Reflective functioning and adolescent psychological adaptation: the validity of the

Reflective Functioning Scale-Adolescent Version

Running title: Reflective functioning and adolescent psychological adaptation

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Abstract

Adolescence is a critical period of rapid biological and social development and early signs of adult mental disorders emerge during this life stage. Previous studies suggest that mentalizing failures, specifically difficulties in reflective functioning (RF) are linked with psychological symptoms. However, relatively little is known about the association between RF and psychological adaptation in typical development. In this study, the relationship between RF, internalizing and externalizing symptoms were investigated in 95 adolescents using the revised Reflective Function Scale-Adolescent version. Results indicate that RF is associated with more self-reported internalizing symptoms. Moreover, the relationship between RF and externalizing symptoms are accounted for by the co-occurrence of internalizing and externalizing symptoms in typically developing adolescents. The implications of these findings are discussed and suggestions for future studies are presented.

Introduction

There is compelling evidence that many psychiatric symptoms emerge during adolescence (Kessler et al., 2005; Kessler & Wang, 2008; Paus, Keshavan, & Giedd, 2008). Achenbach (1966) was the first to distinguish the psychiatric symptoms demonstrated in adolescence through the framework of internalizing and externalizing problems. The construct of internalizing symptoms refers to negative emotions, somatic complaints and social withdrawal that mainly influence an individual's internal psychological world, whereas externalizing symptoms refer to maladaptive behavior toward the external environment through aggression, delinquency and hyperactivity (Hinshaw, 1987). The distinction has provided a theoretical framework to investigate psychological adaptation and psychopathology in young people. Much of the work focused on the prediction of emotional and behavioral problems in adulthood from symptoms exhibited and measured in adolescence (Fontaine, McCrory, Boivin, Moffitt, & Viding, 2011; Kim-Cohen et al., 2003; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007; Moffitt, Caspi, Harrington, & Milne, 2002). It is suggested that internalizing symptoms are predictive of depression and anxiety whereas externalizing symptoms predict aggressive behavior, rule-breaking and intrusive problems (Reef, Diamantopoulou, van Meurs, Verhulst, & van der Ende, 2010). The other important line of research in this domain has focused on the co-occurrence of internalizing and externalizing symptoms in adolescents. High rates of comorbidity of internalizing and externalizing symptoms during adolescence have been consistently reported across studies (Oland & Shaw, 2005; Overbeek et al., 2006).

Adolescence is a transitional period characterized by rapid changes in biological systems and interpersonal relationships. It is argued that adolescents' psychological adjustment is influenced by the interaction between the development of socio-cognitive capacities and challenges from the environment (Blakemore & Mills, 2014). One such socio-cognitive capacity that has gained much attention recently is mentalization. Mentalization or mentalizing capacity refers to the ability to interpret behaviors of the self and others in terms of intentions, beliefs, feelings and desires (Fonagy, Gergely, Jurist, & Target, 2002).

An individual's mentalizing capacity could be assessed in various ways (Fonagy & Luyten, 2009) and the Reflective Functioning Scale (RFS; Fonagy, Target, Steele, & Steele, 1997) is considered the most appropriate measure to assess an individual's mentalizing capacity in attachment contexts. The RFS measures the individual's awareness of the nature of mental states, the effort to understand the mental states underlying interpersonal behavior, and the recognition of the developmental features of mental states from interview transcripts (Fonagy, Target, Steele, & Steele, 1997). The overall RF score coded from attachment-related autobiographical memories reflects the individual's general mentalizing capacity across attachment experiences. During the past decade, studies have shed light on the hypothesized associations between adults' psychological symptoms and their Reflective Functioning (RF) deficits (Katznelson, 2014). Results suggest that adult psychiatric patients' show lower RF than that of healthy controls. It is also notable that depressive patients (Taubner, Kessler, Buchheim, Kächele, & Staun, 2011) and panic disordered patients (Rudden, Milrod, Target, Ackerman, & Graf, 2006) demonstrate RF difficulties in symptom-specific areas, but not in their general RF.

These empirical findings highlight an important link between RF and an individual's psychological adaptation. They raise a central question as to whether RF could be linked to the emergence of psychological symptoms during adolescence. However, the study of individual difference in RF and its association with psychological symptoms in adolescence has been hampered by the scarcity of appropriate and valid measures of RF. Previous studies had to extend the use of measures developed for adults (Taubner, White, Zimmermann, Fonagy, & Nolte, 2013; Taubner, Zimmermann, Ramberg, & Schröder, 2016) or children in middle childhood (Ha, Sharp, Ensink, Fonagy, & Cirino, 2013) to assess RF capacity in adolescents. Consequently, relatively little is known about the typical and atypical development of RF and its effect on mental health during adolescence.

