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Relationships between Theory of Mind and Attachment Styles in Emerging Adulthood

A. Henry¹ P. Allain² C. Potard²

Abstract

Several studies have highlighted a relationship between attachment and theory of mind (ToM) in childhood and in clinical populations. However, little is known about the link between attachment and ToM in the general adult population. The aim of this study was, therefore, to explore how differences in attachment styles influence ToM skills in a nonclinical population of young adults. 69 young adults performed the Reading the Mind in the Eyes test, Movie for the Assessment of Social Cognition test (MASC), and an adult attachment Q-sort questionnaire. Findings revealed that dimensions of avoidant and ambivalent attachment were, respectively, related to undermentalizing and overmentalizing tendencies. Insecure participants performed significantly more poorly than secure ones on the MASC. More specifically, participants with an avoidant attachment style made significantly more responses classified as *undermentalizing* than those with a secure attachment style. A statistical trend was observed for the MASC no-ToM score (answer with complete lack of ToM or literal understanding), with lower scores for the insecure ambivalent group than for the secure group. These results suggest that the individuals with avoidant insecure attachment are more likely to under-attribute mental states to others, while those with ambivalent insecure attachment tend not to make attributions when the situation requires it. Implications for future research are discussed.

Keywords Attachment · Social cognition · Theory of mind · Mentalizing · Executive function · Emerging adulthood

Introduction

The process by which people understand their social worlds is a topic of increasing interest in clinical psychology. A central component of the understanding of mental states is known as *theory of mind* (ToM; Baron-Cohen et al., 1985; Premack & Woodruff, 1978), or *mentalizing*¹ (Fonagy et al., 2007). Both these terms refer to a sociocognitive ability

related to understanding and making inferences about others' mental states, thoughts, beliefs and emotions, and thereby interpreting, explaining, and predicting their behavior (Happé et al., 2017). Fonagy and Luyten (2009) highlighted two processes involved in the socio-affective information process. The first (emotional mentalizing) refers to the automatic, implicit, or nonconscious and reflexive processing of external information about others (e.g., expressions, attitudes), while the second (cognitive mentalizing) refers to more explicit and voluntary levels of social-emotional processing. It is thought to be preferentially involved in the processing of information about others' inner selves, such as their mental states and intentions.

ToM has been identified as an important factor in social competence (Hughes & Devine, 2019; Imuta et al., 2016). Its impairment is correlated with interpersonal problems in individuals with both behavioral and psychological disorders, as well as in healthy populations (e.g., Bosacki et al., 2020). A growing body of research has also demonstrated

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¹“Imaginative mental activity that enables us to perceive and interpret human behavior in terms of intentional mental states (e.g., needs, desires, feelings, beliefs, and goals)” (Fonagy & Luyten, 2009, p. 1357).

social influences on ToM skills, such as quality of the parent–child relationship, which can in part be explained by individual differences in ToM abilities in childhood (e.g., Poulin-Dubois, 2020). Moreover, the mentalizing model proposed by Fonagy (for a summary, see Fonagy & Luyten, 2009) argues that the ability to understand the behavior of others, in terms of their thoughts and feelings, is a developmental achievement that depends, among other things, on the quality of attachment relationships.

Attachment theorists (Bowlby, 1969, 1976; Bretherton, 1992; Cassidy & Shaver, 1999) have stated that the quality of the attachment relationship shapes people’s understanding of themselves, the world, and others across their entire lifespan. Attachment theory suggests that *secure* attachment stems from children’s sense that the attachment figure is available or accepting when needed, and supports autonomy, exploration, and individuation (Ainsworth, 1979; Bowlby, 1969). Conversely, *insecure* attachment characterizes people with insensitive, inconsistent, or abusive parenting experiences. According to Bowlby (1969, 1976), humans develop *internal working models* (IWMs; i.e., experience-based mental representations of their attachment relationships) that affect the way they perceive, attend to, and process (emotionally) meaningful information (Mikulincer & Shaver, 2007, 2008; Stievenart et al., 2011). These IWMs form the basis of personal attachment styles, which tend to remain stable over time and dictate the pattern of individual behaviors and reactions in social interactions.

In theory, quality of attachment has a significant influence on both future affective relations and sociocognitive development (Ainsworth, 1979). For example, *secure* individuals develop coherent and organized mental representations of their self, the world and relationships that give them the ability to engage in *goal-corrected partnerships*, attending to and using mental representations of others. As described earlier, this process overlaps with ToM abilities, and there may indeed be a bidirectional relationship (Hünefeldt et al., 2013). In one direction, ToM may influence IWMs (Fonagy et al., 2007), while in the other direction, quality of attachment may have an impact on ToM skills, in terms of the frequency, sophistication and accuracy of mentalizing (Dykas & Cassidy, 2011).

Research among children or adolescents supports the notion that secure attachment is generally associated with greater ToM (e.g., Carpendale & Lewis, 2004; Meins et al., 2001; Symons & Clark, 2000). Nevertheless, other studies have failed to find an association between security and ToM (Meins et al., 2002; Ontai & Thompson, 2008; Symons & Clark, 2000). There are four possible explanations for the inconsistency of these results. First, sex differences may help to explain the mixed pattern of findings (Bialecka-Pikul et al., 2021; Carpendale & Lewis, 2004). Second, ToM is not a one-dimensional ability, and a broad variety of measures

are used to assess different aspects and components of ToM (Apperly, 2012;). Some ToM tasks assess perspective taking, while others assess mental state decoding. Measures also differ on the nature of the stimuli (affective vs. cognitive mental state), mode of presentation (visual or verbal, static or dynamic), and the magnitude of cognitive demand. Dynamic visual information tasks (i.e., video depicting a set of social interactions in an everyday life context, such as Movie for the Assessment of Social Cognition test—MASC; Dziobek et al., 2006) are described as more ecologically valid and information-rich than verbal narratives or static visual stimuli tasks (Allain et al., 2019; Fossati et al., 2018). Therefore, ToM tasks do not offer a pure measure of ToM abilities, and other cognitive processes may be involved, in particular executive functions (EFs), which refer to a set of higher-level cognitive abilities needed for planning and executing goal-directed operations such as working memory, flexibility, and inhibitory control (e.g., Anderson, 2002). ToM and EFs appear to develop in concert and to share part of the underlying neural network (Wade et al., 2018). Third, these discrepancies could be explained by the considerable variability in age groups and tasks across studies. For example, studies of higher-order nonsocial cognitive functions have pointed to developmental fractionation of EF components (e.g., Brydes et al., 2014), while studies of social cognition in adolescents and young adults have tended to highlight developmental asymmetries in ToM (e.g., Meinhardt-Injac et al., 2020), suggesting that some but not all ToM components continue to develop during emerging adulthood. 4th, most studies have not considered sociocognitive subgroups or the diversity of individuals’ mentalizing profiles. It has been suggested that mentalizing dysfunctions reflect not only deficits in mentalizing or hypomentalizing (i.e., underattribution of mental states), but also specific forms such as hypermentalizing or excessive ToM (i.e., overattribution of mental states) for which there is little or no evidence as yet (e.g., Bliksted et al., 2019; Ciaramidaro et al., 2015; Dziobek et al., 2006; Russell et al., 2006).

