a longitudinal association between early ToM and both later peer acceptance and later peer rejection (Caputi et al., 2012). According to this literature, we expect prosocial behaviour to mediate such associations also in middle childhood. Moreover, existing literature suggests that poor social understanding, behavioural problems and negative peer relationships are likely to be involved in a negative development cascade from early to middle childhood (e.g., Lansford, Malone, Dodge, Pettit, & Bates, 2010). According to this literature, we expect aggressive behaviour to mediate a bidirectional association between ToM and peer rejection. To test all our hypotheses, we adopt a cross-lagged modelling approach, as it allows us to

investigate the reciprocal pattern of association between variables across time, over and above their longitudinal stability (Selig & Little, 2012). Moreover, we adopted a multi-group procedure to explore similarities and differences in the hypothesized developmental pathways across two age-groups (aged respectively 9 and 11 years at the first time-point).

Finally, in the third chapter, we tested the role of children's emotional experience and specifically of social anxiety as potential mediator in the developmental association between early ToM and later peer relationships. Specifically, we focused our attention on a subsample of children who had just made the transition from primary to secondary school to test the hypothesis that individual's ToM skills could facilitate children's social adjustment within such a challenging social environment by reducing feeling of social anxiety over time. Existing research supports the existence of a negative associations between individual differences in ToM and variation in children's social anxiety in middle childhood (e.g., Banerjee & Henderson, 2001), as well as an association between social anxiety and poor peer relationships during the school years (e.g., Tilfors, Persson, Willén, & Burk, 2012). We tested our hypothesis adopting a hypothesis-driven approach within a path-analysis modelling framework.

In summary, the present thesis aimed to:

1)      Test the psychometric properties of a ToM composite battery made up of items from the Strange Stories and the Silent Films tasks to extend previous findings on its validity and reliability (Devine and Hughes, 2016) to an Italian sample, as well as adopt such measure to investigate the stability of individual differences in children's ToM performance over a period of 5-months;

2)      test the role of children's social behaviour as potential mediator in the developmental association between individual differences in ToM and quality of children's peer relationships at school, in both the directions. Namely, from early ToM to later peer relationships and from early peer relationships to later ToM;

3)      test the role on ToM in children's social and emotional adjustment after the transition to secondary school by investigating the role of social anxiety as potential mediator in the longitudinal association between early ToM and later peer relationships.

# Chapter 1 - Measuring Theory of Mind in middle childhood

**Abstract**

Research studies devoted to the investigation of ToM development in middle childhood has employed a variety of advanced ToM tasks that are able to detect age-related changes and individual differences in ToM in middle childhood. Among these tasks, the Strange Stories and Silent Films tasks have shown to have good psychometric properties, in that they show convergent validity among them and with classical False-Belief tasks and they have strong test-retest stability over 1-month. Nevertheless, all these results come from studies involving British samples. The present study aimed to replicate previous finding on the validity and reliability of the Strange Stories and the Silent Films tasks in a sample of Italian children ranging in age between 8 and 12 years. Furthermore, the present study also aimed to contribute to the field of investigation on ToM abilities in middle childhood investigating stability of individual differences in children's performance on a composite ToM battery made up of items from both tasks over a period of 5-months. Confirmatory Factor Analyses showed that the Strange Stories and Silent Film tasks are strongly inter-correlated even when verbal ability, SES, gender and age are taken into account. Moreover, all items (except one item from the Silent Films task) loaded onto a single ToM latent factor. Crucially, this ToM latent factor showed measurement invariance either across gender and across time, as well as high rank-order stability over a period of 5-mounths. The present results extend previous findings about the validity and reliability of the Strange Stories and the

Silent Films tasks to an Italian sample and provide new data supporting the high stability of individual differences in children's ToM performance across middle childhood.

**Introduction**

Most of the research on Theory of Mind (ToM), the ability to understand and predict behaviour in term of mental states, has been related to developments in the first 5 years of life. Nevertheless, research interest in this field has recently expanded its developmental scope including the study of middle childhood (Hughes, 2016).

Primarily, research in this area had to face a methodological issue. Namely, the need of developmentally appropriate tasks able to detect age-related changes and individual variation in ToM beyond children mastering the classic False-Belief tasks. To this end, diverse ToM tasks have been adapted or developed in the last years (e.g., "second-order false-belief" task, Perner & Wimmer, 1985; "Strange Stories" task, Happe, 1994; "Triangle task", Castelli et al., 2000; "Faux Pas" task, Banerjee & Henderson, 2001; "reading the mind in the eyes" test, Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; "Silent Film" task, Devine & Hughes, 2013) that vary in modality of presentation (e.g., stories, animations, film clips) and taps into different facets of mental-states reasoning (emotions, beliefs, intention, perspectives, desires) (Hughes, 2015). Interestingly, the adoption of such advanced ToM tasks has revealed important progression in children's ToM during the school years (Banerjee et al., 2011; Devine & Hughes, 2016; Lagattuta, 2014). For example, children become able to understand multiple perspectives, to coherently align different mental states and to explicitly refer to the emotional causes and

behavioural consequences of decisions (Lagattuta, 2014). Children become also increasingly skilled in making sense of complex social scenarios such as those involving social gaffes (Banerjee et al., 2011), misunderstandings, double-bluffs, white lies as well as irony and sarcasm (Devine & Hughes, 2016). Importantly, works in this area have also highlighted marked individual differences in the time and quality of such acquisitions opening the way to the adoption of these tasks to study the predictors and consequences of ToM development in middle childhood. However, further work is needed to investigate the validity and reliability of these tasks (Devine & Hughes, 2016). In particular, to date, existing studies on the validity of these new advanced ToM tasks have been conducted on British children (Devine & Hughes 2013; Devine & Hughes, 2016;). As a consequence, we don't know whether these tasks work equally well in different countries. Notably, this is important also because existing research has shown important cultural effect on ToM development (Hughes, Devine, Ensor, koyasu, Mizokawa, & Lecce, 2014)

The present study aimed to contribute to this field of investigation by testing the psychometric properties of a composite advanced ToM battery made up of items from the Strange Stories and the Silent Films tasks in a sample of Italian children ranging in age between 8 and 12. Moreover, by doing so the present study also aimed to add new theoretical contribution to the field of investigation on ToM ability in middle childhood by testing individual differences stability in children's performance on this ToM battery over 5-months.

**The Strange Stories and Silent Films tasks: Theoretical rationale**

When exploring the developmental links between individual differences in ToM and children's social relationships at school, it is important to consider that that the adopted ToM tasks should be sensitive to, not only developmental changes

in ToM in middle childhood, but also the specific form of mental-state reasoning that is most pertinent to children's social relationships in daily-life (Banerjee et al., 2011).

Building on this idea, Banerjee and Watling (2005) investigated the association between ToM and social relationships at school adopting two different ToM tasks, namely the Faux Pas task (Banerjee and Henderson, 2001) and a version of the second-order False-Belief task (Sullivan, Zaitchik, and Tager-Flusberg's, 1994). Interestingly, they found that variation in children's social relationships with peers was associated with variation in children's performance on the Faux Pas task, but not on the second-order False-Belief task. Authors argued that the Faux Pas task maps onto real-life differences in interpersonal relations in a more intimate way than the second-order False-Belief task (Banerjee & Watling, 2005). Indeed, while the second-order False-Belief task relies on a specific aspect of mental-state reasoning, namely the appreciation that a person can have a false belief not only about reality but also about the mental state of another person, the Faux Pas task requires children to understand the links between multiple mental states (e.g., intentions, emotions, beliefs) in everyday social situations. Specifically, it requires to appreciate the lack of knowledge that caused the insult, while attributing negative feelings to the (unintentionally) hurt person. Moreover, strengthening their interpretation, the authors showed that the association between children's performance on the Faux Pas task and their peer relationships "was not due to first-order understanding of the emotional impact of the faux pas but rather to the more complex recognition that the upset was not intentional and to the appreciation of the ignorance that led to the faux pas" (Banerjee et al., 2011, p. 1890)

Crucially, adopting the Faux Pas task in a longitudinal follow-up of this first study, Banerjee and colleagues (2011) found significant longitudinal associations between children's performance on the Faux Pas task and both acceptance and rejection by peers.

The present thesis aims adding to these previous works by Banerjee and colleagues in several ways, one of which concerns the investigation of the link between ToM and peer relationships adopting a different measure of ToM, namely the Strange Stories and Silent Films tasks battery. Just as the Faux Pas task, the Strange Stories and the Silent Films tasks are likely to tap into features of mental-state reasoning that are relevant to children's daily-life social relationships, as they require children to understand the links between multiple mental states (e.g., intentions, emotions, beliefs) in everyday social situations. However, compared to the Faux Pas task, they also consider a wider range of social scenarios in which ToM skills are likely to be applied. In other words, although understanding the multiple mentalistic features involved in a social-gaffe scenario might be relevant for children's social relationships at school, this may be just one of the daily social challenges requiring ToM in middle childhood.

Specifically, the Strange Stories (Happè et al., 1994; White et al., 2009) and the Silent Films tasks (Devine & Hughes, 2013) assess children's ability to use their mental-state reasoning to explain character's behaviour in different complex social situations (misunderstanding, double-bluff, persuasion, deception). Each one of these situations requires children to infer and coordinate multiple mental states (intention, knowledge, emotion, belief), as well as to combine them with contextual information to explain characters' behaviour in that specific social situation. Moreover, as anticipated in the general introduction, individual differences in ToM

in middle childhood are likely to reflect changes in children's ability to flexibly and accurately adapt their mental-states reasoning according to context (See Lecce & Bianco, 2018). Thus, the adoption of tasks that involve multiple scenarios, each requiring a differential interpretation of the link between behaviour and mental states depending on the specific context, may also challenge children's ToM skills in a more developmentally appropriate way.

Finally, the adoption of two different tasks to assess children's ToM skills that also vary in modality of presentation might help to grasp more variability related to children's ToM reasoning while reducing the eventual confounding effect due to the cognitive characteristics of the task.

**Strange Stories and Silent Films tasks: Psychometric properties**

The Strange Stories task consists of short vignettes in which a character says or does something which is literally incongruent with the ongoing social situation. In fact, the character's action can be understood only by relying on his/her mental states (e.g., false belief, lack of knowledge, intention of deceive). Children are asked to solve the contrast by inferring the mental state behind character's actions and to explicitly explain why the character behaved in that way in that context.

The Silent Films task presents children with short silent clips depicting social scenarios in which character's actions or behaviour can be understood and explained only with reference to his/her mental state (e.g., instances of deception, false belief, belief-desire reasoning, and misunderstanding). Children have to make sense of the complex social situation that is represented in each clip in order to correctly answer questions addressing the causes of characters' behaviours.

Although they vary in modality of presentation, the Strange Stories and the Silent Films tasks show strong concurrent associations (Devine & Hughes, 2013).

Furthermore, children's performance on both these tasks at age 10 significantly correlated with children's earlier performance on a battery of False-Belief tasks at 6 years (Devine, White, Ensor, & Hughes, 2015). Such evidences speak to the convergent validity of the Strange Stories and Silent films tasks, as well as to the continuity existing between individual differences in classic and advanced ToM tasks.

Notably, in a recent study, Devine and Hughes (2016) deeply explored the psychometric properties of a composite ToM score made up of items from the Strange Stories and Silent Films tasks. Authors showed that Strange Stories latent factor and the Silent Films latent factor were strongly correlated and that these correlations cannot be explained by either age, verbal ability, narrative comprehension, SES, ethnicity or gender differences. Furthermore, items from both the Strange Stories and the Silent Films tasks loaded onto a single ToM latent factor, which was invariant across gender and had strong test-retest stability over 1-month (Devine & Hughes, 2016). Finally, echoing research on pre-schoolers, authors showed that performance on the single ToM latent factor positively correlates with age and verbal ability. Moreover, girls outperformed boys and children from less affluent schools lagged their more affluent peers.

Crucially, supporting the idea that these tasks can grasp facets of children's daily social experience with peers, Devine and Hughes (2013) found that individual difference in children's performance on the composite ToM battery was related to children's self-reported loneliness and dissatisfaction in their peer relationships at school.

Taken all together, these results provided support to the validity and reliability of the Strange Stories and Silent Films tasks and speak to the possibility

that they can be sensitive to variation in children's social experience at school, even in children belonging to different cultures.

**The present study**

The current study aimed to extend previous findings on the psychometric properties of a composite ToM score made up of items from the Strange Stories and Silent Films tasks by replicating the study by Devine and Hughes (2016) presented above in a sample of Italian children ranging in age between 8-and 12-years. Moreover, in doing so the current study also aimed to contribute to the field of investigation on ToM ability in middle childhood by testing individual differences stability in children's performance on this composite advanced ToM measure over a period of 5-months.

Specifically, the present work aimed to confirm the dimensionality and composition of the Strange Stories and Silent Films latent factors in an Italian sample, as well as to test their convergent validity and stress their association controlling for verbal ability, SES, gender and age. Moreover, the present study aimed to replicate the single ToM latent factor structure showed by Devine & Hughes (2016) and to examine its association with verbal ability, SES, gender and age. Moreover, besides extending previous findings about the measurement invariance of the ToM composite battery across boys and girls, the considerable age range of the present sample made it possible to assess measurement invariance across different age-groups. Establishing measurement invariance across different groups is an important step in studying the fairness of a test. Finally, the present study aimed to extend previous findings about the strong 1-month test-retest reliability to a period of 5-months.

**Method**

**Participants**

The original sample consisted of 295 children. They were recruited from the same school located in the surrounding area of Pavia (North of Italy), via informed parental consent. Note that, only 2 families didn't assent to take part in the study. 48 children from the original sample were clinically referred for cognitive or learning difficulties and were excluded. The final sample consisted of 247 children (126 boys and 121 girls) ranging approximately from 8 to 12 years of age ($M$ = 10.03, $SD$ = 1.21, Range = 7.95 - 12.47) at the first time-point of data collection. They came from 13 different classes organized in four groups depending on the grade. According to the Italian school system, 65 children (3 classes) were attending the 3rd year of primary school ($M_{Age}$ = 8.53, $SD$ = .30); 55 children (3 classes) were attending the 4th year of primary school ($M_{Age}$ = 9.42, $SD$ = .29); 58 children (3 classes) were attending the 5th year of primary school ($M_{Age}$ = 10.49, $SD$ = .32) and 69 children (4 classes) were attending the 1st year of secondary school ($M_{Age}$ = 11.54, $SD$ = .29).  One child was absent at Time 2 and 7 children changed school at Time 3.  A weighted least squares estimator was used in the present modelling analyses to handle missing values (Asparouhov & Muthen, 2010). All the children were native Italian speakers. When the Family Affluence Scale (FAS; Currie, Molcho, Boyce, Holstein, Torsheim & Richter, 2008; see below for details) was used to categorize the sample, 82% of the sample was classed as "high affluence" (total score ranging 6 - 9) and 18% as "middle affluence" (total score ranging 3 - 5), with none classed as "low affluence" (total score ranging from 0 - 2).

**Procedure**

The first time-point of data collection took place in December 2015, 3-months after children started the school year. Children were then retested 5-months later (Time 2), at the end of the school year. At each time-point children completed two different ToM tasks – the Strange Stories (Happè, 1994) and Silent Films Tasks (Devine & Hughes, 2013). They also completed a socioeconomic status questionnaire (Family Affluence Scale; FAS; Currie et al., 2008) and a verbal ability test (Mill Hill Vocabulary Test, MHVS; Raven & Rust, 2008) at Time 1. Tasks were administered collectively to the whole class, with children completing their response booklets independently. Researches (at least two for each classroom) introduced the tasks and read the questions out loud one at a time, supported by a PowerPoint presentation that displayed instructions and stories for the Strange Stories task and clips for the Silent Film task. No time limits were imposed to children in answering at each of the items. The session lasted approximately one hour.

**Measures**

**Socioeconomic status.** The Family Affluence Scale (Currie et al., 2008) is a short questionnaire on family wealth. There are four questions about the following: family car ownership (range = 0–2), the participants having/not having their own unshared room (range = 0–1), the number of computers at home (range = 0–3), and the number of times the participants went on a holiday during the past year (range = 0–3). Responses to the four items were summed into an overall index of family affluence (range = 0–9).

**Verbal ability.** We used an Italian translation of the Mill Hill Vocabulary Scale (MHVS; Raven & Rust, 2008). The MHVS is a multiple-choice synonyms

test designed to test verbal ability in 7 to 18 years old children. The task requires children to find the synonym of 44 target words, choosing among six alternatives. Children received 1 point for each correct answer. Children's total scores could range from 0 to 44.

**Theory of Mind.** The Strange Stories task is an advanced ToM task consisting of written short stories in which a character does or says something that is apparently in contrast with the ongoing situation and that could be understood considering his or her underlying mental states. We administered the 5 stories previously used in the previous work by Devine and Hughes (2016) as these stories have shown to be the most challenging for older children (Devine and Hughes, 2013). More in details, these 5 stories depicted 2 double bluff, 2 misunderstanding and 1 persuasion scenarios. Parallel versions of the stories were used at different time-points (See Appendix B for details). After reading the stories, children were asked to explain a character's non-literal utterance in a written format. No time limit was imposed. In line with scoring guidelines (see White, Hill, Happè, & Frith, 2009), we rated children's answers on a 3-point scale: 0 for an incorrect answer, 1 for a partially correct and implicit answer, and 2 for a full and explicit answer. Total scores could range from 0 to 10 points. A second rater independently coded 25% of the responses at each time-point, and interrater agreement was established using Cohen's kappa ($k_{T1} = .91$; $k_{T2} = .88$).

The Silent Films task (Devine & Hughes 2013) is an advanced ToM test that consists of five short film clips (mean length = 25.4 s) from Harold Lloyd's classic silent comedy, Safety Last (Roach et al., 1923). Each clip presents a different scenario (depicting instances of deception, false belief, belief-desire reasoning, and misunderstanding) in which a character's actions or behaviour could be understood

and explained with reference to his/her mental state. During administration, each clip was played once and followed by a question in which participants were required to explain the behaviour of a character. Answers were scored using a three-point scale according to the standard scoring guidelines: 0 for an incorrect response, 1 for a partially correct response and 2 for an explicit mentalistic explanation of the character's behaviour. There were 5 film clips and 6 questions. Total scores could range from 0 to 12 points. A second rater independently coded 25% of the responses at each time-point, and interrater agreement was established using Cohen's kappa ($k_{T1} = .81$; $k_{T2} = .81$).

**Results**

**Preliminary analyses**

Table 1.1 shows descriptive statistics of each variable included in the present study. Independent *t*-test comparison didn't reveal gender differences in age, verbal ability and socioeconomic status scores. Table 1.1 also report the proportions of children scoring 0 (incorrect), 1 (partially correct) or 2 (totally correct) at each item of the ToM tasks. Inspection of summed scores for the Strange Stories and the Silent Films tasks reveals that none of the children performed at ceiling at Time 1 and just the 7.7 % for the Strange Stories task and 0,8 % for the Silent Films task preformed at ceiling at Time 2. Moreover, the distributions of scores for both tasks were symmetrical, with negative skewness reaching a maximum value (-.65) that is lower than the suggested margin of -1 (Muthén & Kaplan, 1985), and did not significantly deviate from normality.

**Main analyses**

First aim of the present study was confirming the factor structure of the Strange Stories and the Silent Films tasks, as well as investigate their reciprocal convergent validity. To this end, a two latent factor measurement model was specified in which each item of the Silent Film task loaded onto a single Silent Film latent factor and each item of the Strange Stories task loaded onto a second correlated Strange Stories latent factor. The model showed a good fit to the data, $\chi^2(43) = 45.815$, $p = .36$, RMSEA = .016, CFI = .983, TLI = .978. The standardized item loadings were all significant (see Figure 1.1) with exception of the item 2 of the Silent Film task, which loading was close to zero. To deeply investigate this result, a second model was run in which the loading estimate for this item was constrained to zero. Nested model comparison model using a corrected chi-square difference test suitable for use with WLSMV didn't show a significant deterioration in model fit, $\chi^2(44) = 46.231$, $p = .38$, RMSEA = .014, CFI = .986, TLI = .983, $\Delta\chi^2$ $(1) = 1.904$, $p = .17$, confirming the nonsignificant contribution of this item to the Silent Film latent factor. Given this item didn't load on any other factor and it was weakly related to other indicators, its elimination would not substantially influence the fit of the model (Brown, 2015). Thus, instead of removing this item, we preferred keeping it (constrained to zero) in the following analyses, to retain the original set of indicators and to not modify the variance-covariance matrix (Brown, 2015). Note also that even if the item would be removed, the model would still show a good fit to the data: $\chi^2(34) = 39.273$, $p = .25$, RMSEA = .025, CFI = .968, TLI = .958, confirming that keeping the item didn't artificially masked a poor goodness of fit of the model.Notably, there was a strong correlation between the Silent Film and Strange Stories latent factors ($\phi = .82$, p < .001) supporting the

convergent validity of these two tasks. Moreover, when the Silent Film and Strange Stories latent factors were regressed onto age, gender, SES and verbal ability (see Figure 1.2) they remain strongly correlated ($\phi$ = .79, p < .001) and the model still showed an adequate fit to the data: $\chi^2(80)$ = 89.654, $p$ = .22, RMSEA = .022, CFI = .921, TLI = .902. Here it is important to note that while both age and verbal ability positively predict variability in children's performance on both the Strange Stories and the Silent Films latent factors; SES didn't predict either variability in the Strange Stores or in the Silent Films latent factors. Moreover, gender only marginally predict variability on the Silent Films but not on the Strange Stories scores, with a tendency of girls in performing higher than boys.