RF and psychological symptoms in adolescence

Several attempts have been made to investigate whether adolescents' RF is associated with externalizing symptoms, more specifically, with aggressive behavior. In a recent study, it was found that RF mediated the relationship between early abuse history and aggressive behavior in an adolescent community sample. For adolescents with higher RF scores, early traumatic experiences were not related to aggression (Taubner & Curth, 2013). A recent study replicated that the effect of early maltreatment on the potential for violence was moderated by RF in a larger sample of clinically referred and normative adolescents (Taubner et al., 2016). These data suggested RF protected against aggressive behavior in adolescents with early abuse experiences. It was also found that RF had a moderating effect on psychopathic traits and aggressive behavior (Taubner, White, et al., 2013). Only for adolescents with low RF did psychopathy predict both proactive and reactive aggressive behaviors. Moreover, the

interaction effect of psychopathy and reactive aggression on RF was explained by the overlap of variance between proactive aggression and RF. For adolescents with high RF, psychopathic traits were not associated with aggressive tendencies. These findings suggested that high RF functions as a protective factor against proactive aggression in adolescents with psychopathic traits.

A more recent study examined the association between RF and high levels of antisocial behaviors in young offenders (Möller, Falkenström, Holmqvist Larsson, & Holmqvist, 2014). Results showed that 75% of the young offenders had low RF and notably, RF in the nonviolent crime subgroup was not higher than that in the violent subgroup. In contrast to the findings of the community-based studies, this study did not find RF to be correlated with psychopathic traits. In summary, the existing limited findings suggest that RF may be considered a protective factor against aggression in adolescents, although the association between RF levels and psychopathic traits remains inconclusive.

To our knowledge, no existing research has investigated the relationship between RF and internalizing symptoms of depression and anxiety in community samples of adolescents although two studies have examined RF in adolescent psychiatric inpatients. The participants in the first study (Rothschild-Yakar, Levy-Shiff, Fridman-Balaban, Gur, & Stein, 2010) consisted of adolescent inpatients with eating disorders. 61.8 % of the inpatients had a comorbid diagnosis of depressive disorders and 26.5% of them had a comorbid diagnosis of obsessive-compulsive disorder. Results indicated that the inpatient group exhibited lower RF compared with age-matched healthy controls. A second study (Ha et al., 2013) measured RF in adolescent psychiatric inpatients by coding RF from the Child Attachment Interview (CAI,

Shmueli-Goetz, Target, Fonagy, & Datta, 2008) with the child version of the RFS (Ensink, 2004). The sample consisted of inpatients with multiple diagnoses of mental disorders. 51 % of them had a diagnosis of anxiety disorder, 45 % of them had a diagnosis of mood disorder, and 45 % of them had an externalizing disorder. Results showed that the average RF of the adolescent inpatients was within the lower range of RF. These results suggested that low RF was related to maladaptive, internalizing symptoms.

Studies examining RF in adults with depressive disorders present a mixed picture of the association between RF and depression. For example, it was found that depressive adult outpatients had a comparable level of overall RF to healthy adults. However, depressive outpatients demonstrated decreased RF scores relative to their overall RF when answering the question specifically related to loss (Taubner et al., 2011). It suggested that there may be domain-specific RF deficits in depressive patients. By contrast, depressive inpatients had lower overall RF scores than healthy controls. Moreover, depressive inpatients' RF deficits were not associated with their current depressive mood, but with the chronicity of their illness (Fischer-Kern, Fonagy, Kapusta, Luyten, Boss, Naderer, Blüml, et al., 2013). It was argued that overall RF difficulties may result from the chronic depressive state of the individual.

The present study

Previous empirical work demonstrates that RF deficits are associated with psychopathology in adults. However, the relationship between RF and psychological adaptation in adolescence has yet to be fully addressed, in part due to the lack of appropriate measures to assess RF in this age group. The goals of the current study are two-fold. Our first goal was to validate the RF coding system for adolescence to address the measurement gap.

Following the modification of the RFS for young children aged between 8-12 years (Target, Oandasan, & Ensink, 2001), age-appropriate RF markers in adolescents' narratives were investigated by carefully analyzing adolescents' attachment transcripts in a prior study (Chow, Shmueli-Goetz, & Fearon, 2014). Based on those findings, examples for each subtype of RF were devised in the RFS-A manual. See Appendix for examples of moderate RF and high RF. While factor analysis indicates that the adult version of the RFS is best described by a single factor model: a general RF factor (Ensink et al., 2015; Taubner, Hörz, et al., 2013), researchers using the child version of the RFS create two subscale scores to indicate children's capacity in understanding self and others (Ensink et al., 2015; Ha et al., 2013). It implies that a two-factor model might represent the internal structure of the RFS as well. In the present study, we explored the latent structure of the adolescent version of RFS-A (Chow et al., 2014) to provide the preliminary data of the internal structure of the RFS-A.