Moreover, two types of ToM skills could be considered, depending on the insecure style of attachment. Based on Mikulincer and Shaver (2007, 2008)’s model of attachment, insecure attachment manifests itself in either *hyperactivated* (i.e., ambivalent attachment) or *deactivated* (i.e., avoidant attachment) strategies of emotion regulation. *Ambivalent* individuals, therefore, tend to engage in hypervigilance and rumination about attachment-related mental states (cognition, emotions, feelings, etc.), and could be expected to have more sophisticated mentalizing or ToM skills (Hünefeldt et al., 2013). *Ambivalent* attached individuals also have specific emotion regulation strategies, marked by the maximizing of negative emotions in social situations (Mikulincer & Shaver, 2007). *Avoidant* individuals tend to dismiss, deny or suppress attachment-related mental states and exhibit a lack

of meaningful interpersonal relationships. Their hypoactivation of the attachment system is also associated with widespread use of suppression of emotional expression in order to conceal their emotional experiences from others (Vrtička et al., 2012; Vrtička, Bondolfi, et al., 2012; Vrtička, Sander, et al., 2012; Vrtička, Sander, et al., 2012). Accordingly, they could be expected to have less sophisticated mentalizing skills (Hünefeldt et al., 2013). To our knowledge, only one study (Hünefeldt et al., 2013) has so far tested this hypothesis in an adolescent sample. Results revealed the opposite relationship, with ambivalent attached adolescents (to mother) exhibiting less accurate mindreading, as assessed with the revised version of the Reading the Mind in the Eyes (RME) test (Baron-Cohen, 2001). Moreover, a recent study (Baskak et al., 2020) suggested that young adults with different attachment styles also have differing cortical activity during a ToM task (i.e., RME test). Although insecure and secure participants achieved comparable scores on the ToM task, avoidant insecure attachment may be related to less activity in the right temporoparietal junction, a brain region known to play a major role in the attribution of intentions (Vistoli et al., 2011). Nevertheless, it should be noted that this study was conducted among a sample of Turkish medical students with a very high prevalence of insecure attachment (68%), which is not very representative of international findings on the issue.

Although the effects of IWMs could be expected to manifest themselves across the entire lifespan, research on the relationship between attachment and ToM has so far focused on childhood or adolescence (see Szpak & Bialecka-Pikul et al., 2020, for a review). In the same way, most ToM research is traditionally focused on young children or adolescents (e.g., Hughes & Devine, 2015). Far less is, therefore, known about adults' mentalizing ability. Nonetheless, recent empirical research on ToM in a nonclinical adult sample (Apperly et al., 2010, 2011) underlined the persistent role of ToM in individual differences across the lifespan and in daily social life (Apperly et al., 2009). There is some preliminary evidence that ToM difficulties also have continuing implications for social interactions in healthy adults (Krych-Appelbaum et al., 2007), but little is known about emerging adults.

Sandwiched between adolescence and adulthood, the developmental stage of emerging adulthood (18–29 years) is characterized by increased independence, self-discovery, and decision making (Arnett, 2018). The formation of new relationships and the maintenance of existing ones is one of the challenges for individuals undergoing this life transition. It is, therefore, important to explore parental attachment and social cognition skills, in order to understand emerging adulthood characteristics. Parental attachment security is linked to social/relationship skills, emotional awareness, and psychological adjustment in emerging adulthood (Hochberg &

Konner, 2020). Moreover, knowledge of the normal relationship between attachment and mentalizing, and the difficulties that may arise in these normal developmental paths, would support our understanding of mental or personality disorders (e.g., Ozturk et al., 2020; Preißler et al., 2010).

Purpose of the Present Study

Thus, attachment styles are now identified as important factors that contribute to a variety of emotional and social disorders, highlighting the need for a better understanding of their relationships with neurocognitive abilities. Combining attachment and neurocognitive theories may open up a promising avenue for the analysis of individual differences in psychosocial skills in both general and clinical populations (Vrtička & Vuilleumier, 2012). Little is known about the relationship between attachment and ToM in emerging adulthood. Although late brain maturation in emerging adulthood (Taber-Thomas & Pérez-Edgar, 2014) and differences in ToM performance between young adults and adults have been demonstrated (Giovagnoli, 2019; Valle et al., 2015), few studies have focused on individual differences in ToM among emerging adults. To our knowledge, no study has so far investigated how individual differences in attachment style may relate to social cognition performance in emerging adults. In the present study, we explored how the three different attachment styles are associated with differential mentalizing performances (or styles). Based on the aforementioned empirical research (Fonagy & Bateman, 2016; Luyten & Fonagy, 2018; Sharp & Fonagy, 2008) and hypo- versus hyperactivation strategies of the attachment system, we predicted that individuals with an insecure attachment style would score more poorly on ToM than individuals with a secure attachment style. In terms of insecure attachment, we expected to observe different patterns for the ambivalent and avoidant styles. Compared with securely attached participants, those with ambivalent insecure attachment would report greater overmentalizing. We also predicted that individuals with avoidant insecure attachment would exhibit greater undermentalizing or insufficient ToM than the securely attached group. Given the associations that are often observed between performances on ToM and executive tasks (Wade et al., 2018) in clinical and developmental populations, we controlled for executive functioning (updating, shifting, and inhibition) when examining attachment-ToM relations.

Method

Sample

Participants were 69 young adults, 34 (49%) of whom were female and 35 (51%) male. Their ages ranged from 18 to

29 years (mean = 21.72, $SD = 2.26$), with no significant difference between males and females ($U = 654.5$, $p = 0.47$). They had a mean education level of 14.03 years ($SD = 1.64$, range = 9–18), with no significant difference between males and females, $t(67) = -1.18$, $p = 0.24$). Participants with a current or prior history of psychiatric or neurological disorders, and alcohol or drug abuse were excluded. The inclusion criteria were (a) native French speaker, (b) aged 18 years or more, and (c) signed written informed consent. Participants were recruited through an advertisement, and the assessments were conducted by a trained neuropsychologist.

Instruments

Attachment cognitions

The *CArtes-Modèles Individuels de Relations* (CA-MIR; Pierrehumbert et al., 1996) is a test designed to evaluate three areas of mental representations of attachment (IWMs) in adults: the present (current experience with key persons), the past (conscious representations of past experience), and state of mind (representations, even unconscious, of attachment). This instrument assesses representations of adult attachment at the levels of attachment style and specific attachment cognitions. Adopting a Q-sort format (or forced distribution), it consists of 72 items written on a card, each bearing a single item. Each item score is correlated with three Q-prototypes of attachment style (i.e., dimensional/continuous scores on secure/balanced, avoidant/deactivating, and preoccupied/hyperactivating, equivalent to ambivalent). Participants are asked to sort the cards into five piles, ranging from 1 (*very false for me*) to 5 (*very true for me*). Based on Pierrehumbert's proposal, participants scoring less than half a standard deviation below the mean ($T = 45$) in Q score were considered to be insecure and were then assigned an insecure subcategory (avoidant/detached or ambivalent/preoccupied), according to the higher score of the two. Participants' scores on each of the attachment styles were calculated by averaging the scores for the items belonging to each of the 13 CA-MIR subscales. Scores (subscales and Q-scores) were T scores, with reference to a normative population (norm = 50, $SD = 10$). The internal consistency for the CA-MIR was $\alpha = 0.81$. Test-retest reliability was 0.97, 0.91 and 0.86 for the three attachment styles (Miljkovitch et al., 2005).