Next, given the strong correlation between the Silent Film and Strange Stories latent factors, we specified a model in which the items from both tasks loaded onto a single ToM latent factor. Furthermore, we compared this single-factor model to the previous two-factors solution using a corrected chi-square difference test suitable for WLSMV. The ToM latent factor solution provided an excellent fit to the data (see Fig. 1.3), $\chi^2(45)$ = 48.374, $p$ = .34, RMSEA = .017, CFI = .979, TLI = .975, with nonsignificant deterioration in model fit moving from the two-factors to the single-factor (more parsimonious) solution, $\Delta\chi^2$ (1) = 3.191, $p$ = .07. Notably, the ToM latent factor showed significant variance, unstandardized estimate = 0.163, $p$ < .05. Correlates of individual differences in children's performance on the ToM latent factor were examined by regressing it onto age, gender, SES, and verbal ability (see Fig. 1.4). This model provided a good fit to the data, $\chi^2(85)$ = 93.891, $p$ = .24, RMSEA = .021, CFI = .927, TLI = .915, and accounted for 31% of the variance in the ToM latent factor. Performance on the ToM latent factor was positively associated with age and verbal ability but was unrelated to SES.

Moreover, there was a marginally significant effect of gender, with a tendency of girls in performing higher than boys.

In the next step, multiple-groups CFA was adopted to test measurement invariance of the ToM latent factor across gender. Following the same procedure reported in Devine and Hughes (2016) we compared a baseline configural invariant model, in which only the model factor structure was equal across boys and girls, with a constrained model in which equally constraints were added to factor loadings and item thresholds. The baseline model showed good fit to the data, $\chi^2(100) = 101.467$, $p = .44$, RMSEA $= .011$, CFI $= .991$, TLI $= .990$. Moreover, the invariant model continued to have good fit, $\chi^2(110) = 117.760$, $p = .29$, RMSEA $= .024$, CFI $= .952$, TLI $= .952$, with nonsignificant deterioration of fit following the inclusion of the equality constraints, $\Delta\chi^2(10) = 15.313$, $p = .12$. This result confirms the equality of the single ToM latent factor structure, variance and item functioning across gender. The same multiple-groups CFA procedure was adopted to test measurement invariance of the ToM latent factor across age-groups. In doing so we divided the sample in two age-groups by the mean age. The younger age-group was aged approximately 9 ($M = 8.93$, $SD = .54$) and the older age-group was aged approximately 11 ($M = 11.05$, $SD = .61$). The baseline configural invariant model, in which only the factor structure was equally defined across age-groups, was compared with a constrained model, in which equally constraints were added to factor loadings and item thresholds. Nonsignificant deterioration in model fit followed the inclusion of the equality constraints $\Delta\chi^2(10) = 14.658$, $p = .15$ indicating no differences between age-groups. However, it should be noted that either the baseline model, $\chi^2(100) = 141.518$, $p < .01$, RMSEA $= .058$, CFI $= .705$,

TLI = .675, and, consequently, the constrained model, $\chi^2(110) = 154.000$, $p < .01$, RMSEA = .057, CFI = .687, TLI = .687, showed poor fit to the data.

The deeply investigate this issue, the model was separately tested in each age-group. Among older children, the model fit the data well, $\chi^2(35) = 39.603$, $p = .27$, RMSEA = .032, CFI = .930, TLI = .910, better than among younger children, $\chi^2(35) = 60.892$, $p < .01$, RMSEA = .079, CFI = .665, TLI = .570. Results for the younger age-group showed that all the Strange Stories' items and just 2 out of 6 items of the Silent Film tasks significantly loaded onto the ToM latent factor. Notably, while the RMSEA was good, the CFI and TLI indices were specifically bad in the youger age-group, which are sensitive to detect low correlations among indicators (Brown, 2015). This pattern of findings together with the nonsignificant deterioration in model fit following the inclusion of equality constraints across age-groups suggests that, although a model solution could be fitted that is suitable for both 9- and 11-years old children, items may not be sufficiently highly related when the overall sample is divided by age, especially among younger children.

The second main aim of the present study was investigating stability of individual differences in children's performance on the ToM battery over a period of 5-months after stressing the metric invariance of its measurement model across time. More in detail, testing metric invariance means investigating whether items' contribution to the ToM latent factor remain equal across time points and, thus, whether individual differences in children's ToM performance at Time 1 have the same meaning at the following measurement occasion (Putnick & Bornstein, 2016). To this aim, a two latent factor model has been specified in which items from the Strange Stories and Silent Film tasks at first time-point loaded onto one latent factor and corresponding items at second time-point loaded onto a second correlated latent

factor. To account for item-specific variance, the residual terms from each item at first time-point was correlated with its corresponding item at second time-point. This model provided a good fit to the data, $\chi^2(198) = 226.38$, $p = .08$, RMSEA = .02, CFI = .95, TLI = .94. Thus, we tested the metric invariance of this model by constraining the item loadings and latent factor variances to be equal across time-points. Note that the item 2 of the silent films tasks was constrained to be equal to zero at both the time-points. The model continued to have good fit to the data, $\chi^2(209) = 242.29$, $p = .06$, RMSEA = .03, CFI = .94, TLI = .93, with nonsignificant deterioration in the model fit, $\Delta\chi^2 (11) = 16.16$, $p = .14$. Given metric invariance, the ToM latent factor showed strong stability across-time ($\phi = .85$, $p < .001$) (see Fig. 1.5 for standardized parameter estimates). Finally, given that the ToM latent factor at Time 1 was correlated with gender, verbal ability and age, the autoregressive effect of ToM across time was also estimated after controlling for these variables. ToM latent factor at Time 2 was regressed on ToM latent factor at Time 1, gender, verbal ability and age. Altogether, the model accounted for 75% of the variance in the ToM latent factor scores at time 2. Over and above gender, verbal ability and age, ToM at Time 1 explained 36% of variance in ToM at Time 2 (B =.71, $p < .001$, $\beta = .73$). Model fit: $\chi^2(268) = 304.94$, $p = .06$, RMSEA = .02, CFI = .90, TLI = .90.

Table 1.1 – Descriptive statistics for all the study measures

| | Time 1 | | % participants scoring | | | Time 2 | | % participants scoring | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | 0 | 1 | 2 | Mean | SD | 0 | 1 | 2 |
| SF1 | .69 | .52 | 33.7 | 63.3 | 2.7 | .81 | .51 | 23.8 | 69.5 | 5.1 |
| SF2 | 1.08 | .69 | 19.9 | 52.0 | 27.7 | 1.21 | .72 | 17.2 | 43.8 | 37.5 |
| SF3 | 1.05 | .85 | 32.9 | 28.6 | 38.4 | 1.41 | .75 | 15.6 | 26.6 | 56.3 |
| SF4 | 1.20 | .68 | 15.2 | 49.2 | 35.2 | 1.38 | .64 | 8.2 | 44.5 | 45.7 |
| SF5 | 1.16 | .91 | 34.8 | 14.5 | 50.4 | 1.41 | .79 | 18.4 | 21.1 | 59.0 |
| SF6 | 1.43 | .81 | 20.7 | 15.6 | 63.3 | 1.55 | .74 | 14.8 | 14.5 | 69.1 |
| SS1 | .93 | .40 | 11.7 | 83.2 | 4.7 | 1.18 | .56 | 7.8 | 64.8 | 25.8 |
| SS2 | 1.44 | .55 | 2.7 | 50.6 | 46.7 | 1.75 | .55 | 5.5 | 13.3 | 79.7 |
| SS3 | .67 | .81 | 53.9 | 24.2 | 21.5 | 1.00 | .85 | 35.5 | 27.3 | 35.5 |
| SS4 | 1.40 | .70 | 12.1 | 35.9 | 51.6 | 1.56 | .57 | 3.9 | 35.5 | 59.0 |
| SS5 | 1.15 | .89 | 33.3 | 18.8 | 47.7 | 1.77 | .53 | 5.1 | 12.5 | 80.9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SS tot | 5.59 | 1.96 | - | - | - | 7.28 | 1.65 | - | - | - |
| SF tot | 6.63 | 2.18 | - | - | - | 7.76 | 2.16 | - | - | - |
| Age | 10.3 | 1.21 | - | - | - | - | - | - | - | - |
| VA | 23.85 | 4.95 | - | - | - | - | - | - | - | - |
| SES | 6.83 | 1.53 | - | - | - | - | - | - | - | - |

*Note.* SF = Silent Film task; SS = Strange Stories task; VA = Verbal ability; SES = Socioeconomic status.
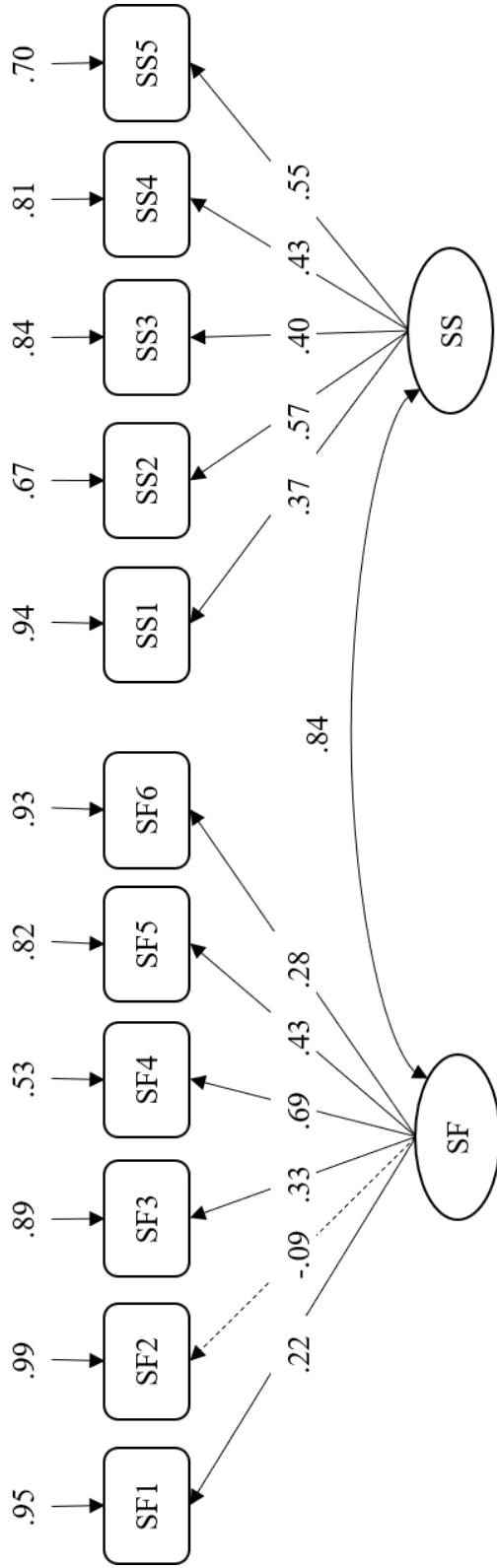
Figure 1.1 - Two latent factor model



*Figure 1*. Standardized parameter estimates for the ToM measurement models (two latent factor solution). Dash lines indicate nonsignificant loading. SF = Silent Film task; SS = Strange Stories task

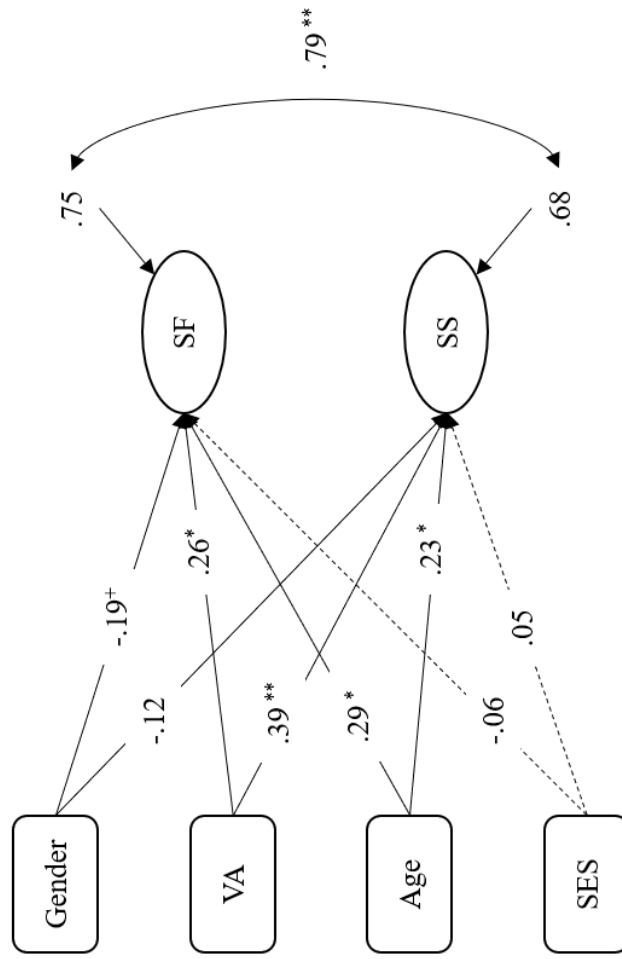Figure 1.2 – Correlates of Strange Stories and Silent Films latent factors



*Figure 3.* Standardized parameter estimates for correlates of Strange Stories and Silent Films latent factors. Dash lines indicate nonsignificant paths. SF = Silent Film task; SS = Strange Stories task; VA = Verbal ability; SES = Socioeconomic status; $+p < .10$; $*p < .05$; $**p < .01$

Figure 1.3 - Single latent factor model



*Figure 2.* Standardized parameter estimates for the ToM measurement models (single latent factor solution). Dash lines indicate nonsignificant loading. SF = Silent Film task; SS = Strange Stories task

Figure 1.4 – Correlates of ToM latent factor



*Figure 4*. Standardized parameter estimates for correlates of ToM latent factor. Dash lines indicate nonsignificant path. VA = Verbal ability; SES = Socioeconomic status; $+p < .10$; $*p < .05$; $**p < .01$

Figure 1.5 – Metric invariance and stability of ToM latent factor across time



*Figure 5.* Standardized parameter estimates for the ToM latent factors at Time 1 and Time 2. Dash lines indicate nonsignificant loadings. SF = Silent Film task; SS = Strange Stories task. ***$p$ < .001
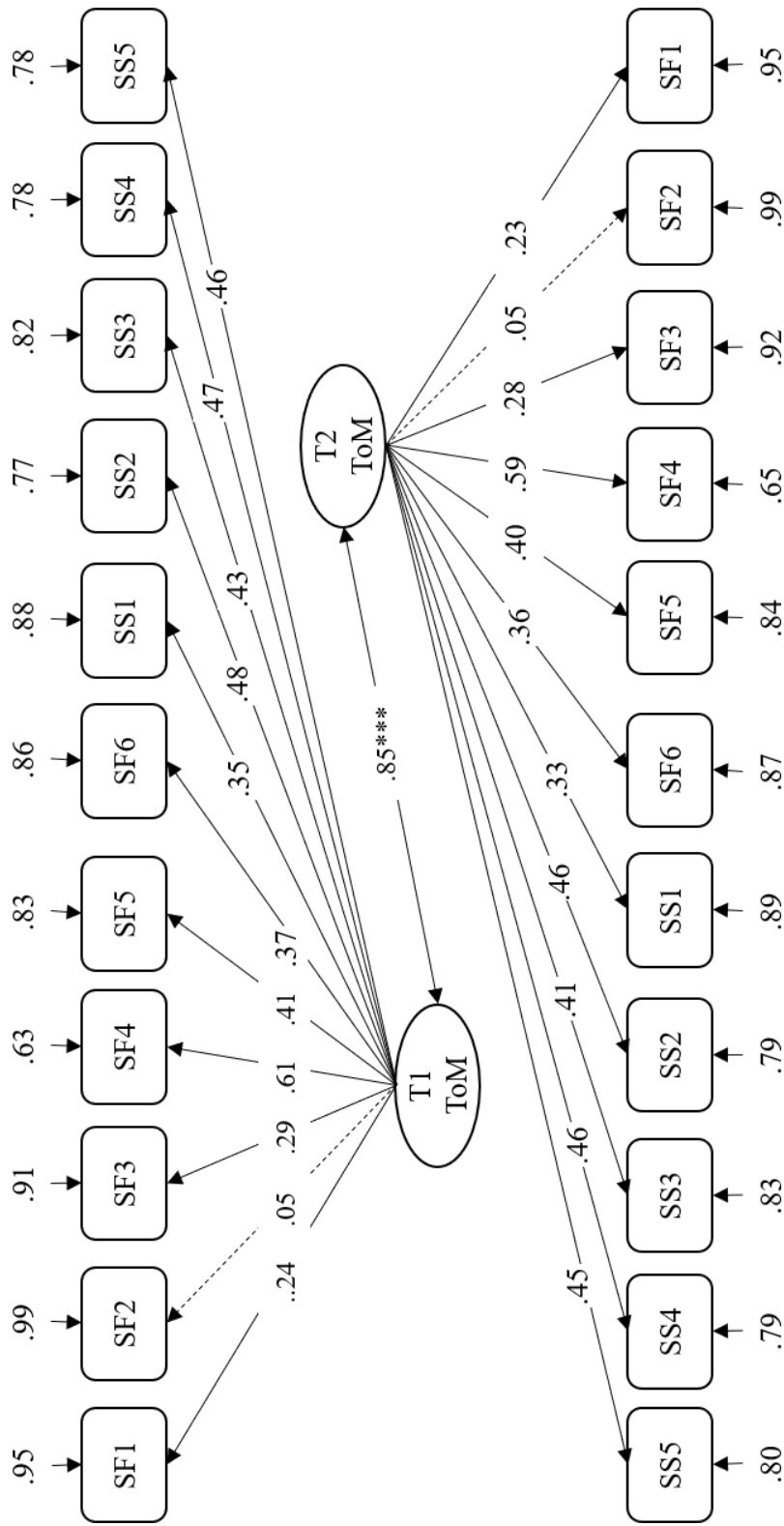
**Discussion**

The present study investigated the psychometric properties of a composite advanced ToM score made up of items from the Strange Stories and the Silent Films tasks in a sample of Italian children ranging in age between 8 and 12. Moreover, in order to contribute to the field of investigation on ToM ability in middle childhood we tested stability of individual differences in children's performance on this ToM composite battery over a period of 5-months.

From a methodological perspective, the present study adds to previous findings regarding the validity and reliability of a composite ToM battery made up of item from the Strange Stories and the Silent Films task (Devine & Hughes, 2016) by extending its validity and factor structure to an Italian sample of 247 school-aged children ranging in age between 8 and 12 years. Specifically, the present study provides further support to the convergent validity of the Strange Stories and Silent Film tasks in that they were highly inter-correlated, and their inter-correlation couldn't be explained by variation in age, verbal ability, SES and gender. Futhermore, items from both tasks loaded onto a single latent ToM factor which was invariant across gender and showed stability over a period of 5-months. In summary, results from the present study indicate that the Strange Stories and the Silent Films tasks are valid and reliable measures of ToM skills in Italian children and encourage researchers to use them in future works. Notably, beside these promising results, it is important to stress that one item of the Silent Films task didn't load on its respective latent factor at both time-points in our sample. It is possible that cultural differences might account for this finding. More broadly, future works involving both Italian and British children are needed to test for

potential differential item functioning (DIF) across these countries, just as previously done with a False-Belief battery (Hughes et al., 2014). Furthermore, regarding the multi-group comparison across age-groups we found that, although a model solution could be fitted that was suitable for both 9 and 11 years old children, CFI and TLI indices of model fit were low, indicating poor item correlations when the over sample was divided by age, especially with respect to the silent film tasks' items within the younger age-group. This pattern of results seems to be indicating a lower cohesion among items from the Silent Film task in children younger than 10. Nevertheless, future studies are needed to replicate this pattern within a larger sample.

The present results have also theoretical implications in that they contribute to the emerging topic on ToM ability in middle childhood. Empirical studies in this field have reported longitudinal associations between performance on the Strange Stories and the Silent Films tasks and early children's performance of classic False-Belief tasks (Devine et al., 2015), supporting the idea that early individual differences in ToM may provide an index of lasting variation in children's ability to reason about others' mind. In other words, children who perform poorer than peers during the preschool years, are likely to lag behind them also in middle childhood. From a theoretical perspective, this idea falls in line with the "genuine variation" account of individual differences in ToM (Hughes & Devine, 2015), which claims that individual variation in ToM in childhood may reflect a genuine predisposition toward reading others' mind rather than just a developmental lag of some children behind other children. Although our results are limited in that they speak only to a short time interval (5-months), they contribute to such a growing body of literature suggesting the possibility that individual differences in ToM may

continue to be hightly stable across middle childhood (Banerjee et al., 2011; Lecce, Zocchi, Pagnin, & Palladino, 2010).

Results from the present study also echo previous research on preschoolers by showing that variability in performance on the ToM composite battery was positively associated with variation in verbal ability and age and also sensitive to gender differences, with a tendency for girls to outperform boys (Devine & Hughes, 2016). Nevertheless, in contrast with previous findings by Devine and Hughes (2015), we didn't find any association between ToM and SES. However, a poor variability in the low end of the Family Affluence Scale (Currie et al., 2008) within our sample suggests that we might have not recruited a sufficiently socially diverse sample of children. This is a limitation of the present study and should be taken into account when interpreting the nonsignificant association among ToM and SES. Related to this point is a further limitation that should be mentioned. That is, the recruitment of the entire sample from the same school. Such selective recruitment threatens the generalizability of the present results to the Italian population. Future study on the validity and reliability of advanced ToM tasks in the Italian samples should recruit a wider and socially diverse sample of children. Notably, this would be particularly relevant in studies aimed to assess measurement invariance of these tasks across countries. In conclusion, notwithstanding these potential limitations, the replication in our sample of the psychometric properties of a valid and reliable battery for the assessment of advanced ToM skills in middle childhood (Devine & Hughes, 2016), allows us to adopt this composite measure to test the association between ToM and peer relationships in middle childhood in the next chapters of the present thesis.