The second goal of the study was to examine the associations between RF and psychological adaptation in terms of adolescents' externalizing and internalizing symptoms in typical development. We hypothesized that there would be negative associations between the severity of psychological symptoms and mentalizing capacity. An individual with a higher RF was expected to report both fewer internalizing and externalizing symptoms. The association between internalizing symptoms and domain-specific RF problems was explored. The relationship between RF, psychopathic traits and externalizing symptoms was also tested. We hypothesized that RF would moderate the relationship between psychopathic traits and the manifestation of externalizing symptoms in the community sample. As internalizing and externalizing problems are frequently reported to be comorbid with each other, we further

investigated whether the effect of RF in predicting psychological adaptation was confounded by the overlap between internalizing and externalizing problems.

Method

Participants

For the current study, 95 participants were selected from the larger follow-up sample of the Twin Early Development Study (TEDS) using a random number table (also called simple random sampling method). Participants were aged between 14 and 15 years ($M = 14.97 \pm 0.23$) and 46 of them were male. The original TEDS sample consisted of 16,810 pairs of twins who were born between 1994 and 1996 (Pike, Iervolino, Eley, Price, & Plomin, 2006). In 2012, based on socio-economic distribution and geographical location, a total of 1292 families were contacted. 582 of them agreed and participated in the TEDS follow up attachment project (Fearon, Shmueli-Goetz, Viding, Fonagy, & Plomin, 2014). The Child Attachment Interview (CAI, Shmueli-Goetz et al., 2008) was conducted with young people and a set of questionnaires was given to the twins and their parents. Data from the Inventory of Callous-Unemotional Traits (ICU, Frick, 2004) and the Youth's Inventory-4 (YI-4, Gadow & Sprafkin, 1997) were analyzed in the current study. Statistical analysis showed that the randomly selected subsample in the current study did not differ from the TEDS follow-up sample (Fearon et al., 2014) with respect to gender composition ($\chi^2 = .520$, $p = .47$), socio-economic status (measured by household income, $\chi^2 = 10.001$, $p = .13$) and age ($t(1,580)= .338$, $p=.74$).

Measures

The Reflective Function Scale-Adolescent (RFS-A). The RFS-A (Chow et al., 2014) is a qualitative coding system to assess adolescents' RF by analyzing attachment-related narratives. The scale had been adapted from the Adult Reflective Function Scale (ARFS; Fonagy et al., 1997) and the Child Reflective Function Scale (CRFS; Target, Oandasan, & Ensink, 2001). The scoring procedure is kept equivalent across all the RF scales. Notably, different age-appropriate RF markers are used to code attachment-related transcripts for different age groups. The RFS-A scale ranges from -1 (anti-reflective) to 9 (exceptionally reflective). A score of 5 indicates moderate or typical RF capacity for understanding and interpreting interpersonal behavior in terms of internal mental states. Coding focuses on the answers to so-called "demand questions" that specifically require the interviewee to consider their own and other's mental states, while reflecting on emotionally charged experiences with their caregivers in attachment contexts. For example, "Can you tell me about a time when you were upset and wanted help". The single score of a narrative with qualitative markers of RF features would be within the range of average to high (RF$\geqq$5). Absence of RF in a narrative is given a single score of low to impaired RF (RF < 5). An overall RF score is assigned by the rater at the end to indicate the individual's overall RF capacity. Detailed descriptions and examples of RF markers in adolescents are presented in the manual of the RFS-A (Chow et al., 2014).

In this study, RF scores were coded independently by three of the authors (CC, DC, & TN) who are reliable RF coders on the AAI and familiar with the RFS-A. On average, it took about 90 minutes to rate an interview transcript of the CAI. The inter-rater reliability indicated by intraclass correlation for two sets of 10 cases was 0.80 and 0.82.

The Child Attachment Interview (CAI). The CAI (Shmueli-Goetz et al., 2008) is a semi-structured interview asking children to describe and reflect on their relationships and experiences with attachment figures. The CAI coding system comprises of eight scales capturing various aspects of the narrative (for example, Emotional Openness, Use of Examples, Idealisation, and Coherence) with the constellation of scores determining the assignment of attachment classifications (Secure, Dismissing, Preoccupied or Disorganized). In the present study, the CAI narratives were used to assess participants' RF level and coded by the RFS-A. Target et al. (2001) suggested that 14 of the 19 CAI questions were "demand questions", challenging children to think about their mental states and those of others. See Appendix for the demand questions of the CAI. Given the nature of our sample and the importance of the twin relationship, an additional demand question was added to the original CAI protocol asking participants to reflect on their relationship with their twin.

Inventory of Callous-Unemotional Traits (ICU). The ICU (Frick, 2004) is a self-report scale consisting of 3 subscales (callousness, uncaring, and unemotional subscales) and a total of 24 items for measuring psychopathic traits. Items are scored using a four-point scale from 0 (not at all true) to 3 (definitely true) for how truly the statements describe the person. Good reliability and construct validity have been reported in previous studies (Essau, Sasagawa, & Frick, 2006;

Fanti, Frick, & Georgiou, 2009; Roose, Bijttebier, Decoene, Claes, & Frick, 2010).