Social cognition

ToM abilities were assessed with the French version (see Martinez et al., 2017) of the Movie for the Assessment of Social Cognition (MASC; Dziobek et al., 2006), translated into French and validated by a partnership between the teams of Dr Patricia Garel (Sainte-Justine University Hospital,

Montreal, Quebec) and Dr Isabelle Amado (Centre Hospitalier Sainte-Anne, Service Hospitalo-Universitaire, Paris, France). The MASC consists of a 15-min movie about four characters (two females, two males) who spend an evening together (cooking, eating, and playing games together) in a naturalistic setting. This task requires participants to attribute mental states, and was designed to detect subtle mindreading difficulties. The MASC consists of a succession of 45 short video clips lasting 3–71 s. The video paused 45 times in each story, and questions were asked concerning the mental state (emotional, epistemic, volitional) of one of the characters, as well as ones ($n = 6$) concerning nonmental details depicted in the video that are used to control for memory and general comprehension abilities. The MASC yields four main scores: (1) MASC sum of correct answers (maximum 45) as an index of ToM performance (MASC ToM), (2) overmentalizing error score (over-ToM; excessive ToM), (3) undermentalizing error score (under-ToM; insufficient ToM), and (4) lack of ToM (no-ToM; complete lack of ToM or literal understanding). The higher the MASC ToM score, the better the performance. The higher the error score (over-, under-, or no-ToM), the poorer the performance. The MASC is a reliable instrument with high interrater reliability, internal consistency (Cronbach's alpha higher than 0.82 for the total scale and each subscale), and test-retest stability (Dziobek et al., 2006; Ritter et al., 2011).

To explore subtle emotion decoding in a more classic manner, we used the RME test (Baron-Cohen et al., 2001; Prevost et al., 2014), which consists of 36 black-and-white photographs of the eye region of faces expressing a complex mental state. For each item, participants are required to decide which of four words best describes the thoughts or feelings being expressed. Photographs are displayed one by one, surrounded by four adjectives (a target and three foils). Participants have unlimited time to decide, but are instructed to answer as fast as possible. A familiarization trial was followed by the 36 experimental items. In the RME, correct answers are rated 1, and incorrect answers 0. The total score ranges from 0 to 36, with higher scores indicating better performance.

Executive functions

EF tests were selected in the light of Miyake's three-factor model (Miyake et al., 2000): *inhibiting* prepotent responses and thoughts, *updating* in working memory, and *shifting* between task sets.

Inhibition was assessed with a Stroop test (Golden, 1975). Participants were instructed to verbally name the color of a stimulus as quickly as possible in each trial. In the first trial (reading), participants were instructed to read aloud color words. In the second trial, they had to name the color of colored lines (naming). In the third trial, they were asked to

name the ink color of colored words printed in an incongruent color, such as *BLUE* printed in green ink (interference). Each trial was scored according to the number of items completed in 45 s. An interference score reflecting the performance decline in the third condition compared with the first and second conditions was also calculated as a more direct measure of prepotent response inhibition (Golden, 1978).

Updating was assessed with a 2-back test. In this task, letters are displayed one after the other, each for 2 s. Participants are asked to indicate if the current stimulus is the same as the one presented two trials earlier. The 2-back task requires participants to continually update their mental set while responding to previously seen stimuli. The number of correct responses is computed.

The spontaneous component of *flexibility* was tested with two tasks: phonemic fluency and semantic fluency (Cardebat et al., 1990). In each condition (phonemic and semantic), participants were given 2 min to produce as many words as possible starting with the letter *S* (phonemic fluency) or in the *animals* category (semantic fluency). The total numbers of correct words produced in each condition were retained as variables for analysis.

Procedure

All participants gave their written informed consent to participate in the study after receiving a detailed explanation of the procedures and goals. They were informed that participation was voluntary, refusal had no consequences, and they would not be rewarded with extra credits for their participation. The study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

All statistical analyses were performed using SPSS 23.0 and Jamovi 1.8.0. As the variables did not follow a normal distribution, we applied a natural log transformation to the variables so that they met with the requirements for regression analysis. A descriptive analysis was undertaken, using means, standard deviations, and percentages, depending on the nature of the variables. Next, we ran partial Spearman (controlling for age and education level) correlation coefficients, χ^2 tests, and independent-sample *t* tests to examine associations between the main study variables and demographic characteristics (age, sex). Next, we ran a series of Kruskal–Wallis analyses of variance (ANOVAs) with attachment style (secure, insecure avoidant, insecure ambivalent) as the independent variable, and cognitive (ToM and EF) measures as dependent variables. Finally, to assess the influence of attachment dimensions (independent variables) on ToM skills (dependent variables), we ran generalized linear models (GLMs) including the possible confounding

variables sex, age, education level, and EF measures. A *p* value of 0.05 was considered statistically significant.

Results

Descriptive Results and Bivariate Correlations Between Main Study Variables

Based on Pierrehumbert's proposal, participants were divided into three attachment groups: secure ($n = 38$, 55%), insecure avoidant ($n = 13$, 19%), and insecure ambivalent ($n = 18$, 26%). These attachment groups did not differ significantly on age, sex ratio, or years of education. The means and standard deviations of demographic characteristics and social cognition, and executive scores of both secure and insecure participants are shown in Tables 1, 2, and 3.

The results of correlation analyses between attachment, accuracy of mentalizing, and executive functioning (controlling for age and education level) are shown in Table 1. As regards the relationships between the secure, insecure avoidant, and insecure ambivalent dimensions and social cognition domains, MASC ToM score was significantly positively correlated with the secure dimension ($r = 0.29$, $p < 0.05$) and significantly negatively correlated with the avoidant dimension ($r = -0.35$, $p < 0.01$). In addition, there were significant positive correlations between under-ToM and the avoidant dimension ($r = 0.35$, $p < 0.05$), and between over-ToM and the ambivalent dimension ($r = 0.27$, $p < 0.05$). Greater security of attachment was significantly associated with a higher MASC ToM score, while a higher level of avoidant attachment was correlated with a lower MASC ToM score. More specifically, higher avoidant attachment was associated with a greater undermentalizing tendency, while higher ambivalent attachment was related to a greater overmentalizing tendency. There were also nonsignificant correlations between attachment scores and EF scores.

Comparison Between Secure and Insecure Attachment Styles on Social Cognition and Executive Measures

Concerning social cognition measures, the insecure group scored significantly lower on MASC ToM score than the secure group. To better characterize the nature of their errors, we examined their under-ToM, over-ToM and no-ToM scores. The insecure group gave more responses classified as under-ToM (indicating insufficient mental state attribution) and fewer responses classified as no-ToM (indicating missing mental state attribution) than the secure group. No other significant results were observed for the MASC. These two groups did not differ on the RME.

Table 1 Descriptive results for and partial spearman correlations between main study variables and demographic variables

	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11
1. Secure dimension (0–100)	50.5 (8.1)											
2. Avoidant dimension (0–100)	46.5 (10.5)	-0.32**										
3. Ambivalent dimension (0–100)	47.9 (9.2)	-0.55***	-0.27*									
4. MASC ToM score (0–45)	31.6 (4.3)	0.29*	-0.35**	-0.14								
5. Overmentalizing (0–45)	5.8 (2.8)	-0.24*	0.06	0.27*	-0.62***							
6. Undermentalizing (0–45)	5.9 (3.5)	-0.18	0.35*	0.04	-0.50***	-0.13						
7. No-ToM (0–45)	1.6 (1.6)	-0.20	0.13	-0.02	-0.46*	0.07	-0.03					
8. RME (0–36)	27.1 (4.5)	0.07	-0.09	0.06	0.16	-0.27*	0.09	0.04				
9. Phonemic fluency	22.9 (5.3)	0.10	-0.06	-0.06	0.20	-0.07	0.04	-0.17	-0.25*			
10. Semantic fluency	35.4 (8.6)	-0.07	0.20	0.07	0.07	-0.10	-0.10	-0.08	0.17	0.45***		
11. 2-back test (correct responses, 0–28)	23.8 (2.4)	-0.07	0.20	0.07	0.07	-0.10	-0.10	-0.28*	0.08	0.21	0.33**	
12. Stroop Interference score	5.4 (9.1)	-0.02	0.10	0.06	-0.10	0.03	0.21	0.16	-0.07	-0.19	-0.12	0.10

Controlling for age and education level

MASC Movie assessment of social cognition; RME Reading the mind in the eyes test

* $p < .05$. ** $p < .01$. *** $p < .001$

On the executive measures, the insecure group scored significantly lower than the secure group in the interference condition. A statistical trend was observed for the inhibition score, with lower performances for the insecure group compared with the secure group. These two groups did not differ on the other executive measures. The data are presented in Table 2.