# Chapter 2 – Theory of Mind and peer relationships: The role of social behaviour

**Abstract**

Individual differences in Theory of Mind (ToM) in middle childhood have been linked to variations in the quality of children's relationships with classmates. The present study investigated this expected association more deeply over time by focusing on the mediation role played by children's social behaviour. We adopted a short-term longitudinal study with three time-points of data collection over one year and followed 247 children aged 9 or 11 years at the first time-point, respectively. At each time-point we evaluated children's verbal ability, ToM, peer relationships, and prosocial and aggressive behaviour with classmates, as reported by teachers. We adopted a multi-group cross-lagged modelling approach to track similarities and differences in pathways between age-groups. Results showed that higher aggressive behaviour at Time 2 mediated a negative association between Time 1 peer rejection and Time 3 ToM within both age-groups, as well as a reciprocal negative association between ToM at Time 1 and peer rejection at Time 3 within the younger group only. Furthermore, among both age-groups, prosocial behaviour concurrently mediated a positive indirect association between ToM and peer acceptance at Time 1. In addition, prosocial behaviour at Time 2 positively predicted ToM at Time 3. Results were independent of children's verbal ability, SES and autoregressive effects. The present study extends our knowledge about the social predictor and consequences of ToM in middle childhood. It allows new insight into the potential role of social behavior in explaining both how individual

differences in ToM affect children's peer relationships in middle childhood, as well as how children's relationships with classmates affect ToM development during the school years.

**Introduction**

As anticipated in the general introduction, children's ToM abilities continue to progress, as well as to show marked individual differences in middle childhood (Apperly et al., 2011; Banerjee et al., 2011; Dumontheil et al., 2010). Notably, such evidences open the way to the investigation of the social predictors and consequences of ToM advancement and variability during the school years. On one hand, the increased complexity of children's social environment as they moved into primary school and spent a greater amount of their time with peers (Rubin, Bukowski, & Parker, 2006) is likely to contribute to ToM development in middle childhood (Carpendale & Lewis, 2004). On the other hand, advancement in children's ToM skills are likely to support children's peer relationships and social adjustment within the school context (Hughes, 2011). In other words, ToM is likely to transform and being transformed by children's social environment in middle childhood, just as during the preschool years (Hughes and Leekam, 2004). Supporting this view, recent research in this area has provided the first evidence of a longitudinal bidirectional association between individual's ToM skills and variation in the quality of their peer relationships in middle childhood (Banerjee et al., 2011). Nevertheless, studies in this area are still rare and, moreover, no study has explored the potential mechanisms underpinning such bidirectional association. The present study is designed to address this gap in literature by investigating the role played by children's social behaviour as potential mediator in this bidirectional

association over time. Notably, social behaviour has been highlighted to be a proximal correlate of ToM (Caputi, Lecce, Pagnin, & Banerjee., 2012; Holl, Kirsch Rohlf, Krahé, & Elsner, 2018) that can influence (Rubin et al., 2006) and is being influenced by (Gazelle & Rudolph, 2004; Werner & Crick, 2004) peer relationships. Thus, considering the role of social behaviour may help to understand how individual differences in ToM can translate into children's positive relationships with classmates, as well as to clarify the way through which peer relationships can influence ToM development in middle childhood.

**Theory of Mind and social relationships in middle childhood**

The idea that individual differences in ToM are related to children's social relationships has a long tradition in developmental psychology (Carpendale & Lewis, 2004; Hughes & Leekam, 2004). However, studies on this topic have been predominantly conducted on pre-schoolers, with the exploration of the link between individual differences in ToM and children's social relationships at school being a very recent area of investigation (Hughes, 2016).

A recent meta-analysis by Slaughter, Imuta, Peterson, and Henry (2015) has demonstrated that there is a weak but significant concurrent association between individual differences in ToM and individual variation in social acceptance and rejection by peers in children ranging in age from 2 to 10 years. Moreover, authors showed that these associations were: a) equivalent for preschool-aged (2–5 years) and school-aged (6–10 years) children, b) stronger among girls compared to boys, and c) stronger for positive than negative peer nominations. However, it is important to note that only two studies included in the meta-analysis have involved children older than 7 years and have adopted an individual differences approach. The first is a cross-sectional study by Banerjee and Watling (2005) in which authors

found a significant concurrent association between children's understanding of Faux Pas and peer rejection (but not peer acceptance) in 8-9 years old children. The second study is a longitudinal follow-up of the previous one in which Banerjee and colleagues (2011) followed two cohorts of children (respectively 6 and 9 years of age at the first-time-point) over a period of two years. They found that, in the younger cohort, peer rejection at age 6 predicted poorer ToM (Faux pas understanding) at age 7. Moreover, they identified a recursive longitudinal pattern of associations between ToM and peer rejection in the older cohort. That is, early peer rejection at age 9 predicted poorer ToM performance one year later, which, in turn, explained greater peer rejection at age 11. In addition, ToM performance at age 9 also positively predicted peer acceptance at age 10. These findings are promising as they support the idea that ToM might matter for children's social relationships in the school context. Furthermore, the finding by Banerjee and colleagues (2011) of a bidirectional recursive association between ToM and peer relationships underlines the close connection that is likely to exist between children's social experience with peers and their ToM development in middle childhood. In particular, the idea that social relationships are important for ToM development in middle childhood reaffirms previous longitudinal and training studies showing that ToM development in early childhood and during the preschool years can benefit from ToM-relevant social experience (Peterson & Slaughter, 2003; Ruffman et al., 1999). More broadly, all these findings theoretically build upon the social learning theory formulated by Carpendale & Lewis (2004), which emphasise the construction of social understanding within the context of social interactions. Notably, although Carpendale and Lewis built their theoretical formulation on research showing the importance of child-parents' interactions for

children socio-cognitive development until the age of 5, there is general consensus among developmental researchers in considering peer relationships a key context for ToM changes in middle and late childhood, as well (Banerjee, 2004; Zerwas, Balaraman, and Brownell, 2004). Nevertheless, while we know a lot about how social experience within the family context contributes to ToM development in early childhood, we still know very little about the specific social processes that may account for advanced ToM development in the context of school. As a starting point, Banerjee and colleagues (2011) showed that peer rejection - and not peer acceptance - was the key antecedent of ToM development in middle childhood, suggesting that facets of social experience connected with rejection may be particularly detrimental for ToM development at this age.

**ToM and peer relationships: The role of social behaviour**

Social competence can be defined as the ability to achieve one's own social goals while preserving a balance between self and other needs (Rose-Krasnor, 1997). According to this definition, social behaviour might play a crucial role in children's social success within the context of peer relationships at school (Rubin et al., 2006). Past research has largely investigated the associations between children's social behaviour and the quality of their experience with peers (see Ladd, 1999 for a review). In general, research in this field supports the view that where poor socially competent behaviours (e.g., antisocial and disruptive behaviours) are commonly causes of poor peer relations (e.g. peer rejection), socially competent behaviours with classmates (e.g., prosocial behaviour) commonly lead to positive social outcomes, such as higher peer acceptance (See Coie, Dodge, & Kupersmidt, 1990 for a review). Specifically, aggressive behaviour has been highlighted as a key correlate and predictor of peer rejection in early childhood (Cillessen, Van

IJzendoorn, Van Lieshout, & Hartup, 1992); Newcomb, Bukowski, & Pattee, 1993; Vitaro, Tremblay, Gagnon, & Boivin, 1992) and across the school years (Bierman, Kalvin, & Heinrichs, 2015). On the contrary, prosocial behaviours, defined as any voluntary action that is performed to benefit another individual (Eisenberg, 2003), has been highlighted as a predictor of peer acceptance (Caputi et al., 2012; Gifford-Smith & Brownell, 2003; Rubin et al., 2006).

Supporting the possibility that children's social behaviour could mediate the social expression of children's ToM skills within peer relationships, existing research studies suggest that social-cognition is likely to ground children's social competence (Banerjee & Henderson, 2001; Devine & Hughes, 2016; Peterson, Slaughter, Moore, & Wellman, 2016) and, more specifically, that ToM is associated with variation in children's expression of both more prosocial (see Imuta, Henry, Slaughter, Selcuk, & Ruffman, 2017 for a meta-analysis) and less aggressive behaviour (Holl et al., 2018). For example, Caputi and colleagues (2012) showed that variation in prosocial behaviour with peers mediated a positive longitudinal association between early ToM and later peer acceptance and rejection moving from the preschool to the early school years. This finding supports the idea that engaging in prosocial behaviour with peers might require children's ability to recognize others' needs and desires. Thus, prosocial behaviour may convey the positive effect of good ToM on later positive peer relationships. Notably, a recent meta-analysis by Imuta and colleagues (2017) has shown that there is a significant association between ToM and prosocial behaviour in children ranging from 2 and 10 years suggesting that prosocial behaviour could mediate the association between early ToM and later peer relationships also later on in development.

Finally, it is important to note that theoretical accounts exist suggesting that the association between ToM and prosocial behaviour may well be a bidirectional one (Astington, 2003; Imuta et al., 2016; Weller & Lagattuta, 2014). According to this view, prosocial interactions with others promote ToM as this kind of interactions require children to pay attention to other's mental states in the attempt to attune their behaviour to others' feeling and needs. Building on this theoretical view, we examined bidirectional relations between ToM and prosocial behaviour and tested the hypothesis that prosocial behaviour could predict ToM development in middle childhood.

If, on one hand, prosocial behaviour could explain how good social understanding promotes children's positive relationships with peers at school, aggressive behaviour, on the other hand, could explain how poor social understanding can increase children's risk of being rejected by peers. Indeed, a number of research studies have highlighted a negative association between children's social understanding and children's expression of aggressive behaviour with peers (Gomez-Garibello & Talwar, 2015; Hoglund, Lalonde, & Leadbeater, 2008; Holl et al., 2018; Kokkinos, Voulgaridou, Mandrali, & Parousidou, 2016). For example, Hoglund and colleagues (2008) have shown that children's performance at age 7 on an interpersonal perspective co-ordination task, in which children were asked to attribute mental states to characters in stories depicting a peer victimization scenario, negatively predicted behavioural and adjustment problems one year later, including aggressive behaviour and peer rejection. Moreover, Holl and colleagues (2018) explored the longitudinal association between ToM and aggressive behaviour following 1657 school-aged children (mean age of 8 years at the first time-point) over a period of three years and showed

that early ToM was a negative predictor of both subsequent physical and relational aggression between time 1 and time 2 (9-months), as well as between time 2 and time 3 (24-mounts). Similarly, Kokkinos and colleagues (2016) showed that, in a group of children age 10 to 12, a composite ToM score including items from both the Strange Stories task, the Faux Pas task and the ToM scale, was negatively associated with concurrent relational aggression. Moreover, Kokkinos and colleagues (2016) also showed that higher ToM scores were concurrently associated with lower moral disengagement, which mediated the negative association between ToM and relational aggression.

It is worth noting that, while literature has consistently reported a negative association between ToM and direct form of aggressive behaviour (e.g., verbal and/or physical), findings are more controversial when focusing on indirect (or relational) form of aggression. Indeed, some works have reported a positive association between measures of social cognition and indirect forms of aggressive behaviour (e.g. Kaukiainen, Björkqvist, Lagerspetz, Österman, Salmivalli, Rothberg, & Ahlbom, 1999; Sutton, Smith, & Swettenham, 1999), especially for low level of prosocial behaviour (Renouf, Brendgen, Parent, Vitaro, David Zelazo, Boivin, M., ... & Séguin, 2010). Researchers in this area claim that ToM is a neutral tool and its development may even inform more sophisticated form of aggressive behaviour aimed to pursue antisocial goals (Sutton et al., 1999). Partially clarifying such inconsistency across studies, a recent study by Gomez-Garibello & Talwar (2015) showed that the valence of the association between ToM and indirect forms of aggressive behaviour is likely to change according to age. Specifically, they found a significant and positive association between ToM and indirect aggression in children younger than 9.5 years that becomes negative and significant in children

older than 9.5 years. Authors interpreted these results considering that ToM development co-occur and interact with development in other social, cognitive and emotional domains (e.g., Empathy) which are likely to moderate the valence of the behavioural expression of advanced ToM skills in middle childhood (see also Caravita, Di Blasio, & Salmivalli, 2010). However, another possible explanation to the controversial findings regarding the valence of the link between ToM and aggression is that studies reporting a positive association between ToM and aggressive behaviour commonly focus on a specific form of aggressive behaviour, that is bullying (e.g., Sutton et al., 1999). This form of negative behaviour is characterized by being goal-oriented, proactive, repeated over time and oriented toward a less powerful victims (Camodeca & Goossens, 2005; Olweus, 1993) and may involve different motivations compared to reactive or less stable form of aggression. Moreover, bullies and especially ringleader bullies, have shown to possess leaderships skills, that are likely to require advanced ToM competences (Garandeau & Cillessen, 2006). In summary, direct aggression, indirect aggression and bullying may well be entailing differential association with ToM skills. Given our main interest in exploring the mechanisms underpinning the association between poor social understanding and peer rejection, in the present study we focused on direct forms of aggressive behaviour (physical and verbal). Although direct and indirect forms of aggressive behaviour continue to be highly intercorrelated across middle childhood, direct aggression is more likely to be negatively related to ToM and is a stronger predictor of peer rejection than indirect aggression (see Card, Stucky, Sawalani, & Little 2008 for a meta-analysis).

Finally, building on the finding by Banerjee and colleagues (2011) of a recursive pattern of associations between ToM and peer rejection during the school

years, in the present study we adopted a cross-lagged modelling approach and investigated whether aggressive behaviour could mediate the link between early rejection and later ToM. Our theoretical rationale to investigate such mediation pattern built on research studies indicating the existence of a developmental cascade involving peer rejection, aggressive behaviours and biased social cognition from kindergarten to grade 3 (Dodge, Lansford, Burks, Bates, Pettit, Fontaine, & Price, 2003; Lansford, Malone, Dodge, Pettit, & Bates, 2010), which is likely to expand into late childhood and also involve ToM development (Holl et al., 2018). On one hand, peer rejection has been shown to increase aggressive behaviours over time, over and above previous level of aggression (Dodge et al., 2003). On the other hand, engaging in aggressive behaviours with peers has been shown to reiterate pattern of biased social cognition over time (Holl et al., 2018; Lansford et al., 2010). Engaging in aggressive behaviour with peers in response to peer rejection may contribute to rejected children's negative expectations about others' behaviour and intentions (Crick & Dodge, 1994), which, in turn, are likely to affect the quality of children's processing of ongoing social situations and to limit children's opportunity to learn about others' mind within such situations.

In summary, in the present study we adopted a bidirectional view on the link between ToM, aggressive behaviour and peer relationships and tested the hypothesis that children engagement in aggressive behaviour as consequence of peer rejection experiences may carry, at least in part, the negative impact of peer rejection on later ToM development.

**The present study**

The present short-term longitudinal study, involving three time-points of data collection over a 1-year period aimed to test the hypothesis that social

behaviour mediates the longitudinal interplay between ToM and peer relationships in middle childhood. Specifically, aggressive behaviour with peers was expected to mediate a negative bidirectional association between ToM and peer rejection in both the directions. Namely, from early ToM to later peer rejection and from early peer rejection to later ToM. Moreover, prosocial behaviour with classmates was expected to mediate a positive longitudinal association between early ToM and later peer acceptance. To test these hypotheses, we evaluated at each time-point, children's ToM, sociometric scores and prosocial and aggressive behaviour with peers, gathering each variable using different source of information in order to reduce artificial potential overlap between different constructs. Specifically, we assessed ToM adopting two advanced socio-cognitive tasks (the Strange Stories and the Silent Films tasks), children's social acceptance and rejection within classroom adopting a sociometric peer nomination technique and children's social behaviour relying on a teacher's report questionnaire (see the procedure and measures sections for more details). We also measured and controlled for children's verbal ability and SES in our analyses.

We addressed our hypotheses adopting a cross-lagged modelling approach, as it allows us to take a bidirectional perspective on the investigated paths (Selig & Little, 2012). Moreover, given the considerable range in the ages of our sample, we divided our sample into two age-groups (aged respectively 9 and 11 at the first time point) and analysed our data adopting a multi-group modelling approach to account for potential differences in the hypothesized longitudinal pathways as children progress through middle childhood.

## Method

### Participants

In the present study, the sample of 247 Italian children, described in the previous chapter was divided into two age-groups by the mean age. The younger group consisted of 120 children (57 boys and 63 girls) aged approximately 9 years (M = 8.93, SD = .54, Range = 7.95 - 9.88), and the older group consisted of 127 children (69 boys and 58 girls) aged approximately 11 years (M = 11.05, SD = .61, Range = 9.94 – 12.47). One child belonging to the older group was absent at Time 2 and 7 children (1 from the younger and 6 from the older group) changed school at Time 3. A full information maximum likelihood estimation was used in the modelling analysis to handle these missing values.

### Procedure

The first time-point of data collection took place in December 2015, 3-months after children started the school year. Children were then retested 5-months later (Time 2), at the end of the school year and 10-months later (Time 3), at the beginning of the next school year. At each time-point children completed two different ToM tasks – the Strange Stories (Happè, 1994) and Silent Films Tasks (Devine & Hughes, 2013) – and sociometric nominations (Coie, Dodge, & Coppotelli, 1982). Children also completed a socioeconomic status questionnaire (Family Affluence Scale; FAS; Currie et al., 2008) and a verbal ability test (Mill Hill Vocabulary Test, MHVS; Raven & Rust, 2008) at Time 1. Finally, children's prosocial and aggressive social behaviour with peers were measured at each time-point by asking their main teacher to complete the "prosocial with peers" and "aggressive with peers" subscales of the Child Behaviour Scale (Ladd & Profilet, 1996).

**Measures**

To avoid repetitions, are reported here only measures not already described in the previous chapter.

**Peer Nominations.** The sociometric indices of peer acceptance and peer rejection were obtained via the peer nomination procedure described by Coie and colleagues (1982). Each child was asked to indicate the name of three peers whom he or she most and least liked. Each child was allowed to nominate only peers belonging to his or her classroom. Cross-gender nominations were permitted. Each child's individual Most-Like (ML) and Least-Like (LL) scores were standardized within classroom to control for the group size.

**Social Behaviour.** The Child Behaviour Scale – Teacher Form (CBS - Ladd & Profilet, 1996) is a 35-item questionnaire that measure children's behaviour with peers at school. The "prosocial with peers" and the "aggressive with peers" subscales are both made up of 7 items. An item example for the "prosocial" subscale is "*offers help to other children*" and for the "aggressive" subscale is "*is aggressive towards other children*". Teachers were instructed to rate the behaviour described in each item on a 3-point response scale in terms of how characteristic it was for the child they were rating. Scale point were labelled as follow: 1 = *doesn't apply*; 2 = *applies sometimes*; 3 = *certainly applies*. Score for each subscale could range from 7 to 21. The mean cronbach's alpha across time for "aggressive with peers" subscale was .87. The mean cronbach's alpha across time for "prosocial with peers" subscale was .92.

## Results

### Data Reduction and Descriptive Statistics

On the basis of preliminary correlational and confirmatory factor analysis (see chapter 1), our main analyses were conducted using an aggregate ToM measure obtained by summing $z$ scores on Strange Stories and Silent films tasks. This procedure is also consistent with existing literature (Lecce, Bianco, Devine & Hughes, 2017; Devine & Hughes, 2016) and helped us in reducing the number of variables. Table 2.1 shows raw descriptive statistics for the study measures, separately for younger and older children. Note that for descriptive analyses and mean comparisons we computed an aggregate ToM score by adding proportion of success in the Silent Film (raw scores divided by 6) and the Strange Stories (raw score was divided by 5) to avoid the problem of standardized scores having a mean of 0 and standard deviation of 1 at each time-point.

We first examined the developmental trajectory for ToM across time, as well as age-group and gender related differences in ToM performance within and across time. A mixed design analysis of variance was conducted on the aggregate ToM score, with age-group and gender between subjects and time-point within subjects. Verbal ability score was included as a covariate. The analysis yielded a main effect of age-group, $F(1, 234) = 14.83$, $p < .001$, with older children scoring higher than younger children ($M_{OLD} = 2.70$, $SE_{OLD} = .04$ vs. $M_{YNG} = 2.47$, $SE_{YNG} = .04$), and a main effect of gender, $F(1, 234) = 11.87$, $p < .001$, with girls scoring higher than boys ($M_F = 2.67$, $SE_F = .04$ vs. $M_M = 2.50$, $SE_M = .04$). There was also a significant main effect of the verbal ability covariate, $F(1, 235) = 35.73$, $p < .001$. Notably, over and above this basic developmental and gender contrast, there was a

significant increasing quadratic effect of time, $F(1, 234) > 6.67$, $p < .01$. More in detail, ToM increases between Time 1 and Time 2 and reachs a plateau between Time 2 and Time 3. Notably, such effect was independent of gender and age-group, as none of the interaction term between time-point and neither age-group nor gender were significant.

Notably, none of children performed at ceiling on the composite ToM score at any time-point. Moreover, distributions of the ToM composite score were symmetrical and did not significantly deviate from normality, except for Time 2 and Time 3 scores in the older group only. However, in both cases, negative skewness values were greater than -1 (Muthén & Kaplan, 1985), and only 21% of the children got scores higher that the 75% percentile. Thus, suggesting that ToM tasks had still room for detect changes in ToM growth between Time 2 and Time 3 even in the older group.

A further set of mixed design analysis of variance was performed to examine age-group and gender related differences in the social behaviour scores within and across time, with verbal ability score included as a covariate. The analysis yielded only a main effect of gender on both aggression, $F(1, 235) = 32.92$, $p < .001$, and prosocial behaviour, $F(1, 235) = 31.14$, $p < .001$, with girls being generally rated by teachers as less aggressive ($M_F = 8.64$, $SE_F = .23$ vs. $M_M = 10.49$, $SE_M = .23$) and more prosocial ($M_F = 16.54$, $SE_F = .29$ vs. $M_M = 14.24$, $SE_M = .29$) than boys.

Tables 2.2 and 2.3 show correlations among all the study variables both within and across time-points for the younger and older groups, respectively. As can be seen peer relationships and social behavior shared both concurrent and across time association with either verbal ability and SES among both age-groups.

Moreover, individual differences in verbal ability predicted variability in ToM at each time-point among both age-groups, while individual differences in SES predicted variability in ToM at Time 2 and Time 3 among the older age-group only. Given these associations, verbal ability and SES have been included as covariates in the following modelling analyses.

