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Sex differences moderate the relationship between adolescent language and mentalization

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Abstract

Mentalization refers to the ability to infer mental states of self and others, and this capacity facilitates social interactions. Advances in mentalization theory have proposed that there are both explicit and implicit mentalizing capacities and language may be identified as being an important factor in differentiating these two components of mentalization. Moreover, given apparent sex differences in language and mentalization, we hypothesized that sex may moderate the relationship between language and mentalization. In this study, measures assessing implicit and explicit mentalization as well as language were examined in 49 adolescents (25 girls and 24 boys) aged 14 to 18 years. Participants were administered the Mentalizing Stories for Adolescents to assess explicit mentalization, and the Reading Mind in the Eyes Task to assess implicit mentalization. Language was assessed using the Clinical Evaluation of Language Fundamentals. Sex was found to moderate the relationship between language and explicit mentalization; while language and explicit mentalization were related in boys, these domains were unrelated in girls. There was no moderation of language and implicit mentalization by sex, and these two domains were also uncorrelated. These findings suggest an important role for language development in the capacity for explicit mentalization in boys, and we interpret this as a benefit in girls who may be more socially motivated and less limited by language in their efforts to mentalize.

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Keywords

Mentalization; language; adolescence; sex differences

The ability to interact interpersonally represents an important part of everyday life, and multiple factors may influence the ability to navigate social interactions successfully. In addition to language, human communication is bolstered by multiple complex mental processes that help individuals interpret and predict behaviors in both themselves and others. This capacity to infer mental states has been termed *mentalization* (Fonagy 1991), and has been more formally defined as "the mental process by which an individual implicitly and explicitly interprets the actions of oneself and others as meaningful on the basis of intentional mental states such as personal desires, needs, feelings, beliefs and reasons" (Bateman & Fonagy 2004 , p.xxi). The early parent-child relationship is believed to be the foundation for the development of mentalization (Fonagy & Target 1997), and impairments in mentalizing capacity have been a feature of a number of clinical disorders (Allen, Fonagy & Bateman 2008). Indeed, disruptions to mentalization are believed to underscore critical features in the psychopathology of borderline personality disorder, which has led to the development of mentalization-based treatment programs. Therefore, mentalizing represents an important construct clinically in understanding the aetiology of personality disorders, as well as social cognition more generally, and is increasingly a focus of empirical research.

It is important to note that the conceptualization of mentalization was derived by Fonagy (1991) from the theory of mind literature, where having a theory of mind entails the capacity to infer mental states to predict behaviour of self and others (e.g.,(Premack & Woodruff 1978). While this capacity is conceptually similar to mentalization, theory of mind emerges from more cognitive domains of understanding false beliefs in external agents, whereas mentalization brings an affective element to this understanding, in respect of both external agents and the self (Choi-Kain & Gunderson 2008). Moreover, mentalization theory has highlighted the significance of social experiences and relationships, particularly those of the child in relation to the parents, in determining one's capacity for mental representation (Fonagy et al. 1997). Nevertheless, while mentalization is more socially and affectively driven and theory of mind more cognitively driven, both processes serve to underscore the essential skill of interpreting mental states and thus facilitate social interactions. Notably, mentalization and theory of mind are sometimes used interchangeably in the literature, and this is also reflected when operationalizing these concepts for assessment. Indeed, the Reading the Mind in the Eyes task (Baron-Cohen et al. 2001) was developed to assess theory of mind but has also been employed to assess some aspects of mentalization (Fonagy, Stein, Allen & Fultz 2003), a point to which we return below.

Implicit and Explicit Mentalization

Recent advances of mentalization theory (Fonagy & Luyten 2009) have conceptualized two processes of mentalization, one more automatic and implicit, and the other more controlled and explicit. Controlled/explicit mentalizing requires focused attention and cognitive effort when decoding mental states, primarily in situations requiring reflection and interpretation. The neural circuitry underlying explicit mentalization is therefore likely heavily cortical, including the lateral and medial prefrontal and parietal cortices, as well as the medial temporal lobe and rostral anterior cingulate (AC). In contrast, automatic/implicit mentalizing is more reflexive and requires little cognitive effort, and is likely mediated through subcortical (amygdala, basal ganglia) and cortical (ventromedial prefrontal cortex, lateral temporal cortex and dorsal AC) circuits (Fonagy & Luyten, 2009). Notably, while increased levels of emotional arousal may suppress the mechanisms underlying controlled

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mentalization, these increases may facilitate the mechanisms underlying automatic mentalization (Mayes, 2006). This is important in considering both the features and treatment of personality disorders where impairments in mentalization are apparent. For instance, increased levels of arousal in patients with borderline personality disorder appear to affect explicit mentalization more than implicit mentalization (Fonagy & Luyten, 2009); thus stabilizing emotional arousal in people with borderline personality may have important implications for specific aspects of mentalization and related social interactions.