Comparison Between Three Attachment Styles on Social Cognition and Executive Performances

We ran a series of ANOVAs to investigate differences between the three attachment styles in terms of sociodemographic variables and the main study variables (MASC scores and executive measures). We observed a main effect of group for MASC ToM and under-ToM scores. Holm post hoc comparisons revealed that the insecure avoidant group scored significantly lower on MASC ToM than the secure group, and gave significantly more responses classified as under-ToM. There was a trend toward significance for no-ToM, with a lower score for the insecure ambivalent group than for the secure group. No other differences were observed. The data are presented in Table 3.

Relationships Between Attachment Styles, Social Cognition and Executive Variables

Sociodemographic variables (age, sex, education level), attachment scores, and executive measures were entered simultaneously into each GLM as predictor variables. The models are summarized in Table 4. Both the avoidant ($OR = 4.78$, 95% CI [0.46, 2.58], $p < 0.004$) and ambivalent ($OR = 4.47$, 95% CI [0.15, 2.75], $p < 0.03$) dimensions of attachment significantly contributed to the under-ToM score. For the over-ToM trend toward significance, the model only retained two predictors, both associated with an EF: semantic fluency ($OR = 2.60$, 95% CI [0.21, 1.38], $p < 0.009$) and phonetic fluency ($OR = 0.54$, 95% CI [-1.21, -0.03], $p < 0.05$). Regarding the trend toward significance for no-ToM, the only significant predictor in the final regression model was the updating score ($OR = 0.25$, 95% CI [-2.81, 0.03], $p = 0.05$).

Discussion

The broad purpose of the current study was to examine whether attachment security was related to ToM in a non-clinical sample of emerging adults. Based on attachment theory, we expected a relationship between parental attachment and mentalizing skills, as the latter would be dependent on the quality of IWMs. This expectation was also supported by previous studies among children and adolescents

Table 2 Sociodemographic Characteristics, Social Cognition, and Executive Measures of Secure and Insecure Participants

	Secure (<i>n</i> =38)	Insecure (<i>n</i> =31)	Group comparisons		
	Mean (SD)	Mean (SD)	<i>Chi</i> ² / <i>U</i>	<i>p</i> values	Effect size
Sociodemographic variables					
Age (years)	21.7 (2.4)	21.7 (2.1)	558	0.71	
Sex (M/F)	21/17	14/17	0.70	0.70	
Education (years)	14.3 (1.6)	13.7 (1.6)	725.5	0.09	
Social cognition variables					
MASC ToM score (0–45)	32.4 (4.7)	30.4 (3.5)	2.05	0.04	0.48
Undermentalizing (0–45)	5 (3.2)	7.2 (3.4)	377.5	0.01	0.31
Overmentalizing (0–45)	5.6 (2.8)	5.9 (2.7)	523	0.42	
No-ToM (0–45)	1.9 (1.4)	1.38 (1.9)	773.5	0.02	0.27
RME (0–36)	26.8 (5.2)	27.4 (3.5)	597.5	0.92	
Executive function variables					
Phonemic fluency	23.6 (5.8)	22.5 (4.7)	0.64	0.52	
Semantic fluency	34.5 (7.7)	36.5 (9.7)	−0.97	0.33	
2-back test (correct responses, 0–28)	23.5 (2.6)	24.2 (2.2)	0.50	0.29	
Stroop Interference	55.5 (10.4)	49.7 (11.5)	2.2	0.03	0.53
Inhibition score (Stroop)	7.2 (8.8)	3.3 (9.2)	1.8	0.07	
Attachment variables					
Secure score (0–100)	52.3 (3.8)	44.6 (8.2)	7.2	<0.001	1.73
Avoidant score (0–100)	42.9 (6.00)	51.1 (12.9)	−3.5	<0.001	−0.84
Ambivalent score (0–100)	43.5 (4.9)	53.4 (10.4)	−5.2	<0.001	−1.26

MASC Movie Assessment of Social Cognition, RME Reading the Mind in the Eyes test

Table 3 Sociodemographic, Social Cognition, and Executive Measures According to Attachment Style

	Secure	Insecure avoidant	Insecure ambivalent	Group comparisons			
	(<i>n</i> =38)	(<i>n</i> =13)	(<i>n</i> =18)				
	1	2	3				
	Mean (SD)	Mean (SD)	Mean (SD)	<i>Chi</i> ² / <i>K-W</i>	<i>p</i> values	Effect size	Post hoc
Demographic variables							
Age (years)	21.7 (2.4)	21.8 (2.2)	21.7 (2.06)	0.16	0.92		
Sex (M/F)	21/17	6/7	8/10	0.70	0.70		
Education (years)	14.3 (1.7)	13.3 (1.8)	14 (1.3)	4.4	0.11		
Sociocognitive variables							
MASC ToM score (0–45)	32.4 (4.7)	28.9 (3.7)	31.4 (2.9)	3.41	0.04	0.06	1 > 2
Undermentalizing (0–45)	5.0 (3.2)	8.5 (3.9)	6.2 (2.8)	9.10	0.01	0.13	2 > 1
Overmentalizing (0–45)	5.6 (2.8)	5.8 (3.1)	6.0 (2.4)	0.92	0.63		
No-ToM (0–45)	1.9 (1.4)	1.7 (2.4)	1.2 (1.5)	5.47	0.06		
RME (0–36)	26.8 (5.2)	26.8 (2.6)	27.9 (4.1)	0.86	0.65		
Executive function variables							
Phonemic fluency	23.6 (5.8)	23.6 (4.5)	21.7 (4.8)	0.68	0.51		
Semantic fluency	34.5 (7.7)	36.7 (8.3)	36.4 (10.8)	0.47	0.62		
2-back test (correct responses, 0–28)	23.5 (2.6)	24.8 (2.2)	23.7 (2.2)				
Stroop Interference	55.5 (10.5)	50.2 (11.6)	49.4 (11.7)	2.38	0.10		
Inhibition score (Stroop)	7.2 (8.8)	4.1 (10.9)	2.6 (8.1)	1.71	0.18		

MASC Movie assessment of social cognition, RME Reading the mind in the eyes test

Table 4 Generalized linear models investigating ToM tendencies according to attachment dimensions, EFs, and sociodemographic variables

Predictors	Undermentalizing				Overmentalizing				No-ToM								
	$R^2 = 0.27$	β	SE	OR	z	p	$R^2 = 0.24$	β	SE	OR	z	p	$R^2 = 0.16$	β	SE	OR	z
Attachment	Secure dimension	0.79	0.71	2.20	1.10	0.27	-0.41	0.54	0.66	0.66	-0.74	0.46	0.23	0.67	1.26	0.34	0.73
	Avoidant dimension	1.56	0.54	4.78	2.86	0.004	-0.05	0.42	0.95	0.95	-0.10	0.92	0.49	0.51	1.64	0.96	0.34
	Ambivalent dimension	1.49	0.66	4.47	2.24	0.03	0.19	0.51	1.21	1.21	0.36	0.72	-0.15	0.63	0.86	-0.24	0.81
Executive functions	Phonemic fluency	-0.02	0.39	0.97	-0.06	0.95	-0.60	0.31	0.54	0.54	-1.99	0.05	-0.51	0.07	0.60	-1.36	0.18
	Semantic fluency	-0.38	0.39	0.67	-0.99	0.32	0.77	0.29	2.17	2.17	2.60	0.009	0.07	0.37	1.08	0.19	0.84
	2-back test	0.15	0.18	1.16	0.80	0.42	0.02	0.58	1.03	1.03	0.04	0.93	-1.40	0.75	0.25	-1.94	0.05
Socio-demographic	Inhibition score (Stroop)	-0.05	0.16	0.95	-0.29	0.76	0.02	0.12	1.05	1.05	0.40	0.69	-0.05	0.15	1.17	-0.32	0.75
	RME	0.15	0.19	1.16	0.81	0.42	0.13	0.14	1.14	1.14	0.91	0.36	0.16	0.18	0.95	0.89	0.37
	Age	0.03	0.01	1.04	2.35	0.02	-0.01	0.01	0.98	0.98	-1.02	0.31	-0.002	0.02	0.98	-1.01	0.32
Sex	0.03	0.06	1.04	0.56	0.57	-0.02	0.05	0.98	0.98	-0.31	0.75	0.02	0.06	1.02	0.32	0.75	
Education level	-0.02	0.02	0.97	-0.81	0.42	-0.01	0.02	0.99	0.99	-0.26	0.79	0.03	0.03	1.03	1.21	0.23	