The Youth's Inventory-4 (YI-4). The YI-4 (YI-4, Gadow & Sprafkin, 1997) is a self-report scale for youth aged between 12 and 18 years old. It evaluates behavioral, cognitive and affective symptoms. The YI-4 scale is comprised of 128 items and each item is rated by frequency. The symptom count score and the symptom severity score are computed based on the DSM diagnostic system. Good reliability and validity were reported for the YI-4 scale (Gadow & Sprafkin, 1997, 1999; Gadow et al., 2002). Of interest for this study, indexes of externalizing and internalizing problems were created. Based on the definition in previous research (Achenbach, 1991; Achenbach, McConaughy, & Howell, 1987), the "internalizing problems" index was created by summing up the symptom severity T scores of: Generalized Anxiety Disorder, Social Phobia, Separation Anxiety Disorder, Major Depression and Dysthymic Disorder. The "externalizing problems" index was derived by summing up the symptom severity T scores of: Attention Deficit Hyperactivity Disorder (ADHD)-Inattentive type, ADHD-Hyperactive-Impulsive type, ADHD combined, Oppositional Defiant Disorder and Conduct Disorder. The internal consistency for the two indexes in the current study was 0.88 and 0.86 for internalizing and externalizing problems respectively.

Data analysis

Firstly, with the goal of validating the RFS-A, descriptive data was examined to determine the average level of RF. This was followed by correlational analyses looking at RF and its relationship with other variables in typically developing adolescents. In addition, a factor analysis was conducted to examine the internal structure of the RFS-A. Then the reliability of the RFS-A was evaluated by examining internal consistency. Secondly, for a better

understanding of the relationship between RF and psychological adaptation in adolescence, correlational analyses were conducted twice for both internalizing and externalizing problems. With the aim to further explore domain-specific RF deficits in depressive individuals, paired t-tests were carried out to investigate whether there was a difference between participants' overall RF score and the averaged RF score of the three items closely related to negative moods. Thirdly, hierarchical regression analyses were carried out in order to explore the role of RF in predicting the severity of internalizing and externalizing problems. As a gender difference for RF was found on a statistical level in the current study, gender was entered as a variable to control for its possible effects. The first hierarchical regression model using gender and RF as predictors was conducted to investigate the role of RF in predicting self-reported internalizing problems. A second regression analysis with gender, psychopathic traits and RF as predictors was carried out to examine the possible protective role of RF in reducing the likelihood of externalizing problems. Finally, in order to examine the possible confounding effect of comorbidity we introduced either the internalizing or externalizing problems as an additional predictor in the regression model.

Results

Descriptive and correlational data

Table 1 presents the descriptive and correlation data for the measures used in the study. In this sample, there was no difference between males' and females' age (Female = 14.95 and Male = 14.98, $t(1,93)= 0.64$, $p > .52$). Age was not correlated with overall RF score ($r = -.13$, $p >.23$). Female participants were characterized by lower CU traits than their male counterparts (Female = 18.73 and Male = 22.85, $t(1,93)= 2.69$, $p < .01$) and by higher overall RF scores

(Female = 5.64 and Male = 5.03, $t(1,93) = -2.93$, $p <.01$).

Psychometric properties of the RFS-A

In order to examine the internal structure of the RFS-A, responses to fifteen demand questions were analyzed using principal component analysis with Varimax rotation. Missing values were identified and preprocessed before conducting the factor analysis. Missing data was recorded when participants were not able to provide answers to interview questions. Little's Missing Completely At Random test indicated data were missing randomly (X^2 (145) =170.09, $p >.07$), and which were then replaced by estimated values using expectation-maximization methods. The mean, standard deviation and correlation coefficients of each item in the RFS-A are presented in Table 2. As shown, correlations ranged from .09 to .65, suggesting one or more factors in the latent structure.

Both the KMO value (0.87) and Bartlett's sphericity test ($p < .01$) showed that the data met the requirements for conducting factor analysis. Results from the Eigenvalue and the Scree plot suggested that one to three factors were considered to account for the internal structure. The Eigenvalue Monte Carlo Simulation (O'Connor, B. P., 2000) indicated that there was no statistical justification for two or three factors, and one factor was the best fit for the internal structure. See Figure 1. The component matrix for one factor structure is presented in Table 3. The one-factor model explained 42.2% of the variance. The Cronbach's alpha coefficient of .90 suggests good internal consistency of the factor.

The same statistical procedure was carried out for the 14 demand questions again after excluding the question on twin relationships, as this question was added to the CAI protocol

specifically for the TEDS study. Similar results were obtained with a one-factor model, explaining 43.8 % of the variance. The internal consistency was .89. Table 3 illustrates the component matrix. In summary, results from factor analysis indicated a one-factor model of the RFS-A: a general RF factor.