One notable contrast between implicit and explicit mentalization is the role of language; specifically, while implicit mentalization is relatively non-verbal and appears to emerge earlier developmentally (Onishi, Baillargeon & Leslie 2007), explicit mentalization requires more advanced verbal and symbolic understanding and likely appears later in development (Carpendale & Lewis 2006). Therefore, while language ability may be important for explicit mentalization, implicit mentalization may be less affected by language development. Consistent with this distinction, different approaches have been employed to assess the capacity to mentalize in research settings. For instance, the Reading the Mind in the Eyes Task (RMET; (Baron-Cohen et al. 2001)) has been used to operationalize implicit mentalization in some studies (Fonagy et al. 2003). In this task, participants are presented with an image containing the eye region of a face and have to choose a single word from a list of four words that best describes the mental state reflected in the image. This task has an important non-verbal component that requires the recognition of the mental state in the eyes before any selection of the verbal descriptor. In contrast, assessments of controlled/explicit mentalization focus on scoring the content of transcribed open-ended interview questions (e.g., (Fonagy, Steele, Steele & Target 1998), as well as more story-based vignettes (e.g., (Sharp, Croudace & Goodyer 2007; Vrouva & Fonagy 2009), both assessments that require more significant language ability.

The need for the social environment is an intrinsic motivation in Fonagy and colleagues' approach to mentalization, and as a result, the developmental progression of mentalization may rely heavily on language ability and correspond to developmental achievements in this social cognitive domain. Indeed, the development of the capacity for mental state language appears to be directly regulated by the amount and frequency of parental mental state talk (Taumoepeau & Ruffman 2006). Therefore, the expression and recognition of mental states appear to constitute important components of mentalizing, and, in verbal communication, language skills in the domain of reception may be important for interpreting and internally labeling mental states. Developmental achievements in language and vocabulary growth may thus correspond to developing mentalization skills. Indeed, verbal communication about mental states has been linked to the understanding of other's mental states in young children (Hughes & Dunn 1998). Therefore, to more fully understand the relationship between language development and the capacity to mentalize, it is necessary to take a developmentally sensitive approach assessing both language and mentalization during a period of developmental change. Adolescence represents such a period, and in the present study language capacity and mentalization in an adolescent sample were assessed.

Adolescent Mentalization

Developmental researchers have sought to establish a concept of mentalization that is not only viable in empirical research, but potentially able to inform and influence theory in several domains including psychology, neuroscience, and clinical understanding (Frith & Frith 2003). However, some researchers have raised concerns about whether or not the concept of mentalization can be empirically measured and effectively applied in developmental studies (Choi-Kain et al. 2008), and there are to date few measures that are applicable to a broad developmental age range. Indeed, while mentalizing capacities change

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across development, theoretical and empirical study has focused on the early foundation of mentalizing in childhood and later assessment of mentalizing in adulthood, with little known about adolescent mentalization.

Adolescent mentalization has been explored most thoroughly at a theoretical level with there being few empirical studies on this topic. Fonagy, Gergely, Jurist and Target (2006) proposed that adolescents are hypersensitive to the mental states of both themselves and those around them. This is in part owing to changes in cognitive development during this period when adolescents are beginning to integrate mental state knowledge and are able to make explicit references using mental state language. However, when this integration becomes too demanding, impairments in mentalizing can become apparent. This difficulty in integration may be owing to the increased complexity of cognitions related to the mental states of self and others, perhaps underscored by insufficient language capacity that may be necessary for explicit mentalization. Accordingly, adolescence is also a period marked by the earlier maturation of the limbic affective system, with cognitive prefrontal cortex maturation developing later (Casey et al., 2008; Somerville et al., 2010). Therefore, cortical regions proposed by Fonagy and Luyten (2009) important to explicit mentalization are likely to be under-developed during adolescence, furthering the potential for difficulties in integrating mental state knowledge and language.

Understanding more about mentalization developmentally is important beyond a normative understanding because impairments in this capacity may lay the foundation for present and future psychopathology. While there may be normative difficulties in the capacity to mentalize in adolescence, there is also a potential for the emerging presentation of symptoms consistent with those observed in adult personality disorders. Indeed these symptoms in adolescents have, in some cases, shown a trajectory to the development of adult psychopathology (Guthrie, 2006). Critically though, before clinical studies of adolescent mentalization can be informative, the foundation needs to be established for studies of normative adolescent mentalization.

Sex Differences and Mentalization

Underscoring the relationship between language and mentalization may be an important moderating role of sex, and this may be especially evident during adolescence. From a neurobiological perspective, across development both males and females evidence maturational changes in white and gray brain matter (Giedd 2004), and while in both sexes, gray matter volume in the frontal and parietal lobes increases in pre-adolescence and decreases in post-adolescence, gray matter volume peaks later in boys than in girls (Giedd et al. 1999). Boys also evident greater loss of gray matter volume as well as increases in white matter and corpus callosum volume relative to girls during development (De Bellis et al. 2001). With adolescence also coinciding with puberty, increases in sex hormones may also contribute to structural brain changes (Sisk & Zehr 2005). As a consequence, these apparent sex differences in brain development may also manifest as sex differences in the processes relevant to language and mentalization. Supporting this notion, sex differences in the development of language abilities have been identified, related to both phonological (Shaywitz et al. 1995) and neural (Burman, Bitan & Booth 2008) processing of language. Early vocabulary growth has also been found to vary by sex, with girls' vocabulary growth maturing sooner and more rapidly than boys' (Huttenlocher et al. 1991; Tamis-Lemonda, Bornstein & Baumwell 2001). Similarly, sex differences in the RMET have also been found, with descriptively higher scores observed in females compared to males (Baron-Cohen et al., 2001). Moreover, females score higher on measures of empathy relative to males (Baron-Cohen & Wheelwright 2004). These findings are consistent with neuroimaging findings that suggest sex differences in brain activity during mentalization-relevant tasks

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that have been observed in adults (Krach et al. 2009). Consequently, sex may play an important moderating role in the relationship between language and mentalization.