Sex was dummy-coded (0 = male and 1 = female)

OR odds ratio (expB), SE standard error, RME Reading the mind in the eyes test

emphasizing the role of secure attachment in the acquisition of ToM (Bialecka-Pikul et al., 2021; Szpack & Bialecka-Pikul, 2020). However, to our knowledge, it had not yet been tested in nonclinical young adults. Consistent with our expectations, the results of bivariate correlations indicated that attachment security was significantly and positively correlated with ToM abilities. In the same vein, ToM scores as evaluated by the MASC differed among the groups of secure and insecure participants. Our findings showed that the secure attachment style was associated with better performance on inferring others' mental states than insecure styles. This result is consistent with Fonagy and Target's model of ToM skill development (Fonagy & Target, 1997) whereby secure parental attachment supports the development of ToM skills. The autonomy associated with secure attachment presumably allows for greater exploration of interpersonal relationships, promoting accurate perceptions of thoughts, intentions, or emotions. Our results also suggested that this connection between social cognition and attachment is not limited to children.

The results of correlations also revealed a significant association between the avoidant dimension and ToM, notably a higher undermentalizing. This is consistent with the idea that the *deactivating* strategies of emotion regulation, typical of avoidant attachment, lead to less accurate mentalizing (see Mikulincer & Shaver, 2007, 2008). Avoidant insecurely attached individuals are anxious and fearful in the presence of others and tend to avoid social interactions, which restricts their ToM abilities. They are able to conceptualize mental states, but are less precise in their use of this knowledge in social situations. Our results also show that the ambivalent (anxious) dimension of attachment is associated with the tendency to overmentalize. This finding is consistent with Mikulincer and Shaver (2007, 2008)'s model describing a *hyperreactivity* strategy among ambivalent people, leading to enhanced and biased sensitivity to social cues (overattribution of intentions; i.e., overestimation errors). This pattern of mentalizing may ultimately contribute to the anxious and insecure interpersonal IWM. Nevertheless, it should be noted that although the GLMs supported a potentially harmful impact of insecure attachment on the tendency to undermentalize (about 4.5 times more likely), they did not support the same impact for the overmentalizing tendency. The latter, like the No-ToM responses, seemed to be more dependent on EF skills (flexibility and updating). It should also be noted that whereas phonetic fluency and updating tended to be protective of overmentalizing and lack of ToM, respectively, semantic fluency tended to be a risk factor for overmentalizing (almost 2.2 times more likely). One possible explanation for the differential influence of phonetic fluency versus semantic fluency on overmentalizing is that they partially depend on distinct cognitive processes. Although they share cognitive processes such as self-monitoring,

they require different search strategies and depend on distinct memory processes (Baldo et al., 2006; Biesbroek et al., 2021). Phonetic fluency relies more on executive processes and phonological memory (retrieval of words on the basis of phonological knowledge), while semantic fluency depends on semantic memory and stored knowledge (retrieval of semantic knowledge about words). Thus, we can hypothesize that there is a link between the searching and selection in semantic memory of the appropriate social scripts to attribute a mental state and the risk of overmentalizing. According to Ciarumelli et al. (2013), relying exclusively on semantic memory to attribute a mental state is sufficient in stereotyped social situations, but not when it comes to making adaptive mental state inferences, which may be more important for ecological tasks such as the MASC. Further studies are needed to explore this issue in association with attachment.

The results of our categorical analysis (attachment styles) tended to confirm that insecure participants exhibited poorer ToM skills than their secure counterparts, and when we drew a distinction between avoidant and ambivalent insecure participants, it was mainly the avoidant insecure subgroup who performed less well on ToM, with a greater tendency to undermentalize than the others. This mentalizing strategy (i.e., reduced ToM response) entails an impoverished reference to mental states, reflecting insufficient mental state reasoning (Lecce et al., 2019). Thus, contrary to our expectations, only the avoidant insecure attachment style was associated with less accurate mentalizing, as the ambivalent style did not appear to differ from the secure style, contrary to Mikulincer and Shaver (2007, 2008)'s assumption.

Finally, it is also important to note an unexpected result, in that secure participants gave more answers indicating a lack of mental state attribution (no-ToM answers) than the insecure participants did. Although the results were not significant when we compared the three attachment styles ($p = 0.06$), participants with an ambivalent attachment style tended to have lower no-ToM scores than the other two groups. These results seem to be related to the fact that the avoidant insecure group tended to undermentalize and the ambivalent insecure group tended to overmentalize. These two groups, therefore, chose no-ToM responses less frequently than the secure group did. Thus, the higher number of no-ToM responses in the secure group does not necessarily reflect a preference for explaining social behaviors in terms of physical (vs. mental) causality (Fossati et al., 2018). If this result is further confirmed, it could also indicate that avoidant attachment is especially related to insufficient mental state reasoning, reflecting impoverished mental state attribution (Dziobek et al., 2006; Fossati et al., 2018).

In addition, no differences were found between the three attachment styles in the RME test, suggesting that affective mental states were correctly interpreted whatever the attachment style. The RME requires affective

mental state attribution based on static photographs, whereas the MASC requires the attribution of both affective and cognitive mental states based on videos featuring interactions between several protagonists. Attributing mental states as a function of these ecological social situations may be harder for individuals with insecure attachment than attributing an affective mental state to a fixed gaze. Moreover, social information has to be processed faster in a video task that cannot be watched again than in a static task with no fixed response time like the RME. It may, therefore, be processed more slowly by insecure individuals. Further research is needed to properly address this issue. Finally, our failure to find any significant link between executive measures and ToM performances is consistent with recent studies showing a relative independence of ToM and EFs abilities among nonclinical adults (e.g., Di Tella et al., 2020). An alternative explanation is that no correlations were found between performance on the ToM tasks and the EF tests because the latter elicited cognitive abilities that were less closely related to the specific ToM processes assessed by the MASC and RME tests.

Limitations

The present study had several limitations. First, the use of cross-sectional data prevented us from establishing any causal relationships. Second, our results cannot be generalized to all emerging adults, owing to the small size of our sample and the over-representation of college students. Third, in forthcoming studies, researchers should aim to examine how different measures of attachment are linked to different types of ToM skills. For example, the MASC involves a third-person perspective on social interactions, rather than a second-person one (active participation). Attachment and ToM variables can be assessed using multiple methods (self-report, interview, and/or an experimental task). A fourth limitation is that the study did not control for participants' actual social/affective environment, even though this can support social cognition skills and is closely related to attachment security. Further research is, therefore, needed to clarify the impact of age during the transition from adolescence to adulthood on undermentalizing (Lecce et al., 2019) and on the association between attachment and social cognition, especially because ToM continues to develop through adolescence and into adulthood (Meinhardt-Injac et al., 2020; Tousignant et al., 2017). Longitudinal studies are needed to track larger emerging adulthood samples, in order to gain a better understanding of developmental trajectories.