RF and psychological adaptation

With regard to the relationship between RF and psychological adaptation, results demonstrated that the overall RF score correlated positively with the overall severity of internalizing symptoms ($r = .28, p < .01$), whereas RF was not significantly correlated with the overall severity of externalizing symptoms ($r = .11, p > .29$). Paired t-tests showed that the averaged RF of the three items closely related to negative moods (self-upset, the experience of losing significant others and parents arguing) was lower than the participants' overall RF (RF= 5.06 ± 0.95 vs. 5.34 ± 1.05, $t(1,94)= 3.879, p < .01$), however, the RF scores were both in the same range of moderate RF.

In order to further ascertain the effect of RF in predicting the severity of internalizing symptoms, a hierarchical regression analysis was conducted with gender and RF as predictors. The results of this analysis indicated that gender did not predict the variance in severity of internalizing problems (R^2 change = 0.003, $F(1,93) = 0.001, p > .97$, Adjusted R^2=0.01). After controlling for the effect of gender, the level of RF explained an additional 8.2% of the variance in severity of internalizing problems (R^2 change = 0.085, $F(2,92) = 4.272, p < .05$, Adjusted R^2=0.065). The level of RF significantly predicted the severity of internalizing problems (*Beta* = .305, *t* (2,92)=2.92, $p < .01$).

With the goal to investigate the role of RF in protecting against externalizing symptoms, a hierarchical regression analysis was conducted with gender, CU traits and RF as predictors. In the first step, gender was entered as the predictor. This model did not explain the variance of externalizing problems. $F_{(1,93)} = 0.41$; $p > .52$, Adjusted $R^2 = .006$, *Beta* = -.066. In the next step, CU traits were entered into the model as a second predictor. This model significantly explained 32.6% of the variance of externalizing problems. $F_{(2,92)} = 22.25$; $p < .01$. CU traits contributed significantly to the prediction of symptom severity. *Beta* = .589, $t_{(2,92)} = 6.63$, $p < .01$; Adjusted $R^2 = 0.322$. After entry of RF in the third step, it was found that together, the model explained 34.1 % of the variance of externalizing problems ($F_{(3,91)} = 17.24$; $p < .01$). RF explained an additional 3.6 % of the variance , $p < .01$. The introduction of RF had a unique effect on externalizing problems, *Beta* = .202, $t_{(3,91)} = 2.28$, $p < .03$. Finally, the interaction term was entered to further examine the effect of an interaction between RF and CU traits. Results indicated that the interaction term did not reach statistical significance to predict additional variance of externalizing problems. It indicated that there was no mediation or moderation effect of RF in the relationship between CU traits and externalizing problems.

Considering the high comorbidity of internalizing and externalizing symptoms (Oland & Shaw, 2005; Overbeek et al., 2006), we examined the predictability after controlling for the effect of respective other symptom cluster. Results demonstrated that after controlling for the effect of gender and externalizing problems, RF remained a significant predictor for the severity of internalizing problems and explained an additional 6.4 % of the variance, *Beta* = 0.265, $t_{(3,91)} = 2.82$, $p < 0.01$. A similar analysis was conducted to predict the severity of externalizing problems. After controlling for the effects of gender, CU traits and the

severity of internalizing problems, RF did not predict the severity of externalizing problems, *Beta* = 0.076, *t* (4,90) = 0.91, *p* > .36. See Table 4 for details. Taken together, these results suggested that the effect of RF on predicting the severity of externalizing problems was contributed by the overlap of variance with internalizing problems and should therefore not be interpreted as a finding.

Discussion

This study was designed to establish the reliability and validity of applying the RFS-A in adolescent samples, to assess their mentalizing capacity by coding RF from interview narratives. The study's second objective was to investigate RF capacity and the association between RF levels and psychological adaptation outcomes in typical development. With respect to the first aim, results showed that the RFS-A could be used with the CAI transcripts to assess the level of RF in adolescents. Factor analysis indicated a one-factor model for the latent structure of the RFS-A. The preliminary data in the present study indicated that the RFS-Adolescent version is best described by an one-factor model: a general RF factor. The result is more similar to the single factor model of the ARFS (Taubner, Hörz, et al., 2013) than a two factor model. Replication with a larger sample size is needed before any conclusion can be drawn for the latent structure of the RFS-A. Satisfactory internal consistency and inter-rater reliability were reported. In addition, the finding that RF was negatively correlated with CU traits was in agreement with previous empirical research demonstrating that individuals with psychopathic traits had a lower RF (Levinson & Fonagy, 2004; Taubner, White, Zimmermann, Fonagy, & Nolte, 2013). Overall, the results suggested that the RFS-A is a reliable and valid tool to measure RF in adolescents.