Study Overview

In the present study, we explored the relationship between receptive language and mentalization in an adolescent sample, focusing on the moderating role of sex. To assess mentalization, we employed the Mentalizing Stories for Adolescents (MSA; Vrouva & Fonagy, 2009; under review), an instrument recently developed to assess mentalization across a broad developmental period in youth (12–18 years). The MSA consists of a series of vignettes that represent situations common in adolescence and contain a protagonist in a negative interaction or verbal exchange with another character in the story. In the study reported here, we employed the MSA-v.2 (Vrouva & Fonagy, under review) where for each vignette, participants respond to a multiple-choice question concerning the protagonist's behavior, and the possible response outcomes vary in their level of mentalizing (low to high). Therefore, the MSA-v.2 represents a task that requires interpretation, reflection, and verbal ability, consistent with controlled/explicit mentalization. We also included the RMET as a measure of automatic/implicit mentalization consistent with prior research in this area (Fonagy et al. 2003).

We predicted that (1) across the adolescent sample, performance on the RMET and MSA-v. 2 would be strongly correlated, and girls would score consistently higher than boys in both tasks; (2) there would be a relationship between receptive language and mentalization that would be moderated by sex. Specifically, we predicted that the relationship between language and mentalization would be stronger in girls than boys. Importantly, we included assessments of both implicit and explicit mentalization to understand the relevant contributions of language development to both processes in furthering our understanding of contemporary mentalization theory.

Methods

Participants

Fifty-three adolescents were recruited from a larger cohort of predominantly disadvantaged, inner-city North American adolescents (N=368) who have been longitudinally studied since birth (Mayes et al., 2005). Three participants were excluded from the data analysis as they did not appear to engage in the mentalization task for a sufficient amount of time (completion time for the MSA-v.2 were three and four minutes, compared to the sample mean of 15 minutes). One participant was also excluded from the data analysis because of a pre-existing learning and reading disability. The mean age of the remaining sample (n=49) was 15 years (SD = 1 year), and consisted of 14 (n = 4), 15 (n = 26), 16 (n =13), 17 (n = 5) and 18 (n = 1) year-olds. These children are representative of a lower socio-economic group that may have experienced multiple social adversities, such as domestic and community violence, homelessness, and severe poverty. Sociodemographic characteristics of the sample are presented in Table 1.

The sample contained approximately equal numbers of boys and girls, and these groups did not differ on measures of age, race/ethnicity, or maternal education [all $p > .05$].

Measures

The Mentalization Stories for Adolescents (MSA-v.2)

The MSA-v.2 is a recently developed test designed to measure mentalizing abilities specifically in an adolescent population. The initial MSA task (Vrouva & Fonagy, 2009)

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differed from the current version in having an open-ended response format. Building on this work, three further versions of the MSA were developed and validated (Vrouva & Fonagy, under review), and the MSA-v.2 was selected from these versions as optimal for the present study. The MSA-v.2 was originally structured as a paper-and-pencil questionnaire, but was adapted using E-Prime (Schneider, Eschman & Zuccolotto 2002) to be computerized in this study. The MSA-v.2 was also modified from the UK version for use in the US to accommodate slight grammatical and dialectical differences between British and American English.

The MSA-v.2 is a scenario-based test consisting of 21 short-story items that are designed to reflect real-life everyday situations one might expect to encounter during adolescence. An example item is included in Appendix A. Each story involves a protagonist in a negative interaction or verbal exchange with another character. The negative context of this situation is intended to elicit feelings of sadness, guilt, jealousy, disappointment, or shame in the protagonist of the story, who then does or says something as a result of their negative state. Participants are prompted to read a brief question regarding the story and must choose between three response choices to select the one that best reflects their own opinion about the reasons why the protagonist responded in the given situation. The story, question, and possible response choices for each item remain on the computer screen until a participant has responded and elected to proceed to the next item. The options in each story were then taken to a group of clinicians and researchers with expertise in mentalization in order to independently rate each answer on a 0–9 scale with respect to the level of mentalizing indicated by each response. Following the Thurstone scaling method of equal intervals (Crocker & Algina, 1986; Dawis, 2000), the median of these ratings was computed for each option. Accordingly, respondents are assigned scores for each answer choice, and are given the highest value by selecting the choice rated by the experts to have the highest degree of mentalizing. The other two answer choices, rated as inaccurate responses, contain explanations for the protagonist's behavior that involve excessive or distorted mentalizing attributions. As such, these responses correspond to lower scores for each item. The MSA-v. 2 composite score is calculated by summing a participant's scores for each of the 21 items, which range from a possible minimum score of 24.5 to a possible maximum score of 136.5. There are no normalized test scores available for the MSA-v.2, but composite scores above the median score of 81 may be considered in the upper range of mentalizing ability, while those below the median qualify scores in the lower half.