Table 2.1 - Descriptive statistics for all the study measures, separated by younger and older children.

| | | | Young Group | | | | | Older Group | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | N | Min | Max | Mean | SD | N | Min | Max | Mean | SD |
| T1 | SES | 120 | 2 | 9 | 6.71 | 1.52 | 127 | 3 | 9 | 6.94 | 1.54 |
| | VA | 120 | 13 | 30 | 26.18 | 3.50 | 127 | 20 | 30 | 28.28 | 1.90 |
| | ToM | 120 | .57 | 3.47 | 2.01 | .58 | 127 | 1.10 | 3.63 | 2.42 | .56 |
| | Agg | 120 | 7 | 18 | 9.41 | 2.44 | 127 | 7 | 21 | 9.74 | 3.10 |
| | Pro | 120 | 8 | 21 | 15.50 | 3.63 | 127 | 7 | 21 | 16.01 | 3.98 |
| T2 | ToM | 120 | .57 | 3.67 | 2.55 | .56 | 126 | 1.60 | 3.83 | 2.94 | .49 |
| | Agg | 120 | 7 | 20 | 9.54 | 3.03 | 127 | 7 | 21 | 9.61 | 3.30 |
| | Pro | 120 | 7 | 21 | 15.37 | 4.07 | 127 | 7 | 21 | 15.50 | 4.03 |
| T3 | ToM | 119 | 1.27 | 3.63 | 2.59 | .51 | 121 | 1.57 | 3.83 | 2.91 | .49 |
| | Agg | 119 | 7 | 21 | 9.78 | 3.40 | 121 | 7 | 17 | 9.49 | 2.42 |
| | Pro | 119 | 7 | 21 | 15.10 | 3.77 | 121 | 7 | 21 | 14.65 | 4.04 |

*Note.* SES= Socioeconomic status; VA = Verbal ability; ToM= Theory of Mind; Agg = Aggressive behaviour;

Pro = Prosocial behaviour.

Table 2.2 - Correlations between study measures within and across time-points (Younger age-group)

| Measures | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 1. SES | .20* | .01 | .29** | -.17 | .01 | .14 | .15 | .36** | -.30** | -.06 | .01 | .06 | .23* | -.22* | .00 | -.02 |
| 2. VA | - | .28** | .18* | -.25** | -.16 | .31** | .23* | .20* | -.32** | -.24** | .29** | .35** | .18 | -.22* | -.25** | .24** |
| 3. ToM | | - | .02 | -.07 | -.02 | .19* | .47** | .03 | -.05 | -.12 | .17 | .42** | .01 | -.07 | -.16 | .29** |
| 4. ML | | | - | -.46** | -.21* | .24** | .08 | .65** | -.39** | -.25** | .24** | .03 | .53** | -.42** | -.19* | .20* |
| 5. LL | | | | - | .43** | -.40** | -.17 | -.37** | .81** | .50** | -.44** | -.11 | -.35** | .85** | .37** | -.28** |
| 6. AGG | | | | | - | -.39** | .01 | -.06 | .34** | .84** | -.49** | -.15 | -.02 | .46** | .75** | -.43** |
| 7. PRO | | | | | | - | .12 | .14 | -.31** | -.40** | .73** | .16 | .14 | -.39** | -.28** | .63** |
| T2 8. ToM | | | | | | | - | .10 | -.20* | -.02 | .15 | .48** | .08 | -.11 | -.01 | .13 |
| 9. ML | | | | | | | | - | -.40** | -.17 | .18* | .00 | .62** | -.39** | -.14 | .16 |
| 10. LL | | | | | | | | | - | .45** | -.32** | -.09 | -.36** | .87** | .34** | -.17 |
| 11. AGG | | | | | | | | | | - | -.61** | -.11 | -.07 | .55** | .85** | -.58** |
| 12. PRO | | | | | | | | | | | - | .26** | .12 | -.40** | -.47** | .76** |
| T3 13. ToM | | | | | | | | | | | | - | .06 | -.07 | -.09 | .20* |
| 14. ML | | | | | | | | | | | | | - | -.38** | -.03 | .07 |
| 15. LL | | | | | | | | | | | | | | - | .40** | -.26** |
| 16. AGG | | | | | | | | | | | | | | | - | -.54** |
| 17. PRO | | | | | | | | | | | | | | | | - |

*Note.* SES= Socioeconomic Status; VA = Verbal ability; ToM= Theory of Mind; AGG= Aggressive behaviour; PRO = Prosocial

behaviour; ML=Most-like nominations; LL= Least-like nominations. $+p \leq .10$ $*p \leq .05$ $**p \leq .01$ $***p \leq .001$.

Table 2.3 - Correlations between study measures within and across time-points (Older age-group)

| Measures | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 1. SES | .25** | .15 | .36** | -.20* | -.18* | .14 | .36** | .30** | -.24** | -.07 | .13 | .29** | .21* | -.18 | -.12 | .13 |
| 2. VA | - | .23** | .11 | -.12 | .01 | -.01 | .26** | .08 | -.22* | .00 | .04 | .31** | .05 | -.19* | -.01 | -.03 |
| 3. ToM | | - | .15 | -.08 | -.09 | .20* | .47** | .20* | -.15 | -.20* | .22* | .38** | -.07 | -.18* | -.15 | .18* |
| 4. ML | | | - | -.37** | -.04 | .18* | .21* | .70** | -.32** | -.02 | .13 | .01 | .56** | -.30** | -.05 | .19* |
| 5. LL | | | | - | .39** | -.26** | -.16 | -.40** | .73** | .44** | -.27** | -.03 | -.39** | .64** | .30** | -.23* |
| 6. AGG | | | | | - | -.43** | -.14 | -.18* | .24** | .70** | -.42** | -.18* | -.02 | .16 | .54** | -.33** |
| 7. PRO | | | | | | - | .23* | .21* | -.25** | -.53** | .66** | .26** | .08 | -.21* | -.36** | .62** |
| T2 8. ToM | | | | | | | - | .34** | -.18* | -.11 | .18* | .52** | .07 | -.20* | -.09 | .21* |
| 9. ML | | | | | | | | - | -.40** | -.18* | .27** | .06 | .49** | -.34** | -.17 | .27** |
| 10. LL | | | | | | | | | - | .37** | -.34** | -.01 | -.31** | .77** | .23* | -.22* |
| 11. AGG | | | | | | | | | | - | -.61** | -.18* | .05 | .25** | .60** | -.39** |
| 12. PRO | | | | | | | | | | | - | .23* | .09 | -.23* | -.44** | .48** |
| T3 13. ToM | | | | | | | | | | | | - | .00 | -.02 | -.10 | .28** |
| 14. ML | | | | | | | | | | | | | - | -.33** | .04 | .06 |
| 15. LL | | | | | | | | | | | | | | - | .20* | -.25** |
| 16. AGG | | | | | | | | | | | | | | | - | -.29** |
| 17. PRO | | | | | | | | | | | | | | | | - |

*Note.* SES= Socioeconomic Status; VA = Verbal ability; ToM= Theory of Mind; AGG= Aggressive behaviour; PRO = Prosocial behaviour;

ML=Most-like nominations; LL= Least-like nominations. $+p \leq .10$ $*p \leq .05$ $**p \leq .01$ $***p \leq .001$.

**Main analysis plan**

Main aim of the present study was to evaluate the mediation role of children's prosocial and aggressive behaviour in the longitudinal association between individual differences in ToM and, respectively, variation in children's peer acceptance and rejection in middle childhood. Thus, we adopted a cross-lagged modelling approach with Mplus (version 7.4; Muthen & Muthen, 2012) and conducted separate analyses to address, on one hand, the mediation role of aggressive behaviour in the longitudinal association between ToM and peer rejection and, on the other hand, the mediation role of prosocial behaviour in the longitudinal association between ToM and peer acceptance. This approach allowed us to tackle our specific hypotheses and to simplify our analyses. Nevertheless, as further analyses we also investigated and reported in the results section the mediation role of prosocial behaviour in the link between ToM and peer rejection, as well as that of aggressive behaviour in the link between ToM and peer acceptance.

Each model included all autoregressive paths connecting the same variable over the three time-points as well as cross-lagged associations among ToM, social behaviour (SB), and social relationships (SR) from Time 1 to Time 2 and from Time 2 to Time 3. In order to estimate accurately the mediation effect of social behaviour in the association between ToM and social relationships we also included cross-lagged direct effects between ToM and social relationships from Time 1 to Time 3. We also included verbal ability, and SES as control variables, predicting all the variables at each time-point. Finally, we allowed error terms for all the variables to covary within time-points in order to account for within-time associations between

variables over and above the longitudinal links. See Figure 2.1 for a prototypical example of the cross-lagged models to be tested.

Notably, according to a multi-group modelling approach, we compared models across younger and older children by specifying an unconstrained multi-group model, in which each path in the model were freely estimated for each age-group, and then applying equality constraints on all paths between variables, such that the estimated coefficients were constrained to be equal for younger and older age-groups. If the chi-square difference test between the unconstrained and constrained model revealed a significant deterioration of fit following the inclusion of the equality constraints, it would mean that some of the pathways were significantly different for older than for younger children. In this case, the relevant pathways can be identified by looking at the model modification indices (MI) and, specifically, at which pathways would lead to improvements in the model fit if freely estimated across age-groups. Equality constraints for each of these pathways are relaxed one at a time starting from that with the highest MI value. Thanks to this procedure, it is possible to create the most parsimonious multi-group model in which all pathways with significant group differences could vary across age-groups and all the other paths were constrained to be equal. Finally, we compared this partially-constrained model with the initial totally unconstrained model and provided a final multi-group model excluding the pathways that were nonsignificant in both groups.

A full information maximum likelihood estimation was used to handle missing values. All models were tested using the Robust Maximum Likelihood estimator to account for non-normal multivariate distribution in the data and nested

models' comparisons were conducted using the Satorra-Bentler scaled chi-square difference test (Santor & Bentler, 2001). Following recommendations by Hu and Bentler (1998), we determined good fit relying on the maximum likelihood-based fit indexes suitable for models with $N$s < 250. More in detail, comparative fit index (CFI) and standardized root mean square residual (SRMR). Hu and Bentler suggest cutoffs of approximately CFI > .95 and SRMR < .08 to determine good fit. Notably, we also reported the chi-square value and degree of freedom for each model but, according to literature showing that the chi-square test of model fit is sensitive to multivariate non-normality (McIntosh, 2006) and to small sample sizes (Kenny and McCoach, 2003), we mainly relied on CFI and SRMR to establish goodness of fit.
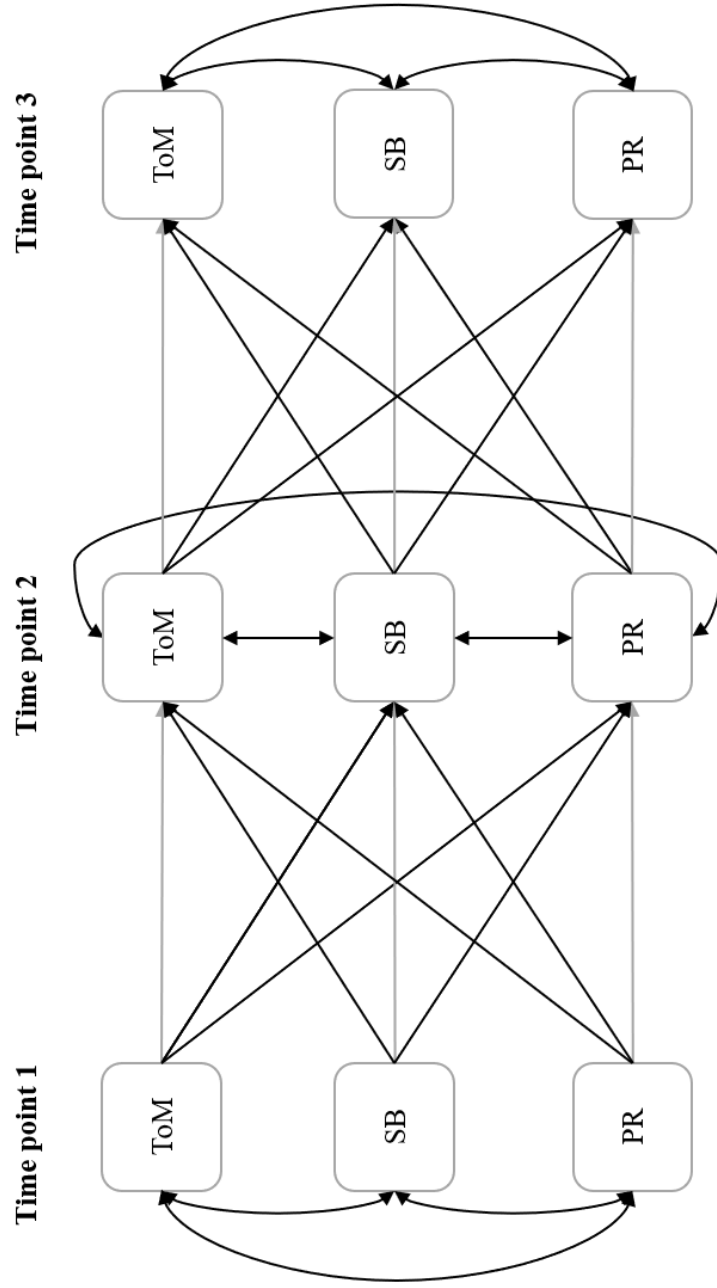
Figure 2.1 – Prototipical model example



*Figure 2.1.* Model to be tested across groups (unconstrained and constrained), showing autoregressive and cross-lagged effects of Theory of Mind (ToM, socal behaviour (SB) and Peer relationships (PR) over the three time-points. Effects of control variables and cross-lagged direct effects between ToM and PR at Times 1 and 3 are not shown to enhance clarity.

**ToM, aggressive behaviour and peer rejection**

We first tested a multi-group cross-lagged model including ToM, aggressive behaviour and peer rejection. The initial unconstrained model, in which each path in the model were freely estimated for younger and older children showed good fit with the data, $\chi^2$ (14) = 53.473, $p < .001$, CFI = .965 SRMR = .022. Notably, according to modification indices with values greater than 10.000, we further allowed the error terms for Time 1 and Time 3 peer rejection to covary in each age-group. This suggested for further stability in peer rejection across a one-year period, over and above stability in the short-term. Fit indices for this model were: $\chi^2$ (12) = 29.581, $p < .010$, CFI = .984, SRMR = .024.

We then proceeded and applied equality constraints on all paths between variables, such that estimated coefficients were constrained to be equal for younger and older age-groups. The chi-square difference test between the unconstrained and constrained model revealed a significant deterioration of fit following the inclusion of the equality constraints, $\Delta\chi^2(48) = 86.414$, $p < .001$. Following the procedure described above, we identified three differing pathways across age-groups: a) the autoregressive effects of aggressive behaviour between Time 2 and Time 3 and b) between Time 1 and Time 2, both stronger in the younger than in the older group; c) the positive effect of Time 2 aggressive behaviour on Time 3 peer rejection, significant among younger children but not among older children. These paths were therefore allowed to vary across age-groups. The partially-constrained multi-group model showed good fit with the data, without significant deterioration from the initial totally unconstrained model, $\chi^2(57) = 55.848$, $p = .52$ CFI = 1.00, SRMR = .050, $\Delta\chi^2(45) = 26.312$, $p = .99$. Finally, pathways that were nonsignificant in both

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groups were removed from the model, with exception of the direct cross-lagged paths between ToM and peer rejection which were retained to control for the direct effects of the predictor on the outcomes while testing for the indirect paths via T2 aggressive behaviour. The final model continued to have good fit $\chi^2(79) = 82.508$, $p = .37$, CFI = .997, SRMR = .071, and is shown in Figure 2.2 with standardized estimates for each age-group. Mediation analyses using 10,000 bootstrap samples to estimate unstandardized confidence intervals revealed, among both younger and older children, a significant negative indirect association between peer rejection at Time 1 and ToM at Time 3 mediated by aggressive behaviour at Time 2 (B = -.040, 95% confidence interval [CI] = [-.097, -.013], $\beta_{YNG}$ = -.023, $\beta_{OLD}$ = -.027). Moreover, among younger children only, aggressive behaviour at Time 2 also mediated a reciprocal indirect negative association between ToM at Time 1 and peer rejection at Time 3 (B = -.014, 95% confidence interval [CI] = [-.032, -.005], $\beta$ = -.023). This pattern of results revealed a bidirectional indirect association between ToM and peer rejection from Time 1 to Time 3 mediated by Time 2 aggressive behaviour in both directions in the younger age-group only.

In addition to all these pathways, peer rejection at Time 2 positively predicted ToM at Time 3 among both age-groups. Moreover, mediation analysis showed that peer rejection at Time 2 mediated a positive indirect association between peer rejection at Time 1 and ToM at Time 3 (B = .272, 95% confidence interval [CI] = [.074, .499], $\beta_{YNG}$ = .159, $\beta_{OLD}$ = .184). Note that the combination of both a positive and a negative indirect association between peer rejection at Time 1 and ToM at Time 3, respectively mediated by peer rejection and aggressive behaviour at Time 2, revealed a competitive mediation pattern for this long-term

association (Zhao, Lynch, & Chen, 2010). More in detail, a competitive mediation pattern occurs when the independent variable (Time 1 peer rejection) has competitive and opposite signed effects on the dependent variable (Time 3 ToM) trough different mediators (Time 2 aggressive behaviour and time 2 peer rejection). Note also that eventual covariance between the two mediators have been partialled out, as they are competitive predictors of the same outcome (ToM at Time 3). Therefore, the respective mediation pathways should be considered independent one from the other.

Next, given the significant effect of both ToM and peer rejection at Time 1 in predicting aggressive behaviour at Time 2, we wanted to further test the eventual interaction between these two variables. Further moderation analysis (performed on the overall sample) revealed a significant interaction between Time 1 ToM and Time 1 peer rejection on Time 2 aggressive behaviour, $\varDelta R^2 = .013$, $\varDelta F(1, 239) = 8.43$, $p < .05$, $\beta = -.12$, over and above individual differences in verbal ability, SES, age, Time 1 aggressive behaviour and the independent effects of Time 1 ToM and Time 1 peer rejection, $R^2 = .61$, $F(6, 240) = 63.75$, $p < .001$. That is, peer rejection predicted increased aggressive behaviour for medium and low (but not for high) level of ToM.

As a final note, parallel analyses including peer acceptance instead of peer rejection in the model didn't add further insight regarding the role of aggressive behaviour in the link between ToM and peer relationships. Specifically, although the links involving ToM and aggressive behaviour were still significant, peer acceptance and aggressive behaviour were not associated across-time. In sum, increased aggressive behaviour at Time 2 mediates, especially in the younger age-

group a negative bidirectional association between peer rejection (but not peer acceptance) and ToM.

**ToM, Prosocial behaviour and peer acceptance**

We then tested a second multi-group cross-lagged model including ToM, prosocial behaviour and peer acceptance. The initial totally unconstrained model, in which each path in the model were freely estimated for younger and older children showed good fit with the data, $\chi^2(14) = 77.923$, $p < .001$, CFI = .920, SRMR = .038. Notably, according to modification indices with values greater than 10.000, we further allowed the error terms for Time 1 and Time 3 peer acceptance, as well as Time 1 and Time 3 prosocial behaviour to covary. These paths accounted for further individual differences stability in both peer acceptance and prosocial behaviour across a one-year period, over and above stability in the short-term. Moreover, modification indices suggested that adding a further regression path form Time 1 ToM to Time 3 prosocial behaviour would have improved the model fit ($\Delta\chi^2 = 9.112$). This path accounts for a long-term effect of ToM on prosocial behaviour, over and above within time and short-term associations among these two variables. We decided to include this path as it theoretically fits with previous literature on pre-schooler (Caputi et al., 2012) and is relevant for our understanding of the association between ToM and social behaviour in middle childhood. This model showed good fit with the data, $\chi^2(8) = 12.008$, $p = .150$, CFI = .995, SRMR = .018. We therefore proceeded and applied equality constraints on all paths between variables, such that the estimated coefficients were constrained to be equal for younger and older age-groups. The chi-square difference test between the unconstrained and constrained model doesn't revealed a significant deterioration of

fit following the inclusion of the equality constraints, $\Delta\chi^2(49) = 52.629$, $p = .335$, suggesting no differences across age-groups in the model pathways. The totally constrained multi-group model showed good fit with the data, $\chi^2(57) = 64.572$, $p = .229$, CFI = .991, SRMR = .061. Pathways that were nonsignificant in both groups were removed from the model. The final model continued to have good fit $\chi^2$ (81) = 100.169, $p = .073$, CFI = .976, SRMR = .076 and is shown in Figure 2.3 with standardized estimated for each age-group.

Results showed concurrent patterns of association between ToM, prosocial behaviour and peer acceptance at Time 1 and Time 2. More in detail, prosocial behaviour was associated with ToM at Time 1 and with peer acceptance at Time 1 and Time 2. Moreover, ToM was associated with peer acceptance at Time 2. Results also showed a long-term association between early ToM at Time 1 and later prosocial behaviour at Time 3. Moreover, in addition to this path a longitudinal association emerged between prosocial behaviour and ToM also in the opposite direction, with early prosocial behaviour at Time 2 predicting increased ToM at time 3. Finally, T2 peer acceptance predicted T3 prosocial behaviour.

Notably, Given the peculiar patters of concurrent association between ToM, prosocial behaviour and peer acceptance at Time 1 and Time 2, we tested whether prosocial behaviour at Time 1 mediated an indirect within-time association between ToM and peer acceptance. Further mediation analysis (performed on the overall sample) revealed a significant indirect association between ToM and peer acceptance that was mediated by prosocial behaviour (B = .020, 95% confidence interval [CI] = [.006, .047], $\beta$ = .030), after controlling for age and individual difference in verbal ability and SES.