The results revealed that the mean RF score of the current sample (5.34 ± 1.05) is slightly higher than other studies using the adult version of RFS to assess adolescent's RF (Taubner, White, et al., 2013; Taubner et al., 2016). The discrepancy between RF scores in other studies and the current sample most likely reflects the different reference points used by different coding systems. However the present study is the first to use the RFS-A to assess adolescents' RF, replication is needed before making any conclusion. On average, female adolescents had a higher level of overall RF than male adolescents indicating a higher capacity to mentalize during adolescence. Since age was not correlated with RF scores in the current study, this finding may reflect the potential gender difference in the development of RF during adolescence. Reflective function refers to an individual's capacity to go beyond observable phenomena to understand one's own and others' behaviors in term of mental states (Fonagy & Target, 1997). As the overall RF was scored from participants' CAI narratives, it is influenced by the complexity of contents participants reported in their interview. The result of lower RF in boys than in girls is in line with previous findings in adolescents' controlled/explicit mentalizing capacity which requires cognitive effort and verbal understanding of mental states (Rutherford et al., 2012). It was shown that only in boys, better language ability was correlated with higher controlled/explicit mentalizing capacities. Researchers suggested that language development might be critical for the development of controlled/explicit mentalizing in boys. There is the possibility that a lack of sufficient linguistic ability to explicitly describe their mental states and interpersonal context may account for the gender difference in RF levels in the present study. Future research may address

this issue to further explore the interplay between gender differences and verbal IQ in the development of RF during adolescence.

In addressing the second aim of the study, our findings suggest that the associations between RF and psychological adaptation outcomes in typically developing adolescents are different from the patterns observed in adults or inpatient groups (Ha et al., 2013; Katznelson, 2014; Taubner et al., 2011). Contrary to our hypothesis, typically developing adolescents with higher RF reported higher internalizing symptoms. Considering one of the common mistakes made by RF coders is that the evidence of hypermentalzing (low RF) is miscoded as evidences of high RF. The accuracy of coding was examined as the first step before we looked into other factors what may account for the unexpected findings. It was confirmed that the coding was correct. Under closer scrutiny, the mean score of internalizing symptoms in the current study did not differ from that of a bigger subsample (N =225, mean internalizing symptoms = 188.59±25.52) in the follow-up dataset of the TEDS study. It is unlikely that the subsample in our study is not representative. Given the typical developmental characteristics of social-cognitive functions during adolescence, it seems more likely that the self-reported, sub-clinical anxiety and depressive moods were the byproduct of the development of their capacity to reflect on their relationships with others and of their increased awareness of emotions in this specific developmental period of life characterized by rapid changes. This is supported by Fonagy et al. (2002)'s contention that with the growing ability for abstract thinking during adolescence, adolescents are capable of generating more complicated, adult-like thoughts to understand the intentional states that underlie their own and others' behavior. They begin to integrate their knowledge of mental states and use language to make

sense of their new social networks and growing complexity in relational experiences. However, this enriched and growing mentalizing capacity may cause adolescents' ongoing sensitivity to their own mental states and those of others. In addition, the new way of thinking about feelings and behavior and taking in their implications is a dynamic process, which may be overwhelming to adolescents. For some, this may lead to increased anxiety and/or preoccupation with such thoughts. For others, it may result in temporary withdrawal from their mental activities in the service of relief from overstimulation by one's own and others' affective states (Target, 2002). Thus, the sub-clinical internalizing symptoms reported by typically developing adolescents with higher RF may result from their recognition of the complicated nature of interpersonal relationships. It is also likely that fulfilling the autonomy needs in the parent-child relationship is an important but challenging task for adolescents. The negotiation between behavioral control and maintaining relatedness to parents causes internal distress (Allen et al., 2003; Paikoff & Brooks-Gunn, 1991). Another reason that may account for adolescents with higher RF reporting greater internalizing problems is that the interview questions used in the study were designed to unconsciously activate the interviewee's general attachment system, but not depression-related representations. Previous studies showed that t depressive adult patients demonstrated RF difficulties only in depression-specific topics, while they showed comparable overall RF to healthy participants (Taubner et al., 2011). It is argued that for psychiatric patients, RF problems were context-sensitive and manifested in disorder-specific areas, rather than in an individual's general RF (Bateman & Fonagy, 2016; Rudden et al., 2006). It is possible that RF might be compromised when adolescents with more internalizing symptoms are considering their depression or anxiety-related topics. In order to

take this aspect into account, we investigated the association between global RF and average

RF scores derived from the three items that are more closely related to the experiences of

negative moods. Results showed that RF scores were statistically lower than their overall RF

when adolescents talked about their negative emotional experiences. However, RF levels in

both conditions were in the same range as moderate RF; replication would be required before

further interpretation of the results.