The Reading the Mind in the Eyes Test (RMET)

The RMET (Baron-Cohen et al., 1997) was developed to assess the capacity to attribute a person's mental state by looking only at a picture depicting a small region of their face and eyes. The child-version of the RMET (Baron-Cohen et al., 2001) includes 28 pictures of the eye region, which are used to measure participants' ability to correctly identify the mental state being reflected in the eyes. Specifically, a participant must choose between four words (e.g., friendly, sad, surprised, and worried) and select the word that they think best describes what the person in the picture is thinking or feeling. There is only one word that represents the correct answer, while the other three choices are mental states that have been rated as incongruent for that set of eyes. The RMET is a self-paced test and there is no time limit for completing all 28 items. The child version of the RMET was chosen for this study as this version decreases the potential for test performance being confounded by participants' vocabulary competence. The RMET has been used extensively in research across development in both clinical and non-clinical samples (Baron-Cohen et al. 2001; Richell et al. 2003; Sharp & Romero 2007; McGlade et al. 2008).

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Clinical Evaluation of Language Fundamentals

The Clinical Evaluation of Language Fundamentals-3 (CELF; Semel, Wiig & Secord 1995) is a standardized test of language ability that serves to distinguish normal language from impaired language in the receptive (i.e., listening) and expressive (i.e., spoken) domains. Receptive language (RL) is quantified by measures including those of sentence structure and semantic relations and was of primary interest to this study. The CELF-3 takes 30–45 minutes to administer, and is suitable for those aged 6 – 21 years. The CELF-3 shows good internal consistency, test/re-test reliability, and validity (see (Reynolds & Fletcher-Janzem 2002). The standard scores for RL on the CELF-3 have been normalized to a mean of 100, with a standard deviation of 15. RL scores in this study did not differ between boys (86.09; SD = 20.19) and girls (93.58; SD = 19.88) [$t(47) = -1.28$, $p = .21$].

Procedure and Data Analyses

The Yale University Human Investigations Committee approved the study. Participants provided informed assent and the presence of their parent or legal guardian was required to give written consent. After obtaining assent and consent, participants were administered the MSA-v.2 (Vrouva & Fonagy under review) and the child version of the RMET (Baron-Cohen et al. 2001). The order of administration was counterbalanced across participants. The experimental session took no longer than 30 minutes to complete. Responses to the CELF were obtained from the data collected as part of the larger study in which the participants were enrolled. Age in months was examined owing to the skewed distribution of participants in age in years brackets (described above). All data analyses were performed using SPSS version 16.0 (SPSS 2009), and variables were assessed for normality and determined to be appropriate for parametric statistical tests. Age in months was the exception to this being not normally distributed and non-parametric analyses were therefore used to examine relationship between age and mentalization.

To assess the moderating role of sex on the relationship between receptive language and mentalization, hierarchical multiple regressions were performed separately for the MSA-v.2 (explicit mentalization) and the RMET (implicit mentalization). Language capacity was entered in the first step, sex was entered in the second step, and the interaction between language and sex was entered in the third step. The language variable was centered and sex was dummy coded. Follow-up analyses consisted of Pearson's correlations, where $r = .10$ to .29 represents a small correlation, $r = .30$ to .49 represents a moderate correlation, and $r = .50$ or higher represents a strong correlation (Cohen 1988).

Results

The mean MSA-v.2 composite score across the sample was 103.28 (SD = 16.98; range = 68.50–133.50), and the mean RMET composite score was 19.73 (SD = 3.74; range = 10–26). Age did not correlate with MSA-v.2 [$r(49) = -.09$, $p = .52$] and RMET [$r(49) = .24$, $p = .09$] scores. Separate analysis of MSA-v.2 scores and age for boys [$r(24) = -.23$, $p = .28$] and girls [$r(25) = .04$, $p = .84$] showed no statistical relationship. Comparing RMET and age for boys [$r(24) = .19$, $p = .39$] showed a similar absence of relationship, and this relationship with girls also did not reach statistical significance, [$r(25) = .36$, $p = .08$].

To assess whether the MSA-v.2 as a measure of explicit mentalization was related to the RMET as a measure of implicit mentalization, scores on both tasks were correlated, revealing a positive relationship between the two measures [$r(49) = .45$, $p < .001$]. Notably, there was also a positive correlation between receptive language and MSA-v.2 scores [$r(47) =.50$, $p < .001$]; however, the correlation between receptive language and RMET scores did not reach statistical significance [$r(47) =.28$, $p = .06$].

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A multiple regression analysis revealed a main effect of receptive language in predicting explicit mentalization scores as assessed by the MSA-v.2 [$\beta = .50$, $R^2 = .25$, $p < .001$]. Moreover, there was also a main effect of sex [$\beta = .35$, $R^2 = .37$, $p = .006$]. Mentalization scores were higher for girls (M = 110.26, SD = 12.78) than boys (M= 96.00, SD = 17.98). Importantly, the interaction between receptive language and sex was also significant [$\beta = -.425$, $R^2 = .45$, $p = .012$]. To understand this interaction, correlations between receptive language and MSA-v.2 scores were conducted separately as a function of sex. In boys, MSA-v.2 scores highly correlated with receptive language scores [$r(23) = .70$, $p < .001$]. However, in girls, there was no significant relationship between receptive language scores and MSA-v.2 performance [$t(24) = .17$, $p = .43$]. These findings suggest that language development predicts explicit mentalization as assessed by the MSA-v.2, and that this relationship is moderated by sex. Specifically, language relating to mentalization capacity was only evident in boys and not girls.