Conclusion and Implications

The current study supports the notion that insecure people differ from secure people on both the accuracy of ToM performance and the type of error made. In particular, avoidant participants were characterized by undermentalizing errors. If our results are verified and replicated by other studies, they will reinforce the idea that parental attachment can play an important role in sociocognitive adjustment in emerging adulthood. From a clinical point of view, standardized and ecological tools for assessing ToM in emerging adults could be useful in routine clinical practice for measuring it more systematically, especially in individuals with insecure attachment. As Doyle and O'Donnell (2020) emphasized, emerging adulthood may be a key window of opportunity for clinical intervention, as psychologists can intervene before emerging adult patterns become more pervasively maladaptive, leading to a variety of psychological and interpersonal problems (e.g., borderline personality disorder, intimate partner violence).

A better characterization of ToM abilities in these insecure people could perhaps help us to develop novel educational and/or therapeutic approaches aimed at improving the quality of their attachment. For example, mentalization-based treatment (Bateman & Fonagy, 2010) and interventions to support reflective functioning could help insecure people make sense of the mental states underpinning their behaviors and those of others. In this way, they could develop a better understanding of how their *bias* in understanding self and others may lead them to engage in interpersonal misunderstanding or inappropriate behavior. This promotion of mentalizing abilities would no doubt be beneficial for individuals who display negative views of self and others in their attachment styles.

Furthermore, prevention and intervention programs for supporting attachment security and/or a secure attached therapeutic relationship (e.g., Berlin et al., 2008; Gregory et al., 2020) might be helpful for developing corrective attachment experiences, increasing attachment awareness (Daly & Mallinckrodt, 2009) and improving mentalizing skills (Bateman & Fonagy, 2010). Finally, given the probable bidirectionality of the association between attachment and ToM skills, a holistic approach involving both socio-cognitive- and attachment-based intervention techniques should be encouraged.

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Data Availability The data that support the findings of this study are available from the corresponding author, AH, upon reasonable request.

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References

- Ainsworth, M. S. (1979). Infant–mother attachment. *American Psychologist*, 34(10), 932–937. <https://doi.org/10.1037/0003-066X.34.10.932>
- Allain, P., Hamon, M., Saoût, V., Verny, C., Dinomais, M., & Bernard, J. (2019). Theory of mind impairments highlighted with an ecological performance-based test indicate behavioral executive deficits in traumatic brain injury. *Frontiers in Neurology*, 10, 1367. <https://doi.org/10.3389/fneur.2019.01367>
- Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, 8(2), 71–82. <https://doi.org/10.1076/chin.8.2.71.8724>
- Apperly, I. A. (2012). What is “theory of mind”? Concepts, cognitive processes and individual differences. *Quarterly Journal of Experimental Psychology*, 65(5), 825–839. <https://doi.org/10.1080/17470218.2012.676055>
- Apperly, I. A., Carroll, D. J., Samson, D., Humphreys, G. W., Qureshi, A., & Moffitt, G. (2010). Why are there limits on theory of mind use? Evidence from adults’ ability to follow instructions from an ignorant speaker. *Quarterly Journal of Experimental Psychology*, 63(6), 1201–1217. <https://doi.org/10.1080/17470210903281582>
- Apperly, I. A., Samson, D., & Humphreys, G. W. (2009). Studies of adults can inform accounts of theory of mind development. *Developmental Psychology*, 45(1), 190–201. <https://doi.org/10.1037/a0014098>
- Apperly, I. A., Warren, F., Andrews, B. J., Grant, J., & Todd, S. (2011). Developmental continuity in theory of mind: Speed and accuracy of belief-desire reasoning in children and adults: Developmental continuity in theory of mind. *Child Development*, 82(5), 1691–1703. <https://doi.org/10.1111/j.1467-8624.2011.01635.x>
- Arnett, J. J. (2018). Conceptual foundations of emerging adulthood. In J. L. Murray & J. J. Arnett (Eds.), *Emerging adulthood and higher education* (pp. 24–38). Routledge.
- Baldo, J. V., Schwartz, S., Wilkins, D., & Dronkers, N. F. (2006). Role of frontal versus temporal cortex in verbal fluency as revealed by voxel-based lesion symptom mapping. *Journal of the International Neuropsychological Society: JINS*, 12(6), 896–900. <https://doi.org/10.1017/S1355617706061078>
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a “theory of mind”? *Cognition*, 21(1), 37–46. [https://doi.org/10.1016/0010-0277\(85\)90022-8](https://doi.org/10.1016/0010-0277(85)90022-8)
- Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The “reading the mind in the eyes” test revised version: A study with normal adults, and adults with asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 42(2), 241–251.
- Baskak, B., Kır, Y., Sedes, N., Kuşman, A., Türk, E. G., Baran, Z., Gönüllü, I., Artar, M., & Munir, K. (2020). Attachment style predicts cortical activity in temporoparietal junction (TPJ): An fNIRS study using a theory of mind (ToM) Task in healthy university students. *Journal of Psychophysiology*, 34(2), 99–109. <https://doi.org/10.1027/0269-8803/a000240>
- Bateman, A., & Fonagy, P. (2010). Mentalization-based treatment and borderline personality disorder. In J. F. Clarkin, P. Fonagy, & G. O. Gabbard (Eds.), *Psychodynamic psychotherapy*