Finally, parallel analyses including peer rejection instead of peer acceptance in the current model revealed a significant negative association between peer rejection at Time 1 and prosocial behaviour at Time 2. Moreover, decreased prosocial behaviour at Time 2 mediated an indirect negative association between early peer rejection at Time 1 and later ToM at Time 3 (B = -.052, 95% confidence interval [CI] = [-.108, -.023], $\beta_{YNG}$ = -.029, $\beta_{OLD}$ = -.037). Finally, T2 prosocial behaviour was also negatively associated with later peer rejection at Time 3. All these effects were invariant across age-groups, $\Delta\chi^2(49)$ = 54.767, $p$ = .265, with the totally constrained model showing good fit with the data, $\chi^2(57)$ = 76.362, $p$ = .044, CFI = .982, SRMR = .070. The final model, without nonsignificant paths and with the longitudinal path from T1 peer rejection to T3 ToM included to test the mediation via T2 prosocial behaviour, showed good fit to the data except for the SRMR index, $\chi^2(80)$ = 103.414, $p$ = .040, CFI = .978, SRMR = .093, (figure 2.4).

Figure 2.2 – Multigroup model with ToM, aggressive behaviour and peer rejection
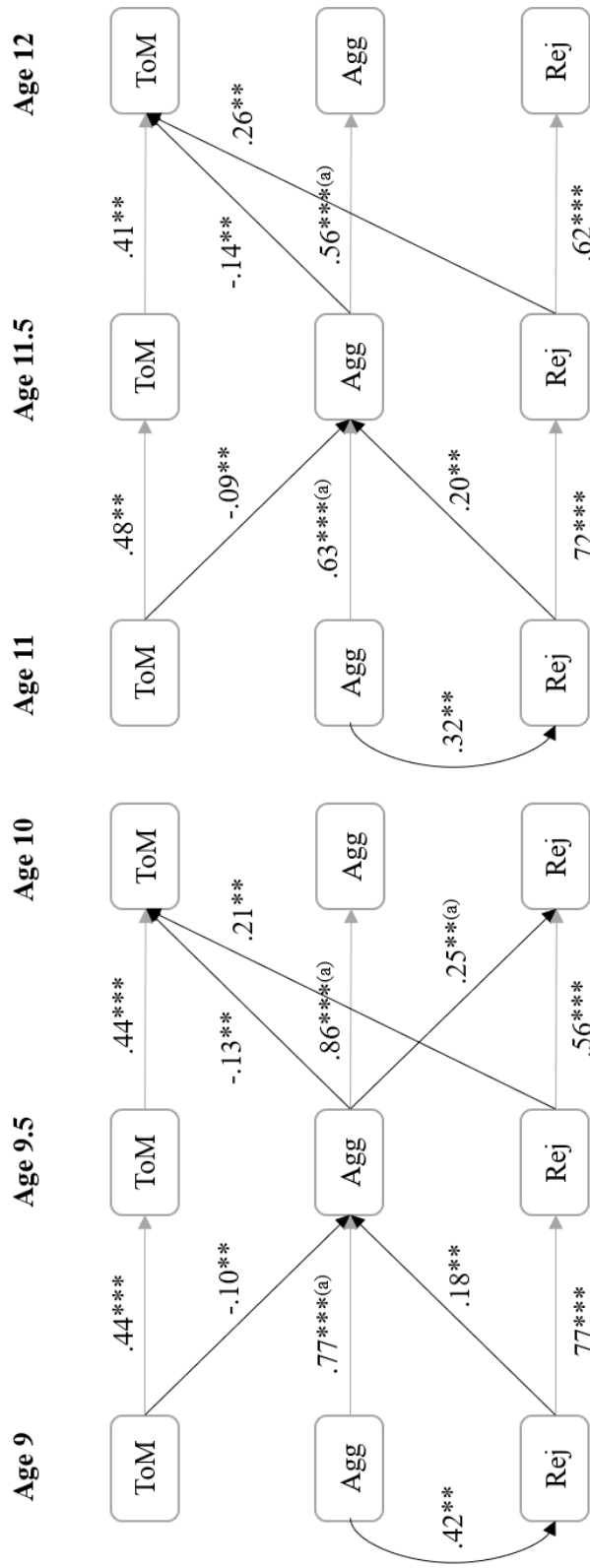


*Figure 2.2.* Standardized parameter estimates for the multigroup model including Theory of mind (ToM), aggressive behaviour (Agg) and peer rejection (Rej). Younger age-group on the left and older age-group on the right. (a) Significantly different pathways across groups. $+p < .10$; $*p < .05$; $**p < .01$; $***p < .001$

Figure 2.3 – Multigroup model with ToM, prosocial behaviour and peer acceptance
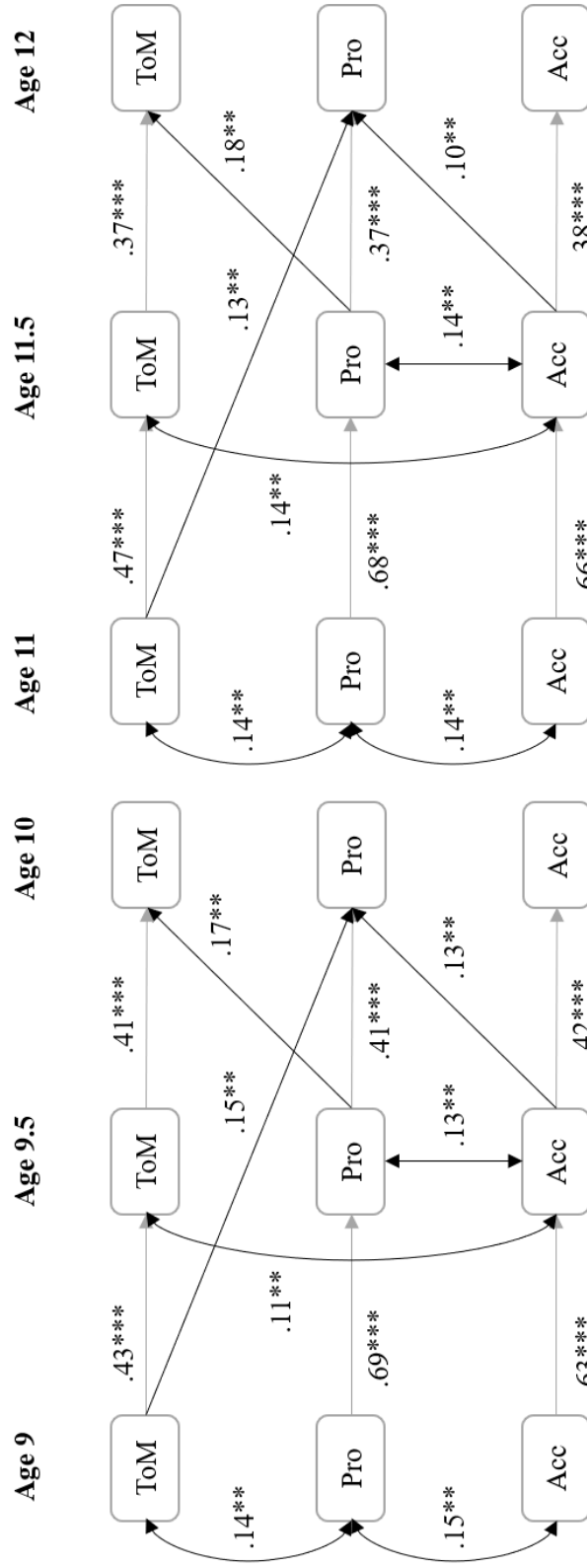


*Figure 2.3.* Standardized parameter estimates for the multigroup model including Theory of mind (ToM), prosocial behaviour (Pro) and peer acceptance (Acc). Younger age-group on the left and older age-group on the right. $+p < .10$; $*p < .05$; $**p < .01$; $***p < .001$

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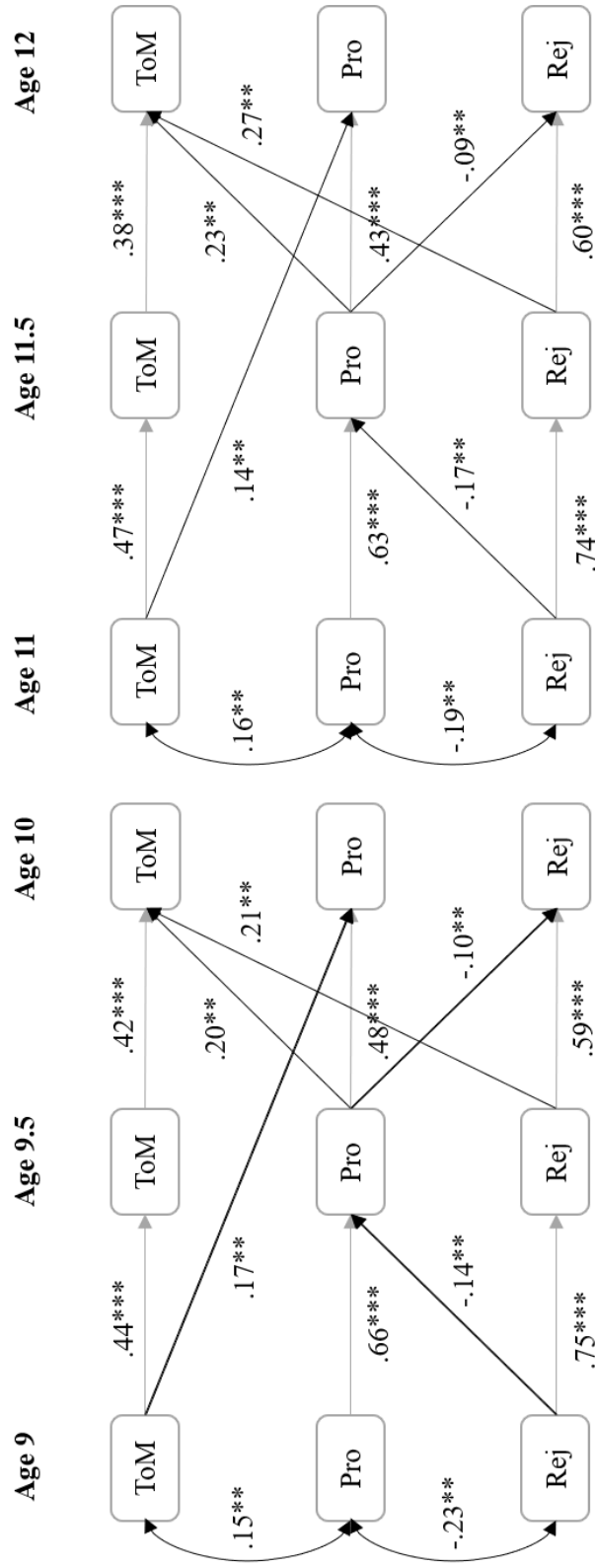Figure 2.4 – Multigroup model with ToM, prosocial behaviour and peer rejection



*Figure 2.4.* Standardized parameter estimates for the multigroup model including Theory of mind (ToM), prosocial behaviour (Pro) and peer rejection (Rej). Younger age-group on the left and older age-group on the right. $^+p < .10$; $^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

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**Discussion**

Both theoretical (Carpendale and Lewes, 2004) and empirical (Banerjee et al., 2011) works suggest that ToM can shape and is shaped by children's social relationships. Building on this premise, the present study aimed to deeply investigate the longitudinal interplay between individual differences in ToM and in peer relationships in middle childhood by testing the role of social behaviour as potential mediator in such association in the context of school. On one hand, we hypothesized that aggressive behaviour with peers could mediate a negative bidirectional association between ToM and peer rejection in both the directions. Namely, from early ToM to later peer rejection and from early peer rejection to later ToM. On the other hand, we hypothesised that prosocial behaviour with classmates could mediate a positive longitudinal association between early ToM and later peer acceptance.

Results supported our first bidirectional hypothesis by showing that, in the younger age-group (aged 9 at Time 1), aggressive behaviour at the second time-point of data collection mediated a negative bidirectional association between ToM and peer rejection over one-year. This pattern of results is in line with previous findings by Banerjee and colleagues, who highlighted a recursive longitudinal pattern of association between ToM and peer rejection in children older than 8 (Banerjee et al., 2011). Crucially, the present study further extends this previous finding by revealing the potential key role played by aggressive behaviour in unfolding such negative developmental patterns involving ToM and peer rejection over time. Specifically, increased aggressive behaviour over time may explain both how negative social relationships with peers can limit children's later socio-

cognitive development, as well as how individual variation in social understanding can affect children's social adjustment at school. Notably, this pattern of findings is only partially replicated in the older age-group (aged 11 years at Time 1) where aggressive behaviour mediated a longitudinal association between early peer rejection and later ToM, but not viceversa. Precisely, multigroup analyses revealed differences across age-groups in the stability of aggressive behaviour over time (lower in older children than younger children), as well as in the association between early aggressive behaviour at Time 2 and later peer rejection at Time 3 (not significant among older children). In other words, individual differences in children's expression of physical and verbal aggressive behaviours seem to be less stable among older children, as well as more tolerated by peers, than among younger children. This pattern of results could suggest that other, more sophisticated, forms of aggression (e.g., indirect or relational), that are likely to increase in late childhood (Bjorkqvist, Lagerspetz, & Kaukiainen, 1992), may become more stigmatized by classmates as children grow older (see Coie et al., 1982). Nevertheless, in a recent meta-analysis, Card and colleagues (2008) have shown that direct forms of aggression are likely to be more strongly associated with peer rejection than indirect forms of aggression, and that age was not a moderator of the association between aggression (both direct and indirect) and peer rejection. In summary, future longitudinal studies adopting a fine-grain approach are needed to clarify the role that different measures of aggression (either direct and indirect) play in the association between ToM and peer rejection among older children.

Notably, no differences emerged across groups in the negative association between early peer rejection at Time 1 and later aggressive behaviour at Time 2, as

well as between early ToM at Time 1 and later aggressive behaviour at Time 2. Moreover, further analyses revealed that ToM at Time 1 also moderated the negative impact of early peer rejection on later aggressive behaviour. That is, peer rejection predicted increased aggressive behaviour for medium and low (but not for high) levels of ToM. Taken all together, these results contribute to a growing body of literature suggesting the importance of ToM development for children's social adjustment in the school context (Lecce et al., 2017; Peterson et al., 2016; Wellman, 2016). In particular, the present results hightlighted the potential role of advanced ToM skills as a protective factor for children's social adjustment when facing situations of risk (e.g., peer rejection).

Regarding our second hypothesis, results do not support a mediation role of prosocial behaviour in the longitudinal association between early ToM and later peer acceptance. This result contrasts with previous research on preschoolers (Caputi et al., 2012). Although we found that ToM, prosocial behaviour and peer acceptance were concurrently associated at Time 1 and Time 2 and that prosocial behaviour at Time 1 mediated an indirect within-time association between ToM and peer acceptance, the lack of any longitudinal links between ToM, prosocial behaviour and peer acceptance in the short-term, prevented us from drawing further conclusion about the developmental nature of these associations. We believe that aspects of the study design may have, at least in part, masked potential longitudinal effects in the short-term. More in detail, the time interval between time-points (5-months) could have been too short to detect a developmental effect of ToM on later prosocial behaviour in the short-term, over and above the early concurrent association among them. For example, teachers may need more time between

subsequent assessments to detect changes in children's prosocial behaviour. Accordingly, a significant longitudinal association between early ToM and later prosocial behaviour emerged in the long-term, over and above their early associations, where reduction in the rank-order stability of prosocial behaviour between Time 2 and Time 3 suggested changes in teacher's judgments about children's prosocial behaviour. In sum, although the finding of both concurrent and long-term associations between ToM and prosocial behaviour fits with the idea that social understanding might support diverse form of prosocial behaviour in middle childhood (Caravita, Di Blasio, & Salmivalli, 2010; Imuta et al., 2017), further studies with longer test-retest interval are needed to further explore whether the interplay between ToM and prosocial behaviour benefits children's peer relationships across middle childhood. However, beside this methodological explanation, also a theroretical one is plausible. Precisely, conceptual changes in the direction of the developmental association between ToM, prosocial behaviour and peer acceptance as children grow older may underlie the contrast with previous studies on pre-schoolers. For example, the finding that ToM benefited from acting prosocially with peers in middle childhood, together with the finding that early peer acceptance (Time 2) predicted later prosocial behaviour (Time 3) indicates the possibility that the concurrent pattern of associations involving ToM, prosocial behaviour and peer acceptance at Time 1 may well be interpreted in the opposite direction. That is, positive relationships with peers promote ToM development by increasing children's likelihood (or motivation) to act prosocially with peers. However, further longitudinal works are needed to deeply investigate this speculation.

So far, our finding that prosocial behaviour predicted ToM development over 5-months fits with suggestions about the potential bidirectional nature of the association between ToM and prosocial behaviour (Astington, 2003; Imuta et al., 2016; Weller & Lagattuta, 2014) and, together with the finding that either increased aggressive behaviour and reduced prosocial behaviour could be mechanisms through which peer rejection negatively affects ToM development, allows interesting insight into the specific features of children's social experience with peers at school that could be relevant for their socio-cognitive development in middle childhood.

The implications of these findings for our understanding of the social predictors and consequences of individual differences in ToM will be discussed more in depth in the following paragraphs, together with suggestions for future research.

**Social consequences of ToM in middle childhood**

The present study contributes to our knowledge about the importance of social understanding for children's social relationships at school in middle childhood in several ways. First, we found that, especially among children attending the third and fourth grades of primary school, early ToM decreased children's risk of being rejected by peers over one year by reducing children's aggressive behaviours over time. Notably, this result was independent of children's levels of verbal ability and socioeconomic status, as well as rank-order stability in aggressive behaviour and peer rejection over time. This finding sheds new light on the potential mechanisms underpinning the developmental association between early ToM and later peer rejection in middle childhood reported by Banerjee et al. (2011).

Moreover, besides confirming the negative impact of aggressive behaviour on children's peer relationships at school (Bierman et al., 2015; Cillessen et al., 1992; Coie et al., 1990; Ladd, 1999; Newcomb et al., 1993 Vitaro et al., 1992), the present result adds new data to the body of literature reporting a negative association between ToM and aggressive behaviour in middle childhood (Gomez-Garibello & Talwar, 2015; Hoglund et al., 2008; Holl et al., 2018; Kokkinos et al., 2016). In particular, the present result contributes to this literature by showing how the beneficial effect of ToM can extend beyond children's behavioural functioning to influence later children's socio-relational adjustment. Finally, the present finding also complements a growing body of literature supporting the important role of ToM for children social competence in middle childhood. Research studies in this field have shown that individual differences in ToM positively correlate with children's expression of social maturity and competence in dealing with classmates, both concurrently (Peterson et al., 2016; Banerjee and Henderson, 2001) and longitudinally (Devine and Hughes, 2016). The present study adds to this literature by showing that children who are good at understanding other's minds and explaining others' behaviour in complex social situations are less likely to select, and/or react with, aggressive strategies to achieve their social goals. Instead, they might rely on adequate, sophisticated and effective forms of social behaviour (e.g., prosocial behaviour).

Second, we found that early ToM moderated the negative impact of peer rejection on aggressive behaviour 5-months later. That is, early peer rejection predicted increased aggressive behaviour for medium or low level of ToM but not for high level of ToM. The finding that ToM may have role in reducing aggressive

behaviour in response to peer rejection, together with research evidences of a negative cycle involving aggressive behaviour and peer rejection across middle childhood (Dodge et al., 2003; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006), suggests that advanced ToM skills may play an important protective role for children's long-term adjustment at school. Notably, the idea that ToM could affect the way children cope with rejection fits with existing literature suggesting that social-cognition is likely to inform more adaptive behavioural strategies in response to aversive social experiences (Asher, Parkhurst, Hymel, & Williams, 1990). Specifically, Asher and colleagues suggested that how children attribute the causes of peer rejection can affect children's behavioural response to that experience. Notably, this line of reasoning is also closely related to research on social information processing (SIP) reporting that biases in attribution of hostile intent to others in ambiguous situations underpins children's engagement in aggressive behaviour, especially when these children have been experiencing an history of peer rejection (Dodge et al., 2003). Although they are different approaches to the study of socio-cognitive processes underlying social understanding, the SIP and ToM frameworks may be, at least in part, related (Banerjee, 2008). Specifically, ToM might be involved in at least some steps of the SIP, such as the encoding and interpretation of social cues during social interactions (Harvey, Fletcher, & French, 2001; Holl et al., 2018). For example, children's adequate understanding of other mental states may prevent children from misreading other intentions and behaviour (Kinderman, Dunbar, & Bentall, 1998), especially in the context of negative social relationships (e.g., peer rejection), reducing the risk of reacting aggressively in those kinds of situations. In other words, ToM may moderate the association

between early peer rejection and later social information processing biases outlined by Dodge and colleagues (2003) in middle childhood. Future longitudinal study including both measures of ToM and SIP are needed test this hypothesis more in depth.

Finally, some contrasts between our results and previous studies deserve to be mentioned. First, while we found an indirect association between ToM and peer rejection that was mediated by aggressive behaviour, Banerjee and colleagues (2011) found a direct one. It is possible that the Faux Pas task they adopted focuses more precisely on the specific socio-cognitive difficulty (attribution of intentionality to an insult in ambiguous situation) that predicts peer rejection through increased aggression. Accordingly, Banerjee and colleagues found that errors in attribution of intentionality and ignorance were the key facets of Faux Pas understanding predicting peer rejection (Banerjee et al., 2005; Banerjee et al., 2011).