A second multiple regression analysis was conducted to assess sex as a moderator between receptive language and scores on the RMET as a measure of implicit mentalization. Receptive language as a predictor of mentalization did not reach significance [$\beta = .28$, $R^2 = .08$, $p = .06$]. However, there was a main effect of sex in predicting RMET scores [$\beta = .33$, $R^2 = .18$, $p = .02$]. Similarly to performance in the MSA-v.2, girls (M = 21.00, SD = 2.72) scored higher on the RMET than boys (M = 18.42, SD = 4.24). Notably there was no significant interaction between receptive language and sex in predicting RMET scores [$\beta = .32$, $R^2 = .23$, $p = .10$]. These findings suggest that receptive language does not predict implicit mentalization as measured by the RMET, with no moderating role for sex evident.

Discussion

Mentalization is believed important for social interactions and represents a central disruption in the psychopathology of personality disorders. While mentalization was once considered a unitary construct, advances in mentalization theory support a more multifaceted account that has evolved in parallel with the development of mentalization-based treatments for borderline personality disorder. Fonagy and Luyten (2009) propose that mentalization can be considered as being implicit or explicit. Implicit mentalization reflects the reflexive capacity to mentalize, requiring little cognitive effort. Explicit mentalization in contrast reflects more cognitively controlled efforts to understand mental states. Consistent with past research, we employed the RMET as a measure of implicit mentalization (Fonagy et al., 2003) and the MSA-v.2 as a measure of explicit mentalization (Vrouva & Fonagy, 2009). Distinguishing implicit and explicit mentalization processes identifies an important role for language capacity; however, tasks independently assessing language and mentalization have demonstrated that girls are typically more advanced than boys in both domains. Therefore, we examined the relationship between language development and implicit and explicit mentalization, focusing on the moderating role of sex. We took a developmental approach by investigating the capacity to mentalize during adolescence, wherein variability in both language and mentalization domains were expected. We found that language capacity predicted explicit mentalization as measured by the MSA-v.2, and that this relationship was moderated by sex. Notably, language did not predict implicit mentalization as assessed by the RMET. These findings are consistent with the notion that language represents an important dissociation between implicit and explicit mentalization, and identifies an important role for sex differences in predicting mentalization capacity.

Our findings suggest that implicit mentalization does not rely on language capacity. Intuitively, a mentalization system that requires minimal linguistic ability has adaptive value. From a developmental perspective, the capacity to mentalize primarily emerges through early infant-caregiver interactions, whereby the caregiver mirrors the infant's

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affective states and this facilitates the infant's development of affect regulation and self-control. The quality of this early attachment is important to facilitate the recognition of mental states in both self and others across development because mental states are first explored during these infant-caregiver exchanges (Fonagy et al., 2006). The limitation in verbal ability in infancy and early childhood would significantly limit the emergence of mentalization if verbal language skills were critical. Therefore, a separate implicit system that does not require verbal reasoning may be an important foundation prior to the development of explicit mentalization. Moreover, in situations where very rapid appraisals of mental states are required, for instance during hostile interactions, an implicit mentalization system would hold greater benefit in determining behavior to approach or withdraw from the interaction without the need for complex cognition to decode mental states. Consequently, an implicit mentalization system may prove more adaptive in potentially threatening situations.

The existence of two distinct mentalization systems would suggest a possibility for different neural pathways underscoring mentalization dependent upon the situational context, and converges with neuroanatomical findings of rapid subcortical and slow cortical pathways underlying emotion perception more generally (LeDoux 1998). Perhaps with social experience, these emotion-processing pathways are adapted to facilitate social communications and mentalization, in addition to emotion perception. Different modes of mentalization would also resonate with clinical observations that mentalization generally is not disrupted in patients with borderline personality disorder: while explicit mentalization may be compromised in these patients, implicit mentalization remains relatively intact (Fonagy & Luyten, 2009). Consequently, the results presented here further support the need for multifaceted accounts of the disruption to mentalization in personality disorders, and call for future research examining the neural correlates of implicit and explicit mentalization, and to what extent these neural systems overlap with emotion processing. This could have important theoretical and clinical implications, and may suggest common dysregulation of affective systems in psychopathology.

Girls scored more highly in both the RMET (implicit) and MSA-v.2 (explicit) mentalization tasks compared to boys. These findings are consistent with other studies where girls have scored more highly on the RMET and measures of empathy in young adults (Baron-Cohen et al. 2004; Carroll & Chiew 2006). Sex differences in theory of mind have been found in much younger samples too: for instance, 3–5 year old girls have been found to score higher than boys in a false-belief task (Walker 2005). Interestingly, performance in this false-belief task was also correlated with teacher reports of behavior, and a positive relationship between scores on the theory of mind task and prosocial behavior were observed only in girls. In contrast, performance in boys was negatively correlated with shy and withdrawn behavior, as well as positively correlated with aggressive and disruptive behavior. Walker (2005) interprets this as reflecting an adaptive advantage for the emergence of behaviors in pre-school for social goals that vary between boys and girls. Indeed, this converges with interpretations regarding sex differences in empathy, where the qualities of girls' peer relationships are typically more intimate and mutually oriented, and contribute towards a better understanding of others compared to boys (Hughes et al. 1998). Therefore, one interpretation of our finding that girls score highly on assessments of mentalization may relate to their intrinsic motivation to understand the mental states of others.