With respect to the relationship between RF, externalizing problems and CU traits, initial

results showed that after controlling for the effect of gender and CU traits, RF predicted the

severity of externalizing problems. However, additional analysis revealed that this effect was

contributed to by the overlap of variance between externalizing and internalizing problems. RF

did not mediate nor moderate the relationship between CU traits and externalizing problems

either. The absence of the association between RF deficits and externalizing problems may be

explained by the definition of externalizing problems. Externalizing problems are a group of

heterogeneous behaviors consisting of aggression, impulsivity, and hyperactivity. It is possible

that mentalizing deficits are not directly linked to the manifestation of the non-violent

externalizing symptoms of hyperactivity and impulsivity. According to mentalizing theory,

misperception of other people's actions or failing to recognize others as intentional beings is

hypothesized to reduce the inhibition of violence against the other person (Bateman & Fonagy,

2016). Thus high RF has been proposed as a "brake" to inhibit inflicting harm on others

(McGauley, Yakeley, Williams, & Bateman, 2011; Yakeley, 2009) It may not be possible to

generalize the protective role of RF against aggression to non-violent hyperactivity and

impulsivity. Given the high rate of co-occurrence between attention-deficit/hyperactivity

disorder and conduct problems in young people (Reeves, Werry, Elkind, & Zametkin, 1987;

Szatmari, Boyle, & Offord, 1989), future studies should recruit clinical patients, such as

adolescents with late-onset conduct disorder who have no history of attentional and behavioral

problems, to further explore the relationship between RF and violent externalizing symptoms.

The finding that the association between externalizing problems and RF was canceled out by

the overlap with internalizing problems indicated that the co-occurrence of internalizing and

externalizing problems should be considered when investigating the relationship between

psychological adaptation and RF levels during adolescence. The high rate of co-occurrence of

internalizing and externalizing symptoms found in this study is consistent with previous

findings (Oland & Shaw, 2005; Overbeek et al., 2006). With respect to the inconclusive results

of the relationship between RF deficits, CU traits, and aggression in previous studies (Levinson

& Fonagy, 2004; Taubner, White, Zimmermann, Fonagy, & Nolte, 2013), our data suggest that

it is possible that the severity of the individual's internalizing symptoms could affect the

relationship between RF, aggression and CU traits and lead to such inconsistent findings.

In summary, the current study presents preliminary data for the reliability and validity of

the RFS-A. It not only provides an age-appropriate measure of adolescent mentalisation,

operationalized as RF, for future research, but also highlights the implication for use and

benefits in clinical work. Clinicians, in using the scale, could relatively quickly ascertain how

their clients make sense for what happened to them in their individual developmental context,

and quantify their ability to interpret interpersonal behavior in terms of mental states through

the client's responses to the CAI questions.

The current study furthers our understanding about the typical development of RF in adolescents. It also raises the necessity to take into account the co-occurrence of internalizing and externalizing symptoms when understanding the role of RF in psychological adaptation outcomes. It was found that increasing internalizing symptoms in adolescents could be partly explained by their advancing capacity to understand the complicated social world they are engaged with. Moreover, the relationship between externalizing symptoms and mentalizing capacity was explained by internalizing symptoms. Therapists working with adolescents could help their clients by acknowledging the challenges under their rapid growth of social cognitive abilities. It is also worth discussing how the advancing ability to perceive other's mental states may influence their emotions and interpersonal behaviors when treating adolescents' externalizing problems.

Some limitations of the current research should be addressed. Firstly, our research design with 95 participants met the minimum requirement (N>50) for conducting multiple regression analysis (Green, 1991; Harris, 2001). However, ideally 30 participants per variable would yield appropriate power to detect small effect size if circumstances allow (VanVoorhis & Morgan, 2007). We encourage future studies using larger samples to elucidate to what extent an enriched mentalizing capacity is related to sub-clinical internalizing symptoms in the typical development of RF; ideally in longitudinal designs to allow for causal conclusions. Secondly, reflective function is the operational definition of mentalizing (Fonagy et al., 1997). In the current study, the results of a factor analysis have provided preliminary data of the construct validity of the RFS-A. Future studies should include other measures to assess additional dimensions of mentalizing capacities, to explore the concurrent validity of the

RFS-A. Finally, previous research has suggested that chronicity of depression rather than the current depressive mood state was associated with an individual's RF deficits (Fischer-Kern, Fonagy, Kapusta, Luyten, Boss, Naderer, Bluml, et al., 2013). As no such data was collected for the participants in this study, future studies might consider using a longitudinal research design to address this issue in developing adolescents.

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APPENDIX

A) The demand questions in the CAI

Q1) Tell me three words that describe yourself, that is not what you look like, but what sort of person you are. 1………. 2…........... 3…………

Q3) Can you tell me three words to describe your relationship with your mum, that is, what it's like to be with your Mum? 1………. 2….............3…………

Q4) What happens when your Mum gets cross with you or tells you off?

Q5) Can you tell me three words to describe your relationship with your Dad, what it's like to be with your Dad? 1………. 2…........... 3…………

Q6) What happens when your Dad gets cross with you or tells you off?

Q7) Can you tell me about a time when you were upset and wanted help?

Q14) Has anyone important to you ever died? Has a pet you cared about died?

Q17) Do/did your parents sometimes argue?

Q18) How do you get on with your twin?

B) Example of moderate RF:

"he hates to admit that he's wrong and lets say for if he's doing the driving instructions if he doesn't does it the wrong way he'll blame the map or something like that, he's just not very good at it at admitting that he is the one who's the fault (RF=5, awareness of the defensive nature of certain mental states)".