- for personality disorders: A clinical handbook (pp. 187–208). American Psychiatric Publishing Inc.
- Berlin, L. J., Zeanah, C. H., & Lieberman, A. F. (2008). Prevention and intervention programs for supporting early attachment security. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 745–761). The Guilford Press.
- Bialecka-Pikul, M., Stępień-Nycz, M., Szpak, M., Grygiel, P., Bosacki, S., Devine, R. T., & Hughes, C. (2021). Theory of mind and peer attachment in adolescence. *Journal of Research on Adolescence, 31*(4), 1202–1217. <https://doi.org/10.1111/jora.12630>
- Biesbroek, J. M., Lim, J.-S., Weaver, N. A., Arikani, G., Kang, Y., Kim, B. J., Kuijff, H. J., Postma, A., Lee, B.-C., Lee, K.-J., Yu, K.-H., Bae, H.-J., & Biessels, G. J. (2021). Anatomy of phonemic and semantic fluency: A lesion and disconnectome study in 1231 stroke patients. *Cortex, 143*, 148–163. <https://doi.org/10.1016/j.cortex.2021.06.019>
- Bliksted, V., Frith, C., Videbech, P., Fagerlund, B., Emborg, C., Simonsen, A., Roepstorff, A., & Campbell-Meiklejohn, D. (2019). Hyper- and hypomentalyzing in patients with first-episode schizophrenia: fMRI and behavioral studies. *Schizophrenia Bulletin, 45*(2), 377–385. <https://doi.org/10.1093/schbul/sby027>
- Bosacki, S., Moreira, F. P., Sitnik, V., Andrews, K., & Talwar, V. (2020). Theory of mind, self-knowledge, and perceptions of loneliness in emerging adolescents. *The Journal of Genetic Psychology, 181*(1), 14–31. <https://doi.org/10.1080/00221325.2019.1687418>
- Bowlby, J. (1969). *Attachment and loss: Attachment* (Vol. 1). Basic Books.
- Bowlby, J. (1976). *Attachment and loss: Separation: Anxiety and anger* (Vol. 2). Basic Books.
- Bretherton, I. (1992). The origins of attachment theory: John Bowlby and Mary Ainsworth. *Developmental Psychology, 28*(5), 759–775. <https://doi.org/10.1037/0012-1649.28.5.759>
- Brydges, C. R., Fox, A. M., Reid, C. L., & Anderson, M. (2014). The differentiation of executive functions in middle and late childhood: A longitudinal latent-variable analysis. *Intelligence, 47*, 34–43. <https://doi.org/10.1016/j.intell.2014.08.010>
- Cardebat, D., Doyon, B., Puel, M., Goulet, P., & Joanette, Y. (1990). Formal and semantic lexical evocation in normal subjects. Performance and dynamics of production as a function of sex, age and educational level. *Acta Neurologica Belgica, 90*(4), 207–217.
- Carpendale, J. I. M., & Lewis, C. (2004). Constructing an understanding of mind: The development of children's social understanding within social interaction. *Behavioral and Brain Sciences*. <https://doi.org/10.1017/S0140525X04000032>
- Cassidy, J., & Shaver, P. R. (1999). *Handbook of attachment: Theory, research, and clinical applications* (p. 925). xvii: The Guilford Press.
- Ciarra, E., Bernardi, F., & Moscovitch, M. (2013). Individualized theory of mind (iTOM): When memory modulates empathy. *Frontiers in Psychology, 4*, 4. <https://doi.org/10.3389/fpsyg.2013.00004>
- Ciarra, A., Bölte, S., Schlitt, S., Hainz, D., Poustka, F., Weber, B., Bara, B. G., Freitag, C., & Walter, H. (2015). Schizophrenia and autism as contrasting minds: Neural evidence for the hypo-hyper-intentionality hypothesis. *Schizophrenia Bulletin, 41*(1), 171–179. <https://doi.org/10.1093/schbul/sbu124>
- Daly, K. D., & Mallinckrodt, B. (2009). Experienced therapists' approach to psychotherapy for adults with attachment avoidance or attachment anxiety. *Journal of Counseling Psychology, 56*(4), 549–563. <https://doi.org/10.1037/a0016695>
- Di Tella, M., Ardito, R. B., Dutton, F., & Adenzato, M. (2020). On the (lack of) association between theory of mind and executive functions: A study in a non-clinical adult sample. *Scientific Reports, 10*(1), 17283. <https://doi.org/10.1038/s41598-020-74476-0>
- Doyle, C. B., & O'Donnell, G. M. (2020). The theory of emerging adulthood: Parents' experience of their child's transition to college. *Higher Education Research and Development*. <https://doi.org/10.1080/07294360.2020.1857342>
- Dykas, M. J., & Cassidy, J. (2011). Attachment and the processing of social information across the life span: Theory and evidence. *Psychological Bulletin, 137*(1), 19–46. <https://doi.org/10.1037/a0021367>
- Dziobek, I., Fleck, S., Kalbe, E., Rogers, K., Hassenstab, J., Brand, M., Kessler, J., Woike, J. K., Wolf, O. T., & Convit, A. (2006). Introducing MASC: A movie for the assessment of social cognition. *Journal of Autism and Developmental Disorders, 36*(5), 623–636. <https://doi.org/10.1007/s10803-006-0107-0>
- Fonagy, P., & Bateman, A. W. (2016). Adversity, attachment, and mentalizing. *Comprehensive Psychiatry, 64*, 59–66. <https://doi.org/10.1016/j.comppsy.2015.11.006>
- Fonagy, P., Gergely, G., & Target, M. (2007). The parent-infant dyad and the construction of the subjective self. *Journal of Child Psychology and Psychiatry, 48*(3–4), 288–328. <https://doi.org/10.1111/j.1469-7610.2007.01727.x>
- Fonagy, P., & Luyten, P. (2009). A developmental, mentalization-based approach to the understanding and treatment of borderline personality disorder. *Development and Psychopathology, 21*(4), 1355–1381. <https://doi.org/10.1017/S0954579409990198>
- Fonagy, P., & Target, M. (1997). Attachment and reflective function: Their role in self-organization. *Development and Psychopathology, 9*(4), 679–700. <https://doi.org/10.1017/S0954579497001399>
- Fossati, A., Borroni, S., Dziobek, I., Fonagy, P., & Somma, A. (2018). Thinking about assessment: Further evidence of the validity of the movie for the assessment of social cognition as a measure of mentalistic abilities. *Psychoanalytic Psychology, 35*(1), 127–141. <https://doi.org/10.1037/pap0000130>
- Giovagnoli, A. R. (2019). Theory of mind across lifespan from ages 16 to 81 years. *Epilepsy and Behavior, 100*, 106349. <https://doi.org/10.1016/j.yebeh.2019.05.044>
- Golden, C. J. (1978). *The stroop color and word test: A manual for clinical and experimental uses*. Stoelting Company Edition.
- Golden, C. J. (1975). A group version of the Stroop color and word test. *Journal of Personality Assessment, 39*, 386–388.
- Gregory, M., Kannis-Dyand, L., & Sharman, R. (2020). A review of attachment-based parenting interventions: Recent advances and future considerations. *Australian Journal of Psychology, 72*(2), 109–122. <https://doi.org/10.1111/ajpy.12270>
- Happé, F., Cook, J. L., & Bird, G. (2017). The structure of social cognition: In(ter)dependence of socio-cognitive processes. *Annual Review of Psychology, 68*, 243–267. <https://doi.org/10.1146/annurev-psy-010416-044046>
- Hochberg, Z., & Konner, M. (2020). Emerging adulthood, a pre-adult life-history stage. *Frontiers in Endocrinology, 10*, 918. <https://doi.org/10.3389/fendo.2019.00918>
- Hughes, C., & Devine, R. T. (2015). Individual differences in theory of mind from preschool to adolescence: Achievements and directions. *Child Development Perspectives, 9*(3), 149–153. <https://doi.org/10.1111/cdep>
- Hughes, C., & Devine, R. T. (2019). Learning to read minds: A synthesis of social and cognitive perspectives. In D. Whitebread, V. Grau, K. Kumpulainen, M. McClelland, N. Perry, & D. Pino-Pasternak (Eds.), *The SAGE handbook of developmental psychology and early childhood education* (pp. 169–183). Sage.
- Hünefeldt, T., Laghi, F., Ortu, F., & Belardinelli, M. O. (2013). The relationship between 'theory of mind' and attachment-related anxiety and avoidance in Italian adolescents. *Journal of Adolescence, 36*(1), 1–11. <https://doi.org/10.1016/j.adolescence.2012.11.002>