Notably even with differences between boys and girls in capacity to mentalize, the relationship between language and explicit mentalization was moderated by sex differences. Contrary to our hypothesis, while language capacity predicted explicit mentalization capacity in boys, this did not hold for girls. Baseline differences in language ability cannot explain these findings with girls and boys evidencing equivalent language capacity as

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assessed by the CELF (Semel et al., 1995). However, a social motivational account may also be applicable to understanding this finding. If girls are inherently motivated for social interactions, their capacity to mentalize may not be as dependent on language as boys. Specifically, the motivation for social interactions may enable girls to overcome limitations of language when mentalizing, facilitating their capacity to mentalize early in development. Indeed, if girls are socially motivated earlier in development than boys, implicit mentalization may be significantly advanced in girls allowing for the earlier emergence of explicit mentalization relative to boys. This may explain the consistently higher scores on mentalization tasks in girls compared to boys reported here and in the literature. In contrast, less social motivation in boys suggests their capacity to mentalize may emerge later, and from the present findings, boys may be more dependent upon using language to infer mental states. With less social motivation, language and mentalization capacities may thus emerge developmentally in parallel in boys, explaining the positive relationship between the two functions reported here. Consequently, the relationship between language and mentalization may be more tightly coupled in boys than girls. To further understand this, future developmental studies would benefit from including assessments of social motivation in addition to mentalization and language capacity both within and across sexes. Indeed, social motivation may represent an important mediation between language capacity and mentalization.

We employed a developmental approach in understanding the relationship between mentalization and language capacity by studying boys and girls during adolescence. This provided an opportunity for the emerging development of both domains to be captured. Notably, scores on the MSA-v.2 and RMET did not correlate with age. Nevertheless, adolescence is a period marked by the earlier maturation of the limbic affective system, with the cognitive prefrontal cortex maturation developing later (Casey et al., 2008; Somerville et al., 2010). These neural systems resonate with those proposed underscore implicit and explicit mentalization respectively. Linking these neural structures to adolescent brain development, completion of the MSA-v.2 reflects controlled mentalization, a process that is dependent upon not fully matured cortical mechanisms at this time. In addition to these neurobiological changes that occur during adolescence, it is also a period of vulnerability for psychopathology, including personality disorders. Although normative turbulent behavior in adolescents has led some clinicians to be reluctant to diagnose personality disorders during this developmental period, symptoms of personality disorders in adolescents appear to relate to psychopathology in adulthood (Guthrie, 2006) and thus warrant clinical investigation. Adopting a mentalization approach may provide an avenue for this investigation. Hypersensitivity to mental states and the demands of representing and interpreting these states may place too much demand on the adolescent, leading to feelings of being overwhelmed and anxious; some adolescents may even react against mentalization (Fonagy et al., 2006). Therefore, assessing the capacity for mentalization in adolescence may be valuable to identifying at-risk adolescents. Critically though, owing to the absence of research in adolescent mentalization, assessments of mentalization in adolescents more generally need to be introduced, prior to clinical investigations.

Parallel with neuronal development, adolescence also represents a period of vulnerability to stress, and neuronal maturation during this period may be especially sensitive to stress exposure (Romeo & McEwen 2006). Specifically, the amygdala, prefrontal cortex, and hippocampus have been implicated as especially vulnerable to stress in animal models (McEwen 2005). One of the characteristics of our adolescent sample is their disadvantaged background and additional (and variable) environmental stressors may contribute to difficulties in mentalizing. Indeed, Fonagy and Luyten (2009) propose that interpersonal stressors pose a significant impairment to the capacity to infer mental states. Furthermore, it has been proposed that the adolescent environment may provide an important role in

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supporting the emergence of mentalization, accompanied by hypersensitivity to mental states during this developmental period (Fonagy et al., 2006). If the participants in this current study are maturing in more adverse environments, this may be a factor that may negatively impact mentalization capacity. Therefore, this may affect the generalizability of the present findings to adolescents without a history of adversity. However, adversity may distinguish adolescents only in some elements of mentalization, considering the notion that heightened emotional arousal hinders explicit mentalization but not implicit mentalization (Fonagy & Luyten, 2009; Mayes, 2006). Nevertheless, this will be important to empirically investigate in future research.

In the present study, we sought to investigate mentalization in adolescence. While these results are informative, it will be necessary for future research to examine the developmental trajectory of mentalization beyond isolated samples of children, adolescents, and adults. Consequently, introducing mentalization assessments that are suitable for adolescence and beyond will prove useful to assess changes over time in capacity to mentalize within the same or comparable paradigm. Indeed, administration of the MSA-v.2 to the current sample across adolescence and into young adulthood, or comparing current performance with a sample of young adults completing the same task would begin to address the developmental trajectory of mentalization empirically. In the theory of mind literature, assessments are focused on early childhood, with successful demonstration of theory of mind shown by children typically aged 4–5 years; however, more recent research has demonstrated the development of theory of mind continues into adolescence (Dumontheil, Apperly & Blakemore 2010). This latter finding was possible through employing a paradigm that could be used from childhood through to adulthood, and stresses the need for comparable measures in mentalization to fully understand the development of this social skill. Moreover, administering tasks of both automatic and controlled mentalization in adolescence may lend greater insight to mentalization capacity during this period; for instance, automatic mentalizing may be more advanced in adolescent samples, consistent with neurobiological development. Benefiting expansion of research in this area will also be assessments of performance in the MSA-v.2 in different adolescent samples, especially those in which early indicators of psychopathology (including borderline personality disorder) may be present and mentalization-related intervention may be applicable.