C) Example of high RF:

" In a way, good and bad, good cos I can like release like the anger that I've had, you know like

if you've had like this anger like building up, you just want to like let it out, cos like I've

been quite emotional lately cos all this work and everything, I can just like let it out, but

like, in a bad way because obviously I don't want to upset her or be, or offend her in any

way or anything cos obviously I care about her so much so it just upsets me when we

argue (RF= 7, mental state may influence one's behavior in another situation, different

perspectives, interactional aspect of mental state)."

Table

Table 1   Mean and SD for overall sample

Measure	*Mean*	SD	N	2	3	4
1 Overall RF	5.35	1.05	95	-.24*	.11	.28**
2 CU traits	20.73	7.69	95	-	.53**	.08
3 Externalizing Problems	291.90	39.65	95		-	.46**
4 Internalizing Problems	188.57	24.63	95			-

Note: *p* < .05, **p* < .01.   CU traits = Callous-Unemotional traits

Table 2   Correlation matrix of demand questions in the RFS-A

(N=95)	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Self1	4.43 (1.07)	1														
2. Self2	4.64 (1.05)	.466*	1													
3. Self3	4.73 (1.12)	.325*	.470*	1												
4. Self Upset	5.05 (1.59)	.213*	.413*	.234*	1											
5. Mum1	4.94 (1.08)	.429*	.433*	.471**	.431**	1										
6. Mum2	4.82 (1.05)	.336*	.423*	.312**	.323**	.570**	1									
7. Mum3	4.95 (1.03)	.383*	.359*	.369**	.449**	.652**	.414**	1								
8. Mum Upset	5.43 (1.02)	.285*	.409*	.376**	.524**	.531**	.557**	.554**	1							
9. Dad1	4.91 (1.16)	.286*	.351*	.222*	.461**	.422**	.342**	.391**	.427**	1						
10.Dad2	4.99 (0.99)	.258*	.346*	.226*	.435**	.414**	.535**	.552**	.586**	.423**	1					
11.Dad3	1.87 (0.97)	0.089	0.193	0.15	.253*	.252*	.405**	.293**	.342**	.500**	.445**	1				
12.Dad Upset	5.35 (0.90)	.209*	.294*	.214*	.420**	.392**	.385**	.440**	.490**	.457**	.469**	.504**	1			
13.Parent	5.12 (1.00)	.344*	.319*	.329**	.422**	.452**	.263*	.461**	.396**	.461**	.324**	.219*	.457**	1		
14.Death	5.01 (0.87)	0.167	.436*	.342**	.518**	.448**	.378**	.372**	.426**	.355**	.404**	.241*	.391**	.296**	1	
15.Twin	4.70 (1.10)	.397*	.304*	0.161	.245*	.370**	.355**	.294**	.455**	.224*	.421**	.367**	.438**	.250*	.208*	1

Note: *$p < 0.05$, **$p < .01$.

Table 3   Component matrix of demand questions in the RFS-A

Component Matrix	15 items	14 items
RF_CAI_Mum_cross	0.77	0.77
RF_CAI_Mum1	0.76	0.76
RF_CAI_Mum3	0.73	0.74
RF_CAI_Dad2	0.72	0.71
RF_CAI_Mum2	0.69	0.69
RF_CAI_Dad_cross	0.68	0.67
RF_CAI_Self_Upset	0.66	0.67
RF_CAI_Dad1	0.65	0.66
RF_CAI_Self2	0.63	0.64
RF_CAI_Death	0.62	0.63
RF_CAI_Parent_Argue	0.62	0.62
RF_CAI_Twin	0.56	-
RF_CAI_Dad3	0.53	0.52
RF_CAI_Self3	0.52	0.54
RF_CAI_Self1	0.52	0.51

Extraction Method: Principal Component Analysis.

Table

Table 4   Hierarchical regression analyses for variables predicting externalizing problems after controlling for internalizing problems

(N=95)	Model 1			Model 2			Model 3			Model 4			Model 5		
Variable	B	$SE\,B$	β	B	$SE\,B$	β	B	$SE\,B$	β	B	$SE(B)$	β	B	$SE(B)$	β
Gender	-5.131	8.047	-.066	-17.435	6.911	-.224*	-16.569	6.602	-0.213**	-15.168	6.26	-0.195*	-15.205	6.272	-0.196*
CU Trait				2.992	0.451	.589***	2.806	0.397	0.552***	2.884	0.407	0.568***	4.523	2.098	0.89*
Internalizing							0.64	0.119	0.403***	0.604	0.126	0.381***	0.603	0.126	0.38***
RF										2.833	3.111	0.076	8.869	8.195	0.239
RF x CU													-0.31	0.389	-0.33
R^2		0.004			0.326			0.487			0.492			0.496	
F for change in		0.407			22.250***			28.846***			21.801***			17.497***	

Note: *** $p < .001$. ** $p < .01$. * $p < .05$; Internalizing = severity of internalizing symptoms