Second, we didn't find any direct or indirect longitudinal association between early ToM and later peer acceptance. This result, especially in the younger age-group, is in contrast with the previous finding by Banerjee and colleagues (2011) that faux pas understanding at age 9 predicted peer acceptance at age 10. Such inconsistency may be interpreted under the light of both methodological and theoretical considerations. From a methodological perspective, differences among the adopted ToM tasks may have led to different pattern of results. As anticipated in the first chapter we decided to adopt the Strange Stories and the Silent Films tasks because they allow us to encompass a wider range of social situations compared to the Faux Pas task, which involves just a single social scenario (namely,

a social gaffe situation). However, it is possible that such a specific social scenario is particularly sensitive to the socio-cognitive processes that are crucial to peer acceptance (see LeMare & Rubin, 1987). On the contrary, Strange Stories and Silent Films tasks' sensitiveness to peer acceptance may be varying depending of different social scenarios. For example, the Strange Stories and the Silent Film tasks involved also deception, persuasion and double bluff situations which, we speculate, may even entail controversial association with peer likability. Future works involving a greater number of stories for each social scenario should test the hypothesis that different facets of ToM understanding may link differently with different facets of children's peer relationships. From a theoretical perspective, the contrast across studies may reflect the idea that possessing advanced ToM skills may not necessary mean that children constantly use such skills to navigate everyday social relationships (Apperly, 2010; Hughes & Devine, 2015). According to this view, it is likely that other factors (e.g., children's motivation, contextual factor) may moderate the strength of the association between ToM and peer acceptance (Hughes & Devine, 2015; Banerjee et al. 2011). For example, classroom norms have shown to influence the impact of children's behaviour (e.g., prosocial, aggressive and withdrawal behaviours) on peer acceptance (Chang, 2004). Similarly, classroom features (e.g., peers' socio-cognitive maturity) may moderate the influence of ToM on peer acceptance. Future studies, involving a greater number of classrooms and adopting a multi-level approach are needed to test this hypothesis. More broadly, a detailed view on the potential moderators and mediators of the association between ToM and peer acceptance is needed to stress the specific nature of their association across middle childhood.

**Social predictors of ToM in middle childhood**

The present study also contributes to our understanding of the social predictors of ToM in middle childhood. In particular, we found that increased aggressive behaviour over a 5-month period mediates the longitudinal association between early peer rejection and later ToM over 1 year. Notably, this was true for both younger and older children and independent of variation in children's verbal ability, socioeconomic status and previous level of aggression and ToM. According to the theoretical account formulated by Carpendale and Lewis (2004), social understanding establishes within the context of social interactions. That is, children's advancements in their understanding of others' mind is closely related to their opportunity to interact with others' mind within the context of social exchanges. Importantly, as anticipated, Banerjee and colleagues (2011) empirically support this idea in middle childhood by showing that being rejected by peers hinders ToM development between the age of 6 and 11 years. The present study further extends our knowledge in this field by highlighting one potential mechanism by which peer rejection hinders ToM development in middle childhood. Indeed, the present study indicates that aggressive behaviour could convey the negative impact of peer rejection on children's later socio-cognitive development during the school years. More in detail, the finding of an *indirect* long-term association between early peer rejection and later ToM that was mediated by children's aggressive behaviour in the short-term suggests that not just being rejected by peers but also the way children behave in response to such experiences contributes to define the specific nature of social experiences that is detrimental for ToM developmental at this age. Although further studies, that adopt a more precise level of investigation, are

needed to clarify what specific features of aggression contribute to limit ToM development, existing research literature can suggest future directions. On one hand, it is possible that facets of the relationship occurring between aggressive children and their peers may limit children's opportunity to make relevant ToM experiences. On the other hand, individual characteristics of the child (e.g., social information processing biases) may contribute to limit his or her ability to capitalize on social experience to learn about other's minds. Regarding the first hypothesis, literature on children's ability to cope with peer rejection suggests that rejected children who engage in aggressive behaviour, compared to those who do not, are likely to receive less clear feedback about their behaviours, as well as about the relation between their behaviours and their poor social status (Zakriski, Jacobs, & Coie, 1997) For example, peers may sometimes reinforce aggressive behaviours or submit without standing up for themselves (Coie, Dodge, Terry, & Wright, 1991). Moreover, aggressive rejected children tend to minimize peer dislike and to pay less attention to their social relationships (Parkhurst & Asher, 1992), possibly as an avoiding strategy to cope with the distress carried by rejection experiences (Zakriski, Jacobs, & Coie, 1997). Taken all together, these features of aggressive-rejected children's social experience may result in unconnected relationships between the child and his/her peers that may even be confounding and misleading for children's social learning.

Regarding the second hypothesis, cognitive and emotional processes within the child may influence the quality of his/her social learning (Crick & Dodge, 1994; Holl et al., 2018; Lamerise & Arsenio, 2000; Lansford et al., 2010). Indeed, inadequate patterns of social information processing commonly co-occur with

aggressive behaviour, especially in the context of negative peer relationships (Dodge et al., 2003). These biases (e.g., negative outcome expectations, hostile attribution biases) may reduce children's attention to others' perspective and limit their opportunity to learn from ongoing social exchanges (Crick & Dodge, 1994; Lansford et al., 2010).

In summary, not just being rejected by peers but acting aggressively in response to rejection may specifically constrain children's opportunity to practice and learn their ToM skills within the context of social interactions with peers.

Notably, the idea that poor ToM could either affect and be recursively affected by aggressive children's biased interpretation of ambiguous social situations, speaks to a potential mechanism that underpins the negative developmental cycle involving aggression and ToM development in middle childhood.

Interestingly, we also found a *positive* association between early peer rejection and later ToM. This finding seems to reinforce the key role of aggressive behaviour in conveying the negative effect of peer rejection on later ToM. Indeed, it speaks to the possibility that being disliked by peers may even contribute to ToM development. Although unexpected, this result resonates with the idea that "Social exclusion is a common situation that compels us to reconnect with new parties, which may crucially involve attending to those parties' mental states" (White, Klein, Klitzing, Graneist, Otto, Hill, J., ... & Crowley, 2016, p.1). According to this view, White and colleagues (2016) showed that 5- to 8-years old children tended to attribute more intentionality to story characters, as well as to use more mental state language in narratives elicited by figures, after experiencing consistent exclusion in

a virtual game of toss "Cyberball". Moreover, research on ostracism in middle childhood and adolescence, defined as ''acts of ignoring and excluding an individual by an individual or a group'' (Williams, 2001, p. ix), reported differences in children's behavioural response to social exclusion (Wolfer & Scheithauer, 2013). Moreover, Haselager and colleagues showed that, rejected children who engaged in more adaptive (prosocial) then nonadaptive (antisocial) behaviour were more likely to change their social status over time (Haselager, Cillessen Van Lieshout, Riksen-Walraven, & Hartup, 2002). Building on this literature, we speculate that children who engage in more adaptive forms of social behaviour in response to peer rejection and try to improve their social status may learn more about others' minds, compared to children who engage in less adaptive forms of social behaviour in response to the same experience (e.g., aggressive behaviour). In part supporting this view, we found that also lower engagement in prosocial behaviour with peers as a consequence of peer rejection mediated the negative impact of early peer rejection on later ToM development. Although these considerations remain just speculations at this time, the finding of either positive and negative pathways linking early peer rejection to later ToM prompt future research to investigate in more depth potential individual and interpersonal moderators of the link between peer rejection and children's socio-cognitive development. Related to this intriguing direction for future research, is the developmental timing of the outlined associations between early peer rejection and later ToM. In particular, it is worth considering that the positive effect of early peer rejection on later ToM emerges between Time 2 and Time 3 (when the group's mean-level performance on ToM tasks is reaching a developmental plateau) but not

between Time 1 and Time 2 (when the group's mean-level performance on ToM tasks is steadily increasing). Such developmental patterns may suggest a catching up effect of early rejected children on their less rejected peers. The adoption of statistical techniques that are more suitable to the analysis of the reciprocal interplay between individual differences and age-related changes (e.g., growth curve modelling) are needed to investigate this hypothesis.

Particularly interesting was the finding that engaging in prosocial behaviour with peers predicted variability in children's ToM performance 5-months later. This result falls in line with previous suggestions that engaging in prosocial acts may support the development of a more nuanced ToM (Astington, 2003; Eisenberg & Fabes, 1998; Sy, De-Meis, & Scheinfield, 2003; Weller & Lagattuta, 2014). Interestingly, the view that specific features of children's social relationships with peers (e.g., prosocial interactions) could matter for ToM development in middle childhood seems to echo literature on preschoolers suggesting that, above general aspects of the parent-child relationship, more specific features of that relationship (e.g., references to mental states in conversations) are likely to scaffold children's understanding of the mind (Ensor & Hughes, 2008; Peterson & Slaughter, 2003). Attempting to translate this idea into middle childhood, it is likely that, above general aspects of peer relationships (e.g., quality or quantity), the way children practice within such relationships matter in defining the specific nature of social experience that is relevant for ToM development at this age. In particular, the finding that acting prosocially promotes ToM development may suggest that, once children master foundational knowledge about the mind, more specific ToM use-

related social experiences may be needed to foster the definition of more nuanced and specialized ToM skills in middle childhood.

Potentially related to this idea, it is worth noting that the positive contribution of prosocial behaviour for later ToM development especially emerges when the group's mean-level performance in ToM has reached a developmental plateau (between Time 2 and Time 3) but not when the group's mean-level performance in ToM is increasing (between T1 and T2). This may suggest that a subtler contribution of prosocial interactions to ToM development may particularly emerge when the effect of other, more general, age-related predictors of ToM development are not providing further gains in children's understanding of others' mind. However, future research specifically designed to tackle the issue is needed to deeply explore the specificity and the developmental timing of such association.

Finally, supporting the idea that acting prosocial within one's own social relationships may play an important role in ToM development in middle childhood is the finding that low engagement in prosocial behaviour with peers mediated a negative association between early peer rejection and later ToM. More broadly, this result hints of a further mechanism by which peer rejection could limit children's socio-cognitive development. On one hand, according to either empirical and theoretical works, peer rejection threats a foundational "need to belong" and may reduce children's motivation and efforts to act prosocially toward others (Baumeister, DeWall, Ciarocco, & Twenge, 2005). On the other hand, lower engagement in prosocial behaviour as a consequence of peer rejection could prevent children from practicing and, therefore, refining, their ToM skills in the context of prosocial interactions with peers.

**Limitations and Conclusions**

The present study has a number of limitations that should be considered when interpreting our findings. First of all, we assessed children's social behaviour relying on a single teacher-reported measure. Although teachers are likely to have a privileged view on the social dynamics within the classroom, peers may become an even more reliable source of information about classmate's behaviour in middle childhood (Van den Berg, Lansu, & Cillessen, 2015). Moreover, the adoption of peers' reports, instead of teacher's report, can strengthen the reliability of behavioural assessments as children's behavioural characteristics would be based on the judgments of multiple participants instead of a single individual (Marks, Babcock, Cillessen, & Crick, 2013). In summary, the adoption in future research of multi-informant approach (including both teachers' and peers' reports) is suggested in order to improve measurement validity and reliability. It is also important to note that the Child Behaviour Scale adopted in the present study has been created to be used with preschool-aged children. Nevertheless, it is a valid measure of social behaviour that has shown to be trustworthy and sensitive to variation in social behaviour (and related social constructs) among children spanning from early childhood through early adolescence (Ladd, Herald-Brown, & Andrews, 2009). Notwithstanding, future study should try to replicate our findings adopting questionnaires that are specifically designed to be used with older children. This might allow to detect age-related expressions of aggressive and prosocial behaviour that could have been overlooked in the present study and could play an important role for our understanding of the link between ToM, social behaviour and peer relationships in middle and late childhood. Moreover, we adopted a general

subscale to measure prosocial behaviour and the adoption of measures able to distinguish between subtypes of prosocial behaviours may better inform about the specific form of prosocial behaviour that is more sensitive to variation in ToM. Notwithstanding these potential limitations, the present study significantly contributes to the field by showing that social behavior can play a role in explaining both how individual differences in ToM affect children's peer relationships in middle childhood, as well as how the quality of children's relationships with classmates can affect ToM development during the school years. In particular, the mediation role of aggressive behavior in the bidirectional association between ToM and peer rejection outline the crucial role that negative relationships with peers at school have in shaping children's trajectories of both social and cognitive development. Finally, the role of prosocial behavior in ToM development highlights the specific nature of children's peer relationships that may be relevant for ToM development at this age.

Finally, by reducing children's aggressive behavior in response to peer rejection, individual's ToM skills are likely to play an important protective role for children's long-term adjustment at school. We argue that children's ability to flexibly understand the mental cause of behavior in complex social environments may support children's ability to cope with peer rejection and manage relational challenges at school.

# Chapter 3 – Theory of Mind and peer relationships: The role of social anxiety

**Abstract**

Recent research has shown that individual differences in Theory of Mind (ToM) during middle childhood are linked to those in children's relationships with peers. The present longitudinal study investigated this association more deeply exploring the potential mediating role played by children's social anxiety. We tested a group of 66 children (11.5 years at Time 1) three times over one year after their transition to secondary school. Over and above language, SES and stability in individual differences, ToM performance shortly after starting secondary school (Time 1) predicted higher peer acceptance, as well as lower peer rejection, one year later (Time 3) by reducing social anxiety over time (Time 2). This study extends our knowledge about the links between social understanding and interpersonal relations in middle childhood. It suggests that ToM plays an important role in children's adjustment when confronted with new social contexts.

**Introduction**

As anticipated in previous chapters, research on the social consequences of individual differences in ToM in middle childhood is far from being compelling (Hughes, 2015). Although general consensus about the importance of social cognition for children's quality of social experience with peers at school (Banerje et al., 2011; Hughes & Leekam, 2004), there is very little research to date that explores the pathways through which ToM can affect children's relationships with classmates. In a shift from the previous chapter and from previous research on

preschoolers (Caputi et al., 2012) that have focused on the role of social behavior in the association between early ToM and later peer relationships, in the present study we focused on children's socio-emotional experience in the social context, and specifically on children's social anxiety, as a potential mediator of this association. Indeed, existing literature centering the relation between ToM and social anxiety suggests that difficulties in mental-state understanding may contribute to maintain and escalate socially anxious children's patterns of emotional distress and poor social functioning in social situations (see Banerjee, 2008) which, in turn, are likely to predict negative peer relationships in middle childhood (see Rubin, Coplan, & Bowker, 2009 for a review).

To investigate the interplay between ToM, social anxiety and peer relationships in middle childhood in more depth, we adopted a longitudinal design spanning over a relevant time-period for children's social and emotional adjustment, that is, the transition from primary to secondary school.

**Social anxiety as mediator in the association between ToM and peer relationships**

Although previous research has focused on the role of social behavior in the association between ToM and social relationships, it is likely that other factors may play a role in this pathway as well. Indeed, we know that social relationships and behavior itself are intimately related to the way children experience and regulate their emotions in the context of social exchanges. More specifically, children's emotionality and regulation have been suggested to affect the manner in which children behave and interact with others and, therefore, the quality of children's social exchanges with their peers (Rubin, Bukowski, & Parker, 2006). Accordingly,

emotion dysregulation has consistently found to be a concomitant and predictor of poor social functioning and social success in childhood (Blair, Perry, O'brien, Calkins, Keane, & Shanahan, 2015; Eisenberg, Shephard, Fabes, Murphy, & Guthrie, 1998; Eisenberg, Fabes, Guthrie, & Reiser, 2000). In the present study we focused on children's social anxiety as it not only involves the manifestation of emotion dysregulation specifically in the context of interpersonal relationships, but also is associated with a distinctive pattern of cognition about mental states (Banerjee, 2008).

Social anxiety is defined as worries or fear of being negatively evaluated during social interactions or performance situations that cause distress in the individual and commonly lead to avoidance of the fear-eliciting stimuli (Beidel & Morris, 1995). Social information-processing models of social anxiety emphasize the interplay between evaluative concerns, emotional distress and biased cognition in the maintenance of social anxiety (Daleiden & Vasey, 1997). More in detail, socially anxious individual's hypersensitivity to possible negative or threat stimuli and bias or inaccurate interpretation of ambiguous or neutral social situation (Beck & Clark, 1997; Daleiden & Vasey, 1997; Muris, Kindt, Bogels, Merckelback, Gadet, & Moulaert, 2000) are likely to be fed and to recursively escalate anxious individual's overwhelming evaluative concerns and emotional distress (Morrison & Heinberg, 2013). Moreover, negative self-evaluation biases with respect to the level of coping resources available to face the possible threat can lead to escalations in anxiety and to the selection of avoidance or escape goals (Beck & Clark, 1997). For example, a lack of confidence in the use of problem-solving strategies have been suggested to be potentially responsible for anxious individuals' worries and

distress in social situations, as well as for their proclivity in selection and enactment of avoidant behavior to face such situations (Banerjee, 2008; Davey, 1994; Daleiden and Vasey 1997). In summary, the definition of social anxiety encompasses emotional, cognitive and behavioral difficulties in social situations, which interplay is likely to impact the quality of individual's daily-life social exchanges not only in adulthood, but also in childhood. More precisely, although the peak of onset for social anxiety disorder is set in adolescence (Kessler, Berglund, Demler, Jin & Walters, 2005), it is possible to detect early individual variation in children's expression of social anxiety symptoms during the primary school years (Banerjee, 2008). Crucially, individual differences in children's social anxiety in middle childhood have been associated with poor social functioning and success (Erath, Flanagan, & Bierman, 2007; Greco & Morris, 2005; Inderbitzen, Walters, & Bukowski, 1997; La Greca & Stone, 1993; La Greca & Lopez, 1998; Siegel, La Greca, & Harrison, 2009; Tilfors, Persson, Willén, & Burk, 2012) and, more specifically, linked with a wide range of negative adjustment outcomes, including peer difficulties such as low peer acceptance, rejection, victimization and poor friendship quality (Rubin et al., 2009). Given the crucial role that positive peer relationships at school may play in moderating the long-term impact of maladaptive social predispositions (Gazelle et al., 2004; Oh, Rubin, Bowker, Booth-LaForce, Rose-Krasnor, & Laursen, 2008; Smith, 2016), highlighting individual factors that help children to cope with social anxiety and successfully navigate social relationships in childhood might also have important practical implication for children's social and psychological adjustment later on in development.

Interestingly, existing literature suggests that individual variation in social anxiety is negatively associated with children's performance on ToM tasks at different ages, including preschoolers (Colonnesi, Nikoli, de Vente, & Bögels, 2016), primary school-aged children (Banerjee & Henderson, 2001; Muris & Broeren, 2009) and adults (Hezel & McNally, 2014). For example, Muris and Broeren (2009) have shown that lower levels of ToM are associated with greatly inhibited behaviors during performance situations and interactions with peers in 4- to 9-year-old children. Focusing on middle childhood, Banerjee and Henderson (2001) collected cross-sectional data from a sample of children ranging in age from 10 to 11 and showed that relatively high social anxiety is associated with children's poorer appreciation of the complex unintended emotional consequences of a faux pas, which understanding is subordinated to the comprehension and integration of multiple mental states (beliefs, emotions, and intentions). Interestingly, in the same study, authors showed also that variation in social anxiety is associated with poorer teacher-rated social skills, but only when those skills require insight into others' mental states (Banerjee & Henderson, 2001). Consonantly, in another study with a sample of 200 children aged 8 to 9 years, Banerjee and Watling (2010) highlighted how higher social anxiety is associated with children's poor appreciation and ineffective usage of self-presentational strategies aimed to mask emotions in order to convey a preferred public self-image. Taken altogether, these results are interesting and suggest that social anxiety may be associated with a distinctive pattern of cognition about mental-states that can contribute to escalate and maintain children's distress and poor social functioning in social situations (Banerjee, 2008). In other words, it is possible that children's difficulties in appreciating the

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mentalistic facets underlying complex social scenarios, as well as difficulties in understanding how evaluative concerns can be translated into effective behavioral strategies (Banerjee, 2008) may, at least in part, underlie children's worries and distress in social situations. Accordingly, it is possible that individual's ToM skills may help children to navigate their social relationships by reducing their social uncertainty and evaluative concerns during social exchanges with other children, especially in the context of novel or complex social situation.

In the present study we tested the hypothesis that individuals' ToM skills could predict changes in children's social relationships with classmates via their associations with social anxiety. In doing so, we focused on a normative developing sample of children facing a relevant period for their social and emotional adjustment, that is, the transition from primary to secondary school.

**The transition to secondary school**

Transition from primary to secondary school is a significant life-event that poses relevant challenges to children's social and academic adjustment (Gillison, 2008; Lohaus, Elben, Ball, & Klein-Hessling, 2004). In addition, transition to secondary school entails a move from a known and structured social environment to a new one, where children encounter new classmates, need to form new relationships, and face the challenge of joining new groups. This change in social environment makes the transition to secondary school a period of relational instability (Hardy, Bukowski, & Sippola, 2002; Symons & Galton, 2014; Weller, 2007) which, on one hand, challenges children's socio-cognitive skills and, on the other, heightens children's thoughts and feelings of social anxiety (Grills-Taquechel, Norton, & Ollendick, 2010; Vernberg, Abwender, Ewell, & Beery

1992). Accordingly, the transition from primary to secondary school is considered a relevant experience of early adolescence that can influence trajectory of social anxiety development (see Grills-Taquechel et al., 2010). Indeed, although children's levels of social anxiety commonly decrease over the course of the first year following the transition (Symons & Galton, 2014) and the majority of children successfully overcome the emotional and relational challenges presented by the transition (Graham & Hill, 2003), individual differences exist. In particular, children who manifest higher levels of social anxiety are likely to perceive the transition to secondary school as more threatening (Sirsch, 2003), as well as to incur adjustment problems after the move into the new environment. Specifically, relatively higher levels of social anxiety after the transition to secondary school have been associated with high disengagement and avoidance behavior, which in turn translate into reduced peer acceptance (Erath, Flanagan, & Bierman, 2007). Overall, these studies show that children's anxiety plays a crucial role in shaping children's experience of the transition to secondary school and suggest the intriguing possibility that children's ability to cope with social anxiety might play a crucial role for their later adjustment over this period of developmental vulnerability. To sum up, the transition to secondary school seems to be a particularly compelling developmental setting in which to elucidate the longitudinal linkages between ToM, social anxiety and social relationships.