In addition to describing future studies in this area, it is also important to acknowledge the limitations of the current study. While administration of the MSA-v.2 is pragmatic with respect to scoring, the richness and quality of attributions and interpretations of mental states is limited in contrast to the original open-ended version of the MSA. The MSA-v.2 thus invites a quantitative rather than qualitative assessment. Moreover, the approach to assessing mentalization in the MSA series tackles an adolescent's capacity to mentalize for others but does not yield a measure for recognition and understanding of the adolescent's own mental state. This is especially important considering the implications for reactions against mentalization during this developmental period and the proposed association of impaired mentalization and psychopathology (Allen et al., 2008; Fonagy et al., 2006). Moreover, although interest in adolescent mentalization is emerging, this is limited to behavioral level of assessment. Clearly, the advances in our understanding of the neural correlates of mentalization as well as the well-documented literature on the neurobiology of adolescence call for interdisciplinary research in this area.

In sum, the current study sought to extend our understanding of mentalization theory by dissociating the relative contribution of language to implicit and explicit mentalizing and the role of sex differences with respect to these relationships. We found that language capacity predicted explicit mentalization only in boys and not girls. These findings suggest sex differences in the relationship between language and mentalizing capacity exist, and

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differences in social motivation may be an important factor in understanding these relationships.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

Allen, JG.; Fonagy, P.; Bateman, A. Mentalizing in clinical practice. Arlington, VA: American Psychiatric Publishing, Inc; 2008.

Baron-Cohen S, Wheelwright S. The empathy quotient: An investigation of adults with asperger syndrome or high functioning autism, and normal sex differences. J Autism Dev Disord. 2004; 34(2):163–175. [PubMed: 15162935]

Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the mind in the eyes" Test revised version: A study with normal adults, and adults with asperger syndrome or high-functioning autism. J Child Psychol Psychiatry. 2001; 42(2):241–251. [PubMed: 11280420]

Bateman, A.; Fonagy, P. Psychotherapy for borderline personality disorder: Mentalization-based treatment. Oxford, UK: Oxford University Press; 2004.

Burman DD, Bitan T, Booth JR. Sex differences in neural processing of language among children. Neuropsychologia. 2008; 46(5):1349–1362. [PubMed: 18262207]

Carpendale, JIM.; Lewis, C. How children develop social understanding (understanding children's worlds). London: Blackwell; 2006.

Carroll J, Chiew K. Sex and discipline differences in empathising, systemising and autistic symptomatology: Evidence from a student population. J Autism Dev Disord. 2006; 36(7):949–957. [PubMed: 16897399]

Choi-Kain LW, Gunderson JG. Mentalization: Ontogeny, assessment, and application in the treatment of borderline personality disorder. Am J Psychiatry. 2008; 165(9):1127–1135. [PubMed: 18676591]

Cohen, J. Statistical power analysis for the behavioral sciences. 2nd. Ed.. Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc; 1988.

De Bellis MD, Keshavan MS, Beers SR, Hall J, Frustaci K, et al. Sex differences in brain maturation during childhood and adolescence. Cerebral Cortex. 2001; 11(6):552–557. [PubMed: 11375916]

Dumontheil I, Apperly IA, Blakemore SJ. Online usage of theory of mind continues to develop in late adolescence. Dev Sci. 2010; 13(2):331–338. [PubMed: 20136929]

Fonagy P. Thinking about thinking : Some clinical and theoretical considerations in the treatment of a borderline patient. International Journal of Psychoanalysis. 1991; 72(4):639–656. [PubMed: 1797718]

Fonagy, P.; Gergely, G.; Jurist, EL.; Target, M. Affect regulation, mentalization, and the development of the self. London: H. Karnac (Books) Ltd; 2006.

Fonagy P, Luyten P. A developmental, mentalization-based approach to the understanding and treatment of borderline personality disorder. Development and Psychopathology. 2009; 21(Special Issue 04):1355–1381. [PubMed: 19825272]

Fonagy, P.; Steele, M.; Steele, H.; Target, M. Reflexive-function manual: Version 5.0 for application to the adult attachment interview. London: University College; 1998.

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Fonagy, P.; Stein, H.; Allen, J.; Fultz, J. Tampa, FL: Biennial Meeting of the Society for Research in Child Development; 2003. The relationship of mentalization and childhood and adolescent adversity to adult functioning.

Fonagy P, Target M. Attachment and reflective function. Dev and Psychopathology. 1997; 9:679–700.