- 36(3), 613–621. <https://doi.org/10.1016/j.adolescence.2013.03.012>
- Imuta, K., Henry, J. D., Slaughter, V., Selcuk, B., & Ruffman, T. (2016). Theory of mind and prosocial behavior in childhood: A meta-analytic review. *Developmental Psychology, 52*(8), 1192–1205. <https://doi.org/10.1037/dev0000140>
- Krych-Appelbaum, M., Law, J., Jones, D., Barnacz, A., Johnson, A., & Keenan, J. (2007). “I think I know what you mean”: The role of theory of mind in collaborative communication. *Interaction Studies, 8*, 267–280. <https://doi.org/10.1075/is.8.2.05kry>
- Lece, S., Ceccato, I., & Cavallini, E. (2019). Investigating ToM in aging with the MASC : From accuracy to error type. *Aging, Neuropsychology, and Cognition, 26*(4), 541–557. <https://doi.org/10.1080/13825585.2018.1500996>
- Luyten, P., & Fonagy, P. (2018). The neurobiology of attachment and mentalizing. In C. Schmahl, K.L. Phan, R.O. Friedel (Eds.) & L.J. Siever (Collaborator), *Neurobiology of personality disorders*. Oxford University Press. (pp. 111-130). <https://doi.org/10.1093/med/9780199362318.003.0006>
- Martinez, G., Alexandre, C., Mam-Lam-Fook, C., Narjes, B., Gaillard, R., Garel, P., Dziobek, I., Amado, I., & Krebs, M.-O. (2017). Phenotypic continuum between autism and schizophrenia: Evidence from the movie for the assessment of social cognition (MASC). *Schizophrenia Research, 187*(1–2), 241–247. <https://doi.org/10.1016/j.schres.2017.01.012>
- Meinhardt-Injac, B., Daum, M. M., & Meinhardt, G. (2020). Theory of mind development from adolescence to adulthood: Testing the two-component model. *British Journal of Developmental Psychology, 38*(2), 289–303. <https://doi.org/10.1111/bjdp.12320>
- Meins, E., Fernyhough, C., Russell, J., & Clark-Carter, D. (2001). Security of attachment as a predictor of symbolic and mentalizing abilities: A longitudinal study. *Social Development, 7*(1), 1–24. <https://doi.org/10.1111/1467-9507.00047>
- Meins, E., Fernyhough, C., Wainwright, R., Das Gupta, M., Fradley, E., & Tuckey, M. (2002). Maternal mind-mindedness and attachment security as predictors of theory of mind understanding. *Child Development, 73*(6), 1715–1726. <https://doi.org/10.1111/1467-8624.00501>
- Mikulincer, M., & Shaver, P. R. (2008). Adult attachment and affect regulation. In The Guilford (Ed.), *Handbook of attachment: Theory, research, and clinical applications* (2nd ed., pp. 503–531). The Guilford Press.
- Mikulincer, M., & Shaver, P. R. (2007). *Attachment in adulthood: Structure, dynamics, and change*. The Guilford Press.
- Miljkovitch, R., Pierrehumbert, B., Karmaniola, A., Bader, M., & Halfon, O. (2005). Assessing attachment cognitions and their associations with depression in youth with eating or drug misuse disorders. *Substance Use & Misuse, 40*(5), 605–623. <https://doi.org/10.1081/JA-200055349>
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49–100. <https://doi.org/10.1006/cogp.1999.0734>
- Ontai, L. L., & Thompson, R. A. (2008). Attachment, parent-child discourse and theory-of-mind development: Attachment and theory of mind. *Social Development, 17*(1), 47–60. <https://doi.org/10.1111/j.1467-9507.2007.00414.x>
- Ozturk, Y., Ozyurt, G., Turan, S., Mutlu, C., Tufan, A. E., & Pekcanlar Akay, A. (2019). Relationships between theory of mind (TOM) and attachment properties in adolescents with social anxiety disorder. *Archives of Neuropsychiatry, 57*(1), 65–70.
- Pierrehumbert, B., Karmaniola, A., Sieye, A., Meister, C., Miljkovitch, R., & Halfon, O. (1996). Les modèles de relations : Développement d’un auto-questionnaire d’attachement pour adultes. *La Psychiatrie De L’enfant, 1*, 161–206.
- Poulin-Dubois, D. (2020). Theory of mind development: State of the science and future directions. *Progress in Brain Research, 254*, 141–166. <https://doi.org/10.1016/bs.pbr.2020.05.021>
- Preißler, S., Dziobek, I., Ritter, K., Heekeren, H. R., & Roepke, S. (2010). Social cognition in Borderline Personality Disorder: Evidence for disturbed recognition of the emotions, thoughts, and intentions of others. *Frontiers in Behavioral Neuroscience, 4*. <https://doi.org/10.3389/fnbeh.2010.00182>
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515–526. <https://doi.org/10.1017/S0140525X00076512>
- Prevost, M., Carrier, M.-E., Chowne, G., Zekowitz, P., Joseph, L., & Gold, I. (2014). The Reading the Mind in the Eyes test: Validation of a French version and exploration of cultural variations in a multi-ethnic city. *Cognitive Neuropsychiatry, 19*(3), 189–204. <https://doi.org/10.1080/13546805.2013.823859>
- Ritter, K., Dziobek, I., Preißler, S., Rüter, A., Vater, A., Fydrich, T., Lammers, C.-H., Heekeren, H. R., & Roepke, S. (2011). Lack of empathy in patients with narcissistic personality disorder. *Psychiatry Research, 187*(1–2), 241–247. <https://doi.org/10.1016/j.psychres.2010.09.013>
- Russell, T. A., Reynaud, E., Herba, C., Morris, R., & Corcoran, R. (2006). Do you see what I see? Interpretations of intentional movement in schizophrenia. *Schizophrenia Research, 81*(1), 101–111. <https://doi.org/10.1016/j.schres.2005.10.002>
- Sharp, C., & Fonagy, P. (2008). Social cognition and attachment-related disorders. In P. Fonagy & I. Goodyer (Eds.), *Social cognition and developmental psychopathology* (pp. 271–302). Oxford University Press. <https://doi.org/10.1093/med/9780198569183.003.0010>
- Stievenart, M., Roskam, I., Meunier, J. C., & van de Moortele, G. (2011). The reciprocal relation between children’s attachment representations and their cognitive ability. *International Journal of Behavioral Development, 35*(1), 58–66. <https://doi.org/10.1177/0165025410370790>
- Symons, D. K., & Clark, S. E. (2000). A longitudinal study of mother-child relationships and Theory of Mind in the preschool period. *Social Development, 9*(1), 3–23. <https://doi.org/10.1111/1467-9507.00108>
- Szpak, M., & Białecka-Pikul, M. (2020). Links between attachment and theory of mind in childhood: Meta-analytic review. *Social Development, 29*(3), 653–673. <https://doi.org/10.1111/sode.12432>
- Taber-Thomas, B., & Pérez-Edgar, K. (2014). Emerging adulthood brain development. In J. J. Arnett (Ed.), *The oxford handbook of emerging adulthood* (Vol. 1, pp. 1–19). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199795574.013.15>
- Tousignant, B., Sirois, K., Achim, A. M., Massicotte, E., & Jackson, P. L. (2017). A comprehensive assessment of social cognition from adolescence to adulthood. *Cognitive Development, 43*, 214–223. <https://doi.org/10.1016/j.cogdev.2017.05.001>
- Valle, A., Massaro, D., Castelli, I., & Marchetti, A. (2015). Theory of mind development in adolescence and early adulthood: The growing complexity of recursive thinking ability. *Europe’s Journal of Psychology, 11*(1), 112–124. <https://doi.org/10.5964/ejop.v11i1.829>
- Vistoli, D., Brunet-Gouet, E., Baup-Bobin, E., Hardy-Bayle, M.-C., & Passerieux, C. (2011). Anatomical and temporal architecture of theory of mind: A MEG insight into the early stages. *NeuroImage, 54*(2), 1406–1414. <https://doi.org/10.1016/j.neuroimage.2010.09.015>
- Vrtička, P., Bondolfi, G., Sander, D., & Vuilleumier, P. (2012a). The neural substrates of social emotion perception and regulation are modulated by adult attachment style. *Social Neuroscience, 7*(5), 473–493. <https://doi.org/10.1080/17470919.2011.647410>
- Vrtička, P., Sander, D., & Vuilleumier, P. (2012b). Influence of adult attachment style on the perception of social and non-social

emotional scenes. *Journal of Social and Personal Relationships*, 29(4), 530–544. <https://doi.org/10.1177/0265407512443451>

Vrtička, P., & Vuilleumier, P. (2012). Neuroscience of human social interactions and adult attachment style. *Frontiers in Human Neuroscience*. <https://doi.org/10.3389/fnhum.2012.00212>

Wade, M., Prime, H., Jenkins, J. M., Yeates, K. O., Williams, T., & Lee, K. (2018). On the relation between theory of mind and executive functioning: A developmental cognitive neuroscience

perspective. *Psychonomic Bulletin & Review*, 25(6), 2119–2140. <https://doi.org/10.3758/s13423-018-1459-0>