**The present study**

The present longitudinal study adopted a 3-wave longitudinal design, with a 5-month interval between time-points, in order to examine the developmental links between ToM, social anxiety and peer relationships in middle childhood. In

particular, we aimed to test the hypothesis that social anxiety mediates the longitudinal association between early ToM and later relationships with classmates in middle childhood. Specifically, ToM were expected to negatively predict social anxiety, which was expected to reduce acceptance and increase rejection by peers. We followed a group of children from the early months after their transition to secondary school across a period of one year and used a hypothesis-driven approach using path-analysis modelling. To be stringent, we measured all the three focus variables (ToM, social anxiety and peer relationships) at each time-point; we were, therefore, able to control for longitudinal stability in the outcome variables when testing the effects of potential predictors. We also wanted to control for children's verbal ability and socioeconomic status, as these variables are known to be related to both ToM (Cutting & Dunn 1999; Devine & Hughes, 2016; Milligan, Astington, & Dack, 2007) and social relationships (Beauchamp & Anderson, 2010). Finally, we recognized that alternative theoretical accounts regarding the direction of the association between ToM, social anxiety and social relationships exist in literature. For example, individual differences in ToM could be influenced by anxiety (Lane, Wellman, Olson, Miller, Wang, & Tardif, 2013; Suway, Degnan, Sussman, & Fox, 2012) and/or peer relationships (Banerjee et al., 2011; Carpendale & Lewis, 2004). Therefore, to strengthen our results, we tested two alternative causal models that follow these alternative suggested pathways. First, we tested a model in which social anxiety mediates the longitudinal association between early social relationships and later ToM. Second, we tested a model in which social relationships mediate the association between early social anxiety and later ToM.

**Method**

**Participants**

A sample of 79 Italian children was recruited at the beginning of the first year of secondary school (Time 1) and also invited to participate 5-months later (Time 2) and 10-months later (Time 3). Nine children were clinically referred for cognitive or learning difficulties and were excluded. Of the remaining 70 children, 4 did not participate at the second and third waves of data collection and were excluded. The final sample was made up of 66 children (36 boys) for whom complete data were available for the key variables of this study. Participants were 11.5 years old ($M =$ 11.53, $SD = 0.29$, range: 10.97–12.47) at Time 1, 12 years old ($M = 11.88$, $SD =$ .32, range: 10.65–12.82) at Time 2, and 12.5 years old ($M = 12.32$, $SD = .29$, range: 11.75–13.25) at Time 3. All the children were native Italian speakers. The sample consisted of four classes belonging to the same school, which was located in the surrounding area of Pavia (North of Italy). Most of the children came from affluent families. Specifically, when the Family Affluence Scale (FAS; Currie, Molcho, Boyce, Holstein, Torsheim, & Richter, 2008; see below for details) was used to categorize the sample, 82% of the sample was classed as "high affluence" (total score ranging 6-9) and 18% as "middle affluence" (total score ranging 3-5), with none classed as "low affluence" (total score ranging from 0-2). In terms of family structure, 15.20% of the children were singletons, 51.50% had one sibling, 25.80% had two siblings, 6.10% had three siblings and 1.50% had four siblings.

**Procedure**

Time 1 data collection took place 3-months after children made the transition to secondary school (Time 1). Children were then retested 5-months later (Time 2), at the end of the first year of secondary school and 10-months later (Time

3), at the beginning of the second year of secondary school. At each time-point children completed two different ToM tasks, the Strange Stories (Happè, 1994) and Silent Films Tasks (Devine & Hughes, 2013), sociometric nominations (Coie, Dodge, & Coppotelli, 1982) and a self-report questionnaire of social anxiety (Social Anxiety Scale for Children, SASC; La Greca, Dandes, Wick, Shaw, & Stone, 1988). Children also completed a verbal ability test (Primary Mental Abilities, PMA; Thurstone & Thurstone, 1962) and a socioeconomic status questionnaire at Time 1 (Family Affluence Scale; FAS; Currie et al., 2008). Tasks were administered collectively to the whole class. One researcher introduced the tasks and read the questions out loud one at a time, supported by a PowerPoint presentation that displayed instructions and stories for the Strange Stories task and clips for the Silent Film task. A second researcher in the classroom was ensuring that all participants understood the task instructions and completed their response booklets independently. The session lasted approximately one hour.

**Measures**

To avoid repetitions, are reported here only measures not already described in the previous chapter.

**Verbal ability.** The Italian version of the Vocabulary subtest of the Primary Mental Abilities, Intermediate Form (age 11-17) (PMA; Rubini & Rossi, 1982; Thurstone & Thurstone, 1962) requires children to find the synonym of 50 target words, choosing among five alternatives. A time limit of 6 minutes was set. Possible total scores could range from 0 to 50.

**Social anxiety.** The Social Anxiety Scale for Children (SASC; La Greca et al., 1988) includes 10 test items to be rated on a 3-point Likert scale, which measure two different facets of social anxiety, namely fear of negative evaluation (FNE) and

social avoidance and distress (SAD). The first reflects the level of fear about receiving negative evaluation from other and is made up of 6 items. The second reflects the experience of distress in and deliberate avoidance of social situations and is made up of 4 items. Children received a total score across the 10 test items, with higher scores indicating higher social anxiety (range: 0 - 20). The $\alpha$ values were as follow; Time 1 ($\alpha$ = .60), Time 2 ($\alpha$ = .65) and time 3 ($\alpha$ = .59). An examination of the item-total statistics revealed problems with one item ("I'm quiet when I'm with a group of children"). It showed low, as well as negative, item-total correlation across all the time-points. Moreover, deleting the item increased $\alpha$ values, which became adequate though modest at each time-point; Time 1 ($\alpha$ = .66), Time 2 ($\alpha$ = .68) and Time 3 ($\alpha$ = .65). We therefore excluded this item, with a final scale ranging 0 to 18. Please also note that the key results reported below were unchanged when the item was included.

**Results**

**Data Reduction and Descriptive Statistics**

On the basis of preliminary correlational and confirmatory factor analysis (see chapter 1), our main analyses were conducted using an aggregate ToM measure obtained by summing $z$ scores on Strange Stories and Silent films tasks. This procedure is also consistent with existing literature (Lecce, Bianco, Devine & Hughes, 2017; Devine & Hughes, 2016) and helped us in reducing the number of variables. For descriptive analyses (see Table 3.1), and mean comparisons we computed an aggregate ToM score by adding proportion of success in the Silent Film (raw scores divided by 6) and the Strange Stories (raw score was divided by 5) to avoid the problem of standardised scores having a mean of 0 and standard

deviation of 1 at each time-point. Independent *t*-test comparisons showed that girls significantly outperformed boys on ToM at all the time-points, $t(64) \geq 2.47$, $p < .05$ and that Girls scored higher than boys on social anxiety at Time 3 only, $t(64) = 2.08$, $p < .05$. Gender did not significantly affect any of the other study variables, $t$s $\leq 1.72$, *ns*. We also conducted a one-way repeated measures ANOVA to examine how social anxiety and ToM scores changed between the three time-points. Results showed a decreasing linear effect of time for social anxiety, $F(1, 65) = 4.86$, $p < .05$, and an increasing quadratic effect of time for ToM, $F(1, 65) = 52.39$, $p < .001$.

Table 3.2 shows associations within and across time-points. As can be seen, individual differences in all the study variables were all stable over time, $r \geq .50$, $p < .05$. Family affluence was significantly associated with ToM (at all the time-points), with social acceptance (at Time 1 and Time 2), and with social anxiety (at Time 2). In addition, verbal ability was: a) concurrently associated with ToM at all the time-points, and b) longitudinally associated, in the short-term, with increased ToM at Time 2 and Time 3. Verbal ability at Time 2 was also marginally associated with social acceptance both concurrently and longitudinally. Given these results, we controlled for both verbal ability and SES in our main analyses. Regarding the associations among ToM, social anxiety and peer relationships, Table 3.2 shows a that the bivariate correlation between ToM at Time 1 (hypothesized predictor) and social anxiety at Time 2 (hypothesized mediator) was not significant. However, is should be considered that such association became significant when controlling for social anxiety at Time 1, $r(63) = -.28$, $p < .05$, indicating a longitudinal effect of early ToM on later social anxiety. Similarly, the nonsignificant bivariate correlation between Time 2 social anxiety (hypothesized mediator) and Time 3 peer rejection

(outcome variable) became marginally significant when controlling for Time 2 peer rejection, $r(63) = .23$, $p = .06$, and became significant when also accounting for the confounding effects of SES and verbal ability (control variables), $r(61) = .29$, $p < .05$.

Finally, the longitudinal bivariate correlations between early ToM and later peer relationships are mainly non-significant and low. However, the lack of direct associations between ToM and peer relationships, does not necessarily mean that ToM is not linked in any ways to later peer relationships. Indeed, this relationship may well be indirect as there is no need for a significant zero-order effect between predictor and criterion to establish a mediation (Zhao et al., 2010).

**Relationships between ToM, social relationships and social anxiety**

The main aim of the present study was to examine the developmental links between ToM and peer relationships by focusing on the mediating role of social anxiety. In particular, we hypothesized that social anxiety could mediate the longitudinal association between individual differences in early ToM (measured shortly after children's transition to secondary school) and those in children's later social adjustment within the peer group in the following school year. We evaluated this hypothesis using MPlus Version 7 (Muthèn & Muthèn, 2012). More in detail, we adopted an hypothesis-driven approach and tested a model in which ToM at Time 1 predicts social anxiety at Time 2, which, in turn, predicts peer nominations at Time 3. We also included in the model a) the long-term effect from Time 1 ToM to Time 3 peer nominations in order to account for the direct effects of the initial variable on the outcome variable, b) the longitudinal stability of each predicted variable (Time 1 social anxiety and Time 2 peer nominations) to control for

continuity in individual differences across time and c) verbal ability and SES as covariate to control for their potential confounding effects. Overall, the number of parameters to be estimated in the model was 13, with a sample size-to-parameters ratio (*N:q* – Jackson, 2003) of *5*:1. Rules of thumb addressing the relation between sample size and model complexity suggest a ratio of 5:1 being acceptable (Bentler & Chou, 1987; Brown et al., 2015). Following recommendations by Hu and Bentler (1998), we used maximum likelihood-based fit indexes suitable for models with *N*s < 250, specifically comparative fit index (CFI) and standardized root mean square residual (SRMR). Hu and Bentler suggest cutoffs of approximately CFI > .95 and SRMR < .08 to determine good fit. We conducted separate modelling analysis including, respectively, peer acceptance and peer rejection as the outcome variable in order to track specific pathways for positive and negative peer nominations. Both models (figures 3.1 and 3.2) showed acceptable fit with the data (ToM, social anxiety and peer acceptance: $\chi^2(2) = 4.603$, $p = .10$, CFI = .955, SRMR = .032; ToM, social anxiety and peer rejection: $\chi^2(2) = 7.939$, $p = .02$, CFI = .939 and SRMR = .044). Results showed that ToM at secondary school entry predicted reduced social anxiety 5-months later, at Time 2. Moreover, children's level of social anxiety at Time 2 predicted both reduced social acceptance and enhanced social rejection within the peer group at time 3. We next evaluated the indirect (mediated) pathways between Time 1 ToM and T3 peer nomination via T2 social anxiety using 10,000 bootstrap samples to estimate unstandardized indirect effects and confidence intervals. Results supported the mediation hypothesis for both models. Indeed, the indirect effect of Time 1 ToM on peer nominations, mediated by Time 2 social anxiety, was significant both when focusing on peer acceptance

($B = .048$; 95% confidence interval [CI] = [.014, .111], $\beta = .074$) and peer rejection ($B = -.028$; 95% confidence interval [CI] = [-.078, -.003], $\beta = .047$) as the outcome variable. Examination of the modification indices for both models showed that adding the omitted two cross-lagged paths from Time 1 social anxiety to Time 2 peer nomination and from Time 1 ToM to Time 2 peer nomination, would not significantly improve model fit. In addition, further analysis including also Time 2 ToM and Time 3 social anxiety into the model did not reveal a significant short-term effect of Time 2 ToM on Time 3 social anxiety.

Finally, we also evaluated two alternative causal models. The first alternative model evaluated the mediating role of social anxiety (at Time 2) between early peer relationships (at Time 1) and later ToM (at Time 3). The second alternative model evaluated the mediating role of peer relationships (at Time 2) between early social anxiety (at Time 1) and later ToM (at Time 3). For both models, we included the auto-regressive paths for the mediator and the outcome variable, as well as SES and VA as control variables following the same principles outlined above. Although both models showed an acceptable fit (CFI > .916, SRMR < .038), none of the lagged paths connecting early social anxiety or peer relationships with later ToM was found to be significant; therefore, no support was evident for these alternative mediation models.

Table 3.1 - Descriptive statistics for all the study measures

| Measure | | *n* | *M* | *SD* | Range | |
|---|---|---|---|---|---|---|
| | | | | | Potential | Actual |
| Time 1 | SES | 66 | 7.02 | 1.64 | 0-9 | 4-9 |
| | VA | 66 | 22.21 | 6.76 | 0-50 | 8-37 |
| | ToM | 66 | 2.42 | .55 | 0-4 | 1.10-3.63 |
| | SA | 66 | 6.00 | 3.04 | 0-18 | 1-14 |
| Time 2 | ToM | 66 | 3.00 | .48 | 0-4 | 1.60-3.83 |
| | SA | 66 | 5.67 | 2.91 | 0-18 | 0-13 |
| Time 3 | ToM | 66 | 2.91 | .46 | 0-4 | 1.70-3.83 |
| | SA | 66 | 5.09 | 2.95 | 0-18 | 0-13 |

*Note.* SES= Socioeconomic status; VA = Verbal ability; ToM= Theory of Mind; SA= Social anxiety.

Table 3.2 - Correlations between study measures within and across time-points

| | Measure | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time 1 | 1. SES | .17 | .29* | -.09 | .33** | -.06 | .41** | -.27* | .33** | .00 | .44*** | -.15 | .16 | .08 |
| | 2. VA | - | .33** | -.12 | .20 | -.14 | .32** | .03 | .20 | -.14 | .19 | -.06 | .17 | -.09 |
| | 3. ToM | | - | .12 | .09 | -.07 | .51*** | -.18 | .23+ | -.12 | .29* | -.15 | .01 | -.14 |
| | 4. SA | | | - | -.24+ | .12 | .04 | .50*** | -.14 | .16 | .08 | .38** | -.39** | .31* |
| | 5. ML | | | | - | -.36** | .14 | -.28* | .74*** | -.23+ | .07 | -.18 | .73*** | -.24* |
| | 6. LL | | | | | - | -.16 | -.17 | -.40** | .63*** | -.02 | -.06 | -.41** | .61*** |
| Time 2 | 7. ToM | | | | | | - | -.08 | .36** | -.11 | .53*** | -.06 | .08 | -.13 |
| | 8. SA | | | | | | | - | -.04 | -.09 | -.17 | .55*** | -.25* | -.08 |
| | 9. ML | | | | | | | | - | -.30* | .13 | .01 | .54*** | -.25* |
| | 10. LL | | | | | | | | | - | .00 | .03 | -.27* | .78*** |
| Time 3 | 11. ToM | | | | | | | | | | - | -.08 | .00 | .07 |
| | 12. SA | | | | | | | | | | | - | -.12 | .14 |
| | 13. ML | | | | | | | | | | | | - | -.32** |
| | 14. LL | | | | | | | | | | | | | - |

*Note*. SES= Socioeconomic Status; VA = Verbal ability; ToM= Theory of mind; SA= Social anxiety; ML=Most-like nominations; LL=

Least-like nominations. $^+p \le .10$ $*p \le .05$ $**p \le .01$ $***p \le .001$

Figure 3.1 –ToM, social anxiety and peer acceptance
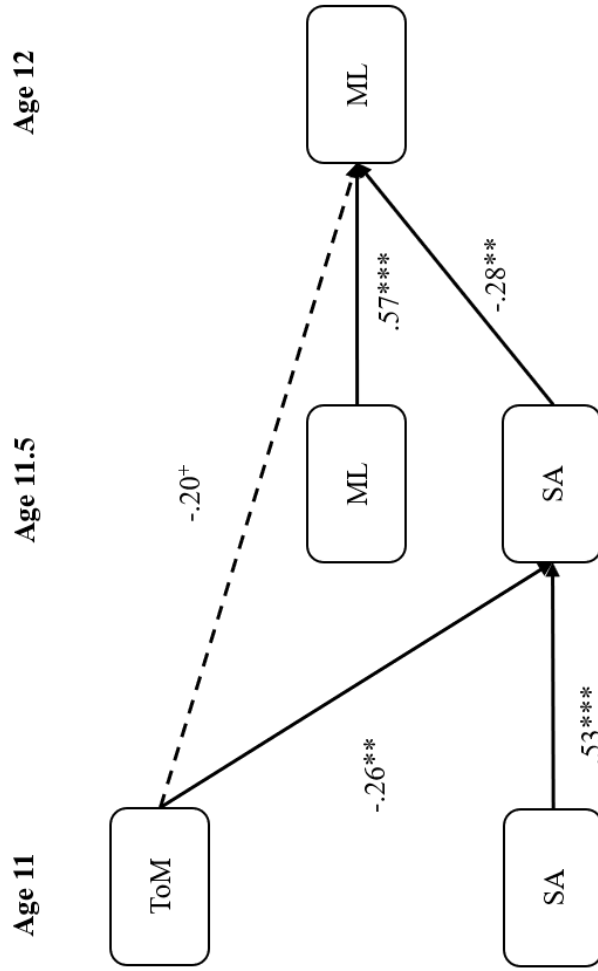


**Age 11**          **Age 11.5**          **Age 12**

*Figure 3.1.* Social anxiety (SA) at time 2 (age 11.5) as mediator of the association between Theory of mind (ToM) at time 1 (age 11) and most-like nominations (ML) at time 3 (age 12). Error terms, verbal ability and SES not shown, in order to enhance clarity. Dashed lines represent nonsignificant paths. **$p \leq .01$. ***$p \leq .001$.

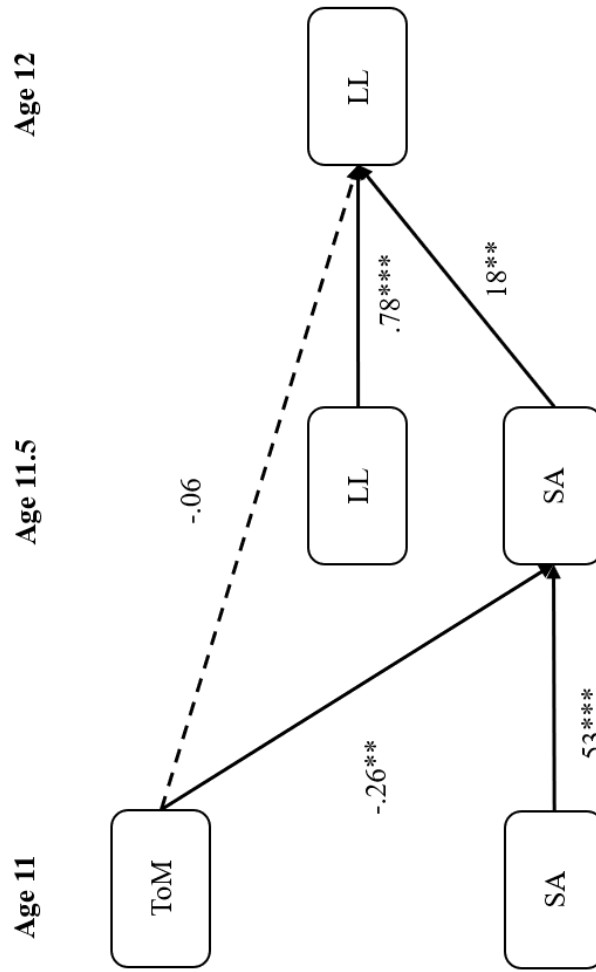Figure 3.2 – ToM, social anxiety and peer rejection



*Figure 3.2.* Social anxiety (SA) at time 2 (age 11.5) as mediator of the association between Theory of mind (ToM) at time 1 (age 11) and most-like nominations (ML) at time 3 (age 12). Error terms, verbal ability and SES not shown, in order to enhance clarity. Dashed lines represent nonsignificant paths. **$p \leq .01$. ***$p \leq .001$.

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**Discussion**

The present study explored the role of social anxiety as a mediator of the developmental association between early individual differences in ToM and later children's peer relationships, after the period of transition from primary to secondary school. Our main analysis showed that ToM performance shortly after starting secondary school predicted higher levels of peer acceptance, as well as lower levels of peer rejection, one year later, and that this effect could be explained in terms of reduced social anxiety. Notably, this longitudinal effect was independent of individual differences in verbal ability and socioeconomic status, as well as of stability in individual differences in children's social anxiety and social relationships across time.

**ToM and peer relationships in the school years**

Although conclusive statements about causality cannot be made, the outlined developmental pathway suggests that individual differences in ToM could play an important role in shaping children's emotional and social experience after the transition to secondary school. Indeed, besides confirming the negative impact of social anxiety on children's social relationships with peers (Erath et al., 2007; Greco & Morris, 2005; Inderbitzen et al., 1997; La Greca & Stone, 1993; La Greca & Lopez, 1998; Rubin et al., 2009; Siegel et al., 2009; Tilfors et al., 2012), the present study extends previous literature on ToM and social anxiety (Banerjee & Henderson, 2001; Colonnesi et al., 2016; Muris & Broeren, 2009; Hezel & McNally, 2014) by providing the first longitudinal evidence that individual differences in ToM can predict changes in children's levels of social anxiety over time. Furthermore, the observed mediational pathway suggests that ToM, via

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reduced social anxiety, could play an important protective role for children's social relationships after the transition to secondary school, which represents a challenging period for children's social and emotional adjustment (Gillison, 2008; Lohaus et al., 2004). Being good at reading others' minds may well be an important tool to overcome one's social concerns and feelings of anxiety when facing this kind of relationally unstable social context and, therefore, successfully navigate a new social environment.

The present results complement a small but growing literature demonstrating the importance of social understanding for children's social relationships with classmates in middle childhood (Banerjee & Watling, 2005; Banerjee et al., 2011; Devine & Hughes, 2013; Slaughter et al., 2015). So far, research studies on this topic have shown that ToM is associated with children's acceptance and rejection by peers, both concurrently and longitudinally (Banerjee et al., 2011; Slaughter et al., 2015), as well as with children's self-rated loneliness and dissatisfaction in their social relationships with classmates (Devine & Hughes, 2013), although they typically focused on children younger than the ones included in the present study. The present study also takes us forward in the understanding of the potential mechanisms by which ToM can influence children's peer relationships. Specifically, the observed mediation role played by social anxiety suggests that children's emotional experience, rather than just social behavior (Imuta et al., 2016; Devine & Hughes, 2016; Peterson et al., 2016), might have important implications for our understanding of how social understanding may shape children's social experiences at school.