Frith U, Frith C. Development and neurophysiology of mentalizing. Philos Trans R Soc Lond B Biol Sci. 2003; 358(1431):459–473. [PubMed: 12689373]

Giedd JN. Structural magnetic resonance imaging of the adolescent brain. Ann N Y Acad Sci. 2004; 1021(1):77–85. [PubMed: 15251877]

Giedd JN, Blumenthal J, Jeffries NO, Castellanos FX, Liu H, et al. Brain development during childhood and adolescence: A longitudinal mri study. Nat Neurosci. 1999; 2(10):861–863. [PubMed: 10491603]

Hughes C, Dunn J. Understanding mind and emotion: Longitudinal associations with mental-state talk between young friends. Dev Psychol. 1998; 34(5):1026–1037. [PubMed: 9779748]

Huttenlocher J, Haight W, Bryk A, Seltzer M, Lyons T. Early vocabulary growth: Relation to language input and gender. Developmental Psychology. 1991; 27(2):236–248.

Krach S, Blumel I, Marjoram D, Lataster T, Krabbendam L, et al. Are women better mindreaders? Sex differences in neural correlates of mentalizing detected with functional mri. BMC Neuroscience. 2009; 10(1):9. [PubMed: 19193204]

LeDoux, J. The emotional brain. London: Phoenix; 1998.

McEwen BS. Glucocorticoids, depression, and mood disorders: Structural remodeling in the brain. Metabolism. 2005; 54(5, Supplement 1):20–23. [PubMed: 15877308]

McGlade N, Behan C, Hayden J, O'Donoghue T, Peel R, et al. Mental state decoding v. Mental state reasoning as a mediator between cognitive and social function in psychosis. Br J Psychiatry. 2008; 193(1):77–78. [PubMed: 18700225]

Onishi KH, Baillargeon R, Leslie AM. 15-month-old infants detect violations in pretend scenarios. Acta Psychologica. 2007; 124(1):106–128. [PubMed: 17107649]

Premack D, Woodruff G. Does the chimpanzee have a theory of mind? Behavioral and Brain Sciences. 1978; 1(04):515–526.

Reynolds, CR.; Fletcher-Janzem, E. Consice encyclopedia of special education: A reference for the education of the handicapped and other exceptional children and adults. New York: John Wiley & Sons, Inc; 2002.

Richell RA, Mitchell DG, Newman C, Leonard A, Baron-Cohen S, et al. Theory of mind and psychopathy: Can psychopathic individuals read the 'language of the eyes'? Neuropsychologia. 2003; 41(5):523–526. [PubMed: 12559146]

Romeo RD, McEwen BS. Stress and the adolescent brain. Ann N Y Acad Sci. 2006; 1094:202–214. [PubMed: 17347352]

Schneider, W.; Eschman, A.; Zuccolotto, A. E-prime user's guide. Pittsburgh: Psychology Software Tools Inc; 2002.

Semel, E.; Wiig, E.; Secord, R. Clincial evaluation of language fundamentals. San Antonio: The Psychological Corporation; 1995.

Sharp C, Croudace T, Goodyer I. Biased mentalizing in children aged seven to 11: Latent class confirmation of response styles to social scenarios and assoociations with psychopathology. Social Development. 2007; 16:181–202.

Sharp C, Romero C. Borderline personality disorder: A comparison between children and adults. Bull Menninger Clin. 2007; 71(2):85–114. [PubMed: 17666001]

Shaywitz BA, Shaywitz SE, Pugh KR, Constable RT, Skudlarski P, et al. Sex differences in the functional organization of the brain for language. Nature. 1995; 373(6515):607–609. [PubMed: 7854416]

Sisk CL, Zehr JL. Pubertal hormones organize the adolescent brain and behavior. Frontiers in Neuroendocrinology. 2005; 26(3–4):163–174. [PubMed: 16309736]

SPSS. Spss base 16.0 user's guide. Chicago: SPSS Inc; 2009.

Tamis-Lemonda C, Bornstein M, Baumwell L. Maternal responsiveness and children's achievement of language milestones. Child Development. 2001; 72(3):748–767. [PubMed: 11405580]

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Taumoepeau M, Ruffman T. Mother and infant talk about mental states relates to desire language and emotion understanding. Child Dev. 2006; 77(2):465–481. [PubMed: 16611184]

Vrouva I, Fonagy P. Mind the mind! The mentalization stories' test for adolescents. Journal of the American Psychoanalytic Associaton. 2009; 57(5):1174–1179.

Vrouva I, Fonagy P. The mentalizing stories for adolescents (msa): Development and psychometric evaluation. Personality Disorders: Theory, Research, and Treatment. (under review).

Walker S. Gender differences in the relationship between young children's peer-related social competence and individual differences in theory of mind. The Journal of Genetic Psychology. 2005; 166(3):297–312. [PubMed: 16173673]

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Table 1

Participant Characteristics of Sample Overall and by Sex

	Sample (*n*=49)	**Boys (*n*=24; 49%)**	**Girls (*n*=25; 51%)**
Mean Age (years)	15.35	15.29	15.40
Race/Ethnicity			
African American	38 (78%)	19 (79%)	19 (76%)
Caucasian	1 (2%)	0 (0%)	1 (4%)
Hispanic	10 (20%)	5 (21%)	5 (20%)
Maternal Education			
High School	37 (75%)	20 (83%)	17 (68%)
No High School	12 (26%)	4 (17%)	8 (32%)

Note. Percentage of overall sample are presented in parentheses throughout.