**Social Anxiety and Theory of Mind in the context of peer relationships**

Of particular note is the finding that social anxiety mediates the association between ToM and both social acceptance and rejection by peers. This pattern of results suggests not only that advanced ToM skills may promote children's social participation by reducing social anxiety, but also that relatively higher social anxiety as a consequence of poor social understanding may convey a risk of active rejection by peers. This pattern of results supports the idea that social understanding plays a critical role in children's interpersonal relationships at school (Banerjee et al., 2011) and also suggests that the way children experience and deal with their socio-emotional concerns about the social world has explanatory potential for our understanding of how both advanced and poor ToM skills respectively relate to children's social adjustment and maladjustment in middle childhood.

The way in which the interplay between individual differences in ToM and social anxiety affect children's peer relationships remains opaque. We know from previous literature that social anxiety can affect children's processing of both external (e.g., the threat stimulus) and internal information (e.g., one's coping responses) during social interactions (Banerjee, 2008; Daleiden & Vasey, 1997; Lemerise & Arsenio, 2000), with consequences on social engagement (Rubin et al., 2009), behavior (Crick & Dodge, 1994; Daleiden &Vasey, 1997) and success (Erath, 2007; Rubin et al., 2009). Results of the present study suggest that children's social understanding may interact, at least at certain levels, with such emotional, cognitive and motivational processes, influencing the way in which children experience – and cope with – their social world (Banerjee, 2008). For example, individual's ability to reason about one's own and others' mental states may help

children to cope with their emotions (Sharp, Pane, Ha, Venta, Patel, Sturek, & Fonagy, 2011) and to experience more self-confidence during interactions with new peers in a challenging social environment. In other words, advanced ToM skills may promote children's awareness of what is going on inside and around them, as well as how they should behave in order to achieve their social goals in that situation (Banerjee & Watling, 2010). This hypothesis fits with the idea that "socially anxious individuals' expectation of negative social outcomes may result from a lack of knowledge about how self-conscious concerns can be translated into effective behavioral strategies" (Banerjee & Henderson, 2001, p. 559). In turn, a greater sense of agency is expected to motivate children to attempt challenging social tasks (Ford, 1987), to reduce helpless behaviors (Bandura, 1988; Caprara Scabini, Barbaranelli, Pastorelli, Regalia, & Bandura, 1999) and display more positive social engagement with peers (Caspi, Elder, & Bem, 1988; Gazelle & Rudolph, 2004) which is likely to facilitate children's peer relationships. In contrast, heightened social uncertainty (Schlenker & Leary, 1992) as a consequence of poor social understanding may foster socially anxious children's tendency to avoid social relationships, as a strategy to regulate their emotion (Tillfors et al., 2012; Rubin et al., 2009). Indeed, children's social withdrawal and disengagement have been shown to mediate the association between high social anxiety and low peer acceptance after the transition to secondary school (Erath et al., 2007).

However, the present study also shows that when relatively low levels of ToM translate into relatively high levels of social anxiety, children may be exposed to an increased risk of peer rejection. This finding suggests that poor social understanding, rather than just undermining children's self-confidence in

challenging environments, is also likely to exacerbate socially anxious children's display of dysfunctional behaviors during social interactions. It is possible that biased attribution of intention and knowledge, a relevant feature of poor social understanding that predicts social rejection (Banerjee et al., 2011), may amplify children's thoughts and feelings of social anxiety, as well as playing a key role in later negative social behavior and interpersonal relations (Dodge & Pettit, 2003). For example, difficulties in interpersonal understanding, especially when coupled with emotional dysregulation, can lead to inadequate or disconnected responses to others' behaviour during ongoing interactions (Slomkowski & Dunn, 1996), which might lead the social partner to leave the interaction and the child to be excluded from future social exchanges.

**Directions for further work**

Although the line of argument presented so far seems plausible, further research is required for a better understanding of how ToM and social anxiety relate to each other in affecting children's peer relationships. Future research should adopt a fine-grain approach and explore in depth the nature and specificity of the link between ToM and social anxiety. In particular, we argue that adopting a social information-processing approach may enable the detection of theoretical similarities and differences between ToM and information-processing characteristics related to anxiety. For example, previous literature has suggested that biases at various stages of information processing are likely to interact with socio-cognitive difficulties, including difficulties in ToM tasks (e.g., Banerjee & Henderson, 2001; Harvey, Fletcher, & French, 2001; Holl et al., 2018).

Future research should also explore how the interplay between ToM and social anxiety influences children's experience of positive and negative peer relationships. We argue that social behavior may play a role here. As noted earlier, some existing research shows that individual differences in ToM predict children's socially competent behavior with peers (Imuta et al., 2017; Devine & Hughes, 2016; Peterson et al., 2016), and therefore suggests that social behavior is likely to mediate the longitudinal link between ToM and social relations (Caputi et al., 2012). Furthermore, Banerjee and Henderson (2001) found a concurrent association between variation in ToM and low social anxiety, on the one hand, and high teacher ratings of socially competent behavior, on the other. In addition, they also showed that high social anxiety was associated with low frequencies of 'interactive' social behavior that specifically required ToM. This pattern of correlation between ToM, social anxiety and social behavior suggests that social anxiety and social behavior may well be entwined, and that both reduced social anxiety and skilled social behaviors may stem from advanced ToM skills. Future studies should explore how these different features of social competence (cognitive, behavioral and affective) interact with each other in shaping children's social experiences with their peers. For example, we argue that the combination of high social anxiety and reduced social competence as consequences of poor social understanding may be particularly promising in explaining the developmental pathway that links early ToM difficulties and later social rejection by peers in late childhood (Banerjee, 2011).

Finally, an intriguing direction for further work concerns the developmental timing of the associations between ToM and social anxiety, and between social

anxiety and social relationships. Indeed, in the present study we found that the longitudinal effect of ToM on social anxiety was present only in the early period after transition to secondary school (between Time 1 and Time 2) but not later. In addition, the negative effect of social anxiety on peer relationships was significant only from 5- to 10-months after children had moved to the new school. As we showed in the results, after secondary school entry, social anxiety started to decrease linearly. This observation is in line with previous longitudinal work on the trajectory of children's anxiety after the transition to secondary school (Grills-Taquechel et al., 2010; Vernberg et al., 1992), and suggests that high reported levels of social anxiety at secondary school entry may reflect more normative concern regarding the impact of the new social environment (Symonds & Galton, 2014). Speculating on this premise, it is possible that children who continue to manifest a relatively high level of anxiety at the end of the first year of secondary school (time 2 in the current study), when the mean level of social anxiety in the peer group is decreasing, would be more likely to show later relational problems. Thus, working backwards along this line of interpretation, individual differences in ToM could be particularly relevant in the early phase of the transition, when children are managing their new encounters, rather than later on, when the social structure may start to be fairly established and the "newness" has worn off (Vernberg et al., 1992). Further longitudinal studies are needed to test these hypotheses.

**Limitations and Conclusions**

The present study has a number of limitations that must be considered when interpreting the reported findings. First of all, the sample size of the present study is limited, and further research is needed to confirm and generalize our preliminary

results. Moreover, the limited sample size prevented us from exploring the alternative causal hypotheses about the link between ToM, social anxiety and peer relationships testing a single cross-lagged model, which means, including into the same statistical model each key variable at each the time-points, together with their autoregressive effects and reciprocal associations across-time (Seling & Little, 2012). Given the reduced sample size of the present study, we were able to address this limitation testing separate models. Notwithstending, future studies with a larger sample size should adopt a single, more parsimonious, model solution. A further limitation of the present study is the focus on a single self-reported measure to assess individual differences in social anxiety. Although research studies support the validity of self-report when measuring of social anxiety in middle childhood (La Greca et al., 1993; Banerjee et al., 2008) and children's perspective might allow access to specific facets of social anxiety (e.g., worries) that parents and teachers may not be completely able to report, self-report measures may also reflect social desirability in the results. Thus, future studies should adopt a multi-informant approach to stress the robustness of anxiety scores. The adoption of physiological measure, able to estimate children's distress in the context of social and/or performance situation (Nikolic, Colonnesi, de Vente, & Bögels, 2016) should also be considered.

Finally, our focus on the period of transition to secondary school and on a normative-developing sample raise questions on whether the benefit of ToM for children's social functioning generalize beyond the period of transition, and/or replicated in clinical samples. Regarding this latter aspect, future research may investigate, as a first step, the link between ToM and social anxiety over the

transition to secondary school (or other socially-taxing situations) considering also measures of trait anxiety. This approach would allow researchers to stress the link between ToM and social anxiety at different level of trait anxiety and answer the question of whether the positive effects of ToM are valid for all of the children, and specifically for those at greater risk for adjustment problems over the transition to secondary school (Sirsh, 2003). To this aim, a greater and variegated sample would be needed.

Notwithstanding these potential limitations, the present results are promising and prompt future research to further pursue the potential implications of individual differences in ToM for children's socio-emotional experience in late childhood. We argue that advanced ToM skills may constitute a valuable tool for children to handle their social concerns and manage relational challenges in new social contexts. For example, children's ability to effectively understand other's intentions and expectancies, as well as the implicit social roles that animate the novel social context, may allow them to overcome the barrier of social uncertainty and get involved with more chance of success in social group processes. Furthermore, the potential effect of ToM in reducing disadvantageous consequences of social anxiety and favoring children's relationships represents an adaptive and protective mechanism that may be crucial for children's broader development and adjustment.

# General discussion and conclusions

Both theoretical (Carpendale & Lewis 2004; Hughes & Leekam, 2004) and empirical (Banerjee et al., 2011; Caputi et al., 2012) works suggest that ToM might play an important role for children's social adjustment at school and, at the same time, that the quality of children's social relationships can contribute to ToM development during the school years. The present thesis deeply investigated the expected association between individual differences in ToM and children's social relationships in middle childhood by exploring *how* ToM can shape and is shaped by children's peer relationships in the context of school. Particularly, we investigated in two separate studies (chapter 2 and chapter 3) the role of either children's social behaviour with peer and children's socio-emotional experiences after the transition to secondary school as potential mediators of the developmental association between ToM and peer relationships. Notably, preliminary Confirmatory Factor Analyses (chapter 1) was aimed to stress, in our Italian sample, the psychometric properties of the composite ToM battery (made up of items from the strange stories and silent tasks) that has been adopted in the present thesis. Importantly, results from the first study confirmed the validity and reliability of this advanced ToM measure in our sample and allowed us to confidently use it to address our following mediation hypotheses. Notably, beside this practical implication, results reported in the first chapter provide new evidence about the convergent validity and test-retest reliability of the Strange Stories and Silent Films tasks in an Italian sample of school-aged children. Capitalizing on these results, in the second study (chapter 2) we investigated the interplay between ToM, children's social behaviour and peer relationships in middle childhood. Results from this work

showed that increased aggressive behaviour and reduced prosocial behaviour mediated a negative longitudinal association between early peer rejection and later ToM in both younger and older children. That is, early peer rejection predicted increased aggressive behaviour and reduced prosocial behaviour over time, which in turn were likely to limit children's opportunity to learn about others' minds. Furthermore, aggressive behaviour also mediated a longitudinal association between early ToM and later peer rejection in the younger age-group only. That is, individual differences in ToM negatively predicted aggressive behaviour over time, which increased children's risk of being rejected by peers. Interestingly, we found that early ToM also moderated the negative impact of early peer rejection on later aggressive behaviour. That is, peer rejection led to increased aggressive behaviour for low and medium (but not high) levels of ToM. In the third study (chapter 3) we focused our attention on a subsample of children who, at Time 1, had just made the transition from primary to secondary school. In doing so, we aimed to test the specific hypothesis that individual's ToM skills could facilitate children's peer relationships one year after the transition by reducing children's feeling of social anxiety over time, in a novel and challenging social environment. Results from this study showed that children's social anxiety mediated a longitudinal association between early ToM and later both acceptance and rejection by peers. That is, individual differences in ToM at Time 1 negatively predicted variability in social anxiety at Time 2, which in turn increased peer rejection and decreased peer acceptance at Time 3.

Taken all together, results from the second and third chapters of the present thesis are likely to have important implications for our understanding of the social

predictors and consequences of individual differences in ToM middle childhood. On one hand, the role of children's social behaviour in gathering the effects of peer relationships on children's socio-cognitive learning suggests the importance of children's active role in the definition of their ToM-relevant social experience in middle childhood. Notably, this idea fits with the socio-constructivist view that children's social learning builds on the active interaction between the child and its social environment (Carpendale & Lewis, 2004). Indeed, along with the emphasis on the importance of social environment in children's socio-cognitive development, socio-constructivism also underlies the crucial role of the child as an active participant in this process. According to this interactional perspective it is likely that not just the richness and/or quality of children's social environment but also the way children behave within their relationships matters in defining the specific nature of social experience that is relevant for ToM development at this age. On the other hand, the findings that ToM indirectly predicted children's peer relationships by affecting children's aggressive behaviour (study 2) and social anxiety (study 3) over time contribute to our understanding of how individual differences in ToM can shape children's peer relationships at school. Interestingly, our results suggest that, rather than *promote* peer relationships by increasing positive (prosocial) behaviours, individual's ToM skills were more likely to *protect* children's peer relationships by reducing negative social behaviours (aggression) or maladaptive emotional responses (social anxiety), especially in response to stressful social experience such as peer rejection or school transition. More specifically, the finding that ToM moderated the impact of early peer rejection on later aggressive behaviour, as well as reduced children's feeling of anxiety over time after the

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transition to secondary school, suggests that individual's ToM skills may play an important protective role for children's social adjustment in late childhood. The present findings prompt future research to deeply investigate the potential benefits of advanced ToM skills for children social adjustment in contexts of risk. Furthermore, the fact that the associations between ToM and peer relationships were totally mediated, suggests that ToM, rather than *directly* influencing children's peer relationships, might be affecting the way children experience and behave within their social environment. This idea is likely to explain, at least in part, the modest and fluctuating nature of the relation between Theory of Mind and peer relationships found in previous literature (see Slaughter, Imuta, Peterson, & Henry, 2015 for a meta-analysis). Nevertherless, future studies are needed to further stress the direct or indirect nature of the association between ToM and peer relationships. For example, as discussed in the second chapter, different ToM tasks (as well as different items within each tasks) are likely to taps of different features of children's daily-life social exhanges and, thus, the adoption of one (or the other) task may influence the specificity of the association between children's ToM use of and their peer relationships (e.g., Banerjee et al., 2011; Caputi et al., 2012).

Besides these theoretical contributions and suggestions for future research, the present thesis also have practical implications. Training studies have shown that ToM is a malleable skill in middle childhood that can be fostered (Lecce, Bianco, Devine, & Hughes, 2014) and taught at school (Bianco, Lecce, & Banerjee, 2016). Interestingly, research in this field is also interested in extending the beneficial effects of ToM trainings behind the immediate socio-cognitive development to influence the quality of children's daily-life social exchanges. By investigating the

potential mechanisms by which ToM development can transform children's peer relationships in the natural setting of school, the present thesis provides insights into how to tailor interventions in order to emphasise their relevance for children's social life. Crucially, this line of investigation may have widespread positive implications on children's well-being and long-term adjustment, since peer relationships at school are known to have a crucial influence upon children's further socio-emotional, cognitive and academic adjustment (Gazelle & Rudolph, 2004; Tillfors, Persson, Willén, & Burk, 2012; Lecce, Caputi, Pagnin, & Banerjee, 2017; Rubin, Bukowski, & Parker, 2006).

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# Appendices

## Appendix A

Summary of all the measures adopted in the present thesis. For each measure is reported the time of acquisition, the specific study (or studies) in which has been considered and the chapter in which is described more in depth.

| Construct | Measures | Measured at | Considered in | Described in |
|---|---|---|---|---|
| Theory of Mind | Strange Stories task (Happe, 1994) and Silent Films task (Devine & Hughes, 2013) | Each time-point | Each study | Chapter 1 |
| Peer relationships | Sociometric peer Most-Like and Least-Like nominations (Coie, Dodge, & Coppotelli, 1982) | Each time-point | Study 2 and 3 | Chapter 2 |

| | | | | |
|---|---|---|---|---|
| Social behaviour | Child behaviour scale teacher-form (CBS - Ladd & Profilet, 1996) – Prosocial with peer and Aggressive with peer subscales | Each time-point | Study 2 | Chapter 2 |
| Social anxiety | Social Anxiety Scale for Children (SASC – La Greca, Dandes, Wick, Shaw, & Stone, 1988) | Each time-point | Study 3 | Chapter 3 |
| Verbal ability | Mill Hill Vocabulary scale (MHVS – Rust, 2008) | Time 1 | Study 1 and 2 | Chapter 1 |
| | Primary Mental Ability (PMA - Thurstone & Thurstone, 1962); vocabulary sub-scale intermediate form 11-17 years | Time 1 | Study 3 | |
| Socioeconomic status | Family Affluence Scale (FAS – Currie, Molcho, Boyce, Holstein, Torsheim & Richter, 2008) | Time 1 | Each study | Chapter 1 |

Strange Stories tasks – Initial and parallel version of the stories adopted respectively at Time 1 and Time 2.

| Social scenario | Story at Time 1 | Story at Time 2 |
| --- | --- | --- |
| Persuasion (Item 1) | Brian is always hungry. Today at school it is his favourite meal—sausages and beans. He is a very greedy boy, and he would like to have more sausages than anybody else, even though his mother will have made him a lovely meal when he gets home! But everyone is allowed two sausages and no more. When it is Brian's turn to be served, he says, ''Oh, please can I have four sausages, because I won't be having any dinner when I get home!'' <br> Q: Why does Brian say this? | Jill wanted to buy a kitten, so she went to see Mrs. Smith, who had lots of kittens she didn't want. Now Mrs. Smith loved the kittens, and she wouldn't do anything to harm them, though she couldn't keep them all herself. When Jill visited she wasn't sure she wanted one of Mrs. Smith's kittens, since they were all males and she had wanted a female. But Mrs. Smith said, ''If no one buys the kittens I'll just have to drown them!'' <br> Q: Why did Mrs. Smith say that? |
| Misunderstanding (Item 2) | One late night, old Mrs. Peabody is walking home. She doesn't like walking home alone in the dark because she is always afraid that someone will attack her and rob her. She really is a very nervous person! Suddenly, out of the shadows comes a man. He wants to ask Mrs. Peabody what time it is, so he walks toward her. When Mrs. Peabody sees the man coming toward her, she starts to tremble and says: ''Take my purse, just don't hurt me please!'' Q: Why did she say that? | On the bus, Mary has her purse open and, due to a sudden braking of the driver, her wallet slips under a seat, without her noticing. Carlo, a boy who has seen the incident, takes the wallet with the intent to return it to the owner who at that moment turns and sees his wallet in the hands of a stranger. So, Mary screams: "you Thief! Give me back my wallet right now! " <br> Q: Why did she say that? |

| | | |
|---|---|---|
| Double bluff (Item 3) | During the war, the Red army captures a member of the Blue army. They want him to tell them where his army's tanks are; they know they are either by the sea or in the mountains. They know that the prisoner will not want to tell them, he will want to save his army, and so he will certainly lie to them. The prisoner is very brave and very clever, he will not let them find his tanks. The tanks are really in the mountains. Now when the other side asks him where his tanks are, he says, ''They are in the mountains.'' Q: Why did the prisoner say that? | During a battle between the Northern and the Southern pirates, the Northern pirates capture a member of the opposing crew to ask him where the treasure is hidden. The Northern pirates know that the treasure is either in the hills or on the coast. The pirates of the North also know that the prisoner does not want to say where the treasure is and that he will certainly lie to them. The prisoner is very brave and very clever, he will not let them find it. The treasure is hidden in the hills. When the pirates of the North ask him where the treasure is, he replies that he is on the hill. Q: Why did the prisoner say that? |
| Double bluff (Item 4) | Simon is a big liar. Simon's brother Jim knows this, he knows that Simon never tells the truth! Now yesterday Simon stole Jim's ping-pong paddle, and Jim knows Simon has hidden it somewhere, though he can't find it. He's very cross. So he finds Simon and he says, ''Where is my ping-pong paddle? You must have hidden it either in the cupboard or under your bed, because I've looked everywhere else. Where is it, in the cupboard or under your bed''? Simon tells him the paddle is under his bed. Q: Why will Jim look in the cupboard for the paddle? | Greta loves reading and has just received as a gift a book of her favourite writer. Her little sister is very spiteful and liar and Greta knows that she always hides her objects and tells her lies not to let them find them! Now, today Greta would like to start reading her new book but does not find it on the bedside table, where she had left it. Greta knows her little sister has hidden it somewhere, though he can't find it. So, she asks her sister: "Where is my book? You must have hidden it either inside the chest or under the sofa, because I've looked everywhere else. Where is it? In the chest or under the sofa? ". His sister replies that she is under the sofa. Q: Why will Greta look in the chest for the book? |

Misunderstanding (Item 5)

A burglar who has just robbed a shop is making his getaway. As he is running home, a policeman on his beat sees him drop his glove. He doesn't know the man is a burglar, he just wants to tell him he dropped his glove. But when the policeman shouts out to the burglar, ''Hey, you! Stop!,'' the burglar turns round, sees the policeman and gives himself up. He puts his hands up and admits that he did the break-in at the local shop. Q: Why did the burglar do that?

A child has just rung the intercom of a house as a joke and is running away. While he is running away in haste, a policeman sees that he is about to cross a road with red light. He does not know the child rang the bell and just wants to tell him not to cross. However, when the policeman shouts to the child: "Hey you, stop!", The child stops and says: "Please do not punish me! I will never play jokes again! ". Q: Why did the child say that?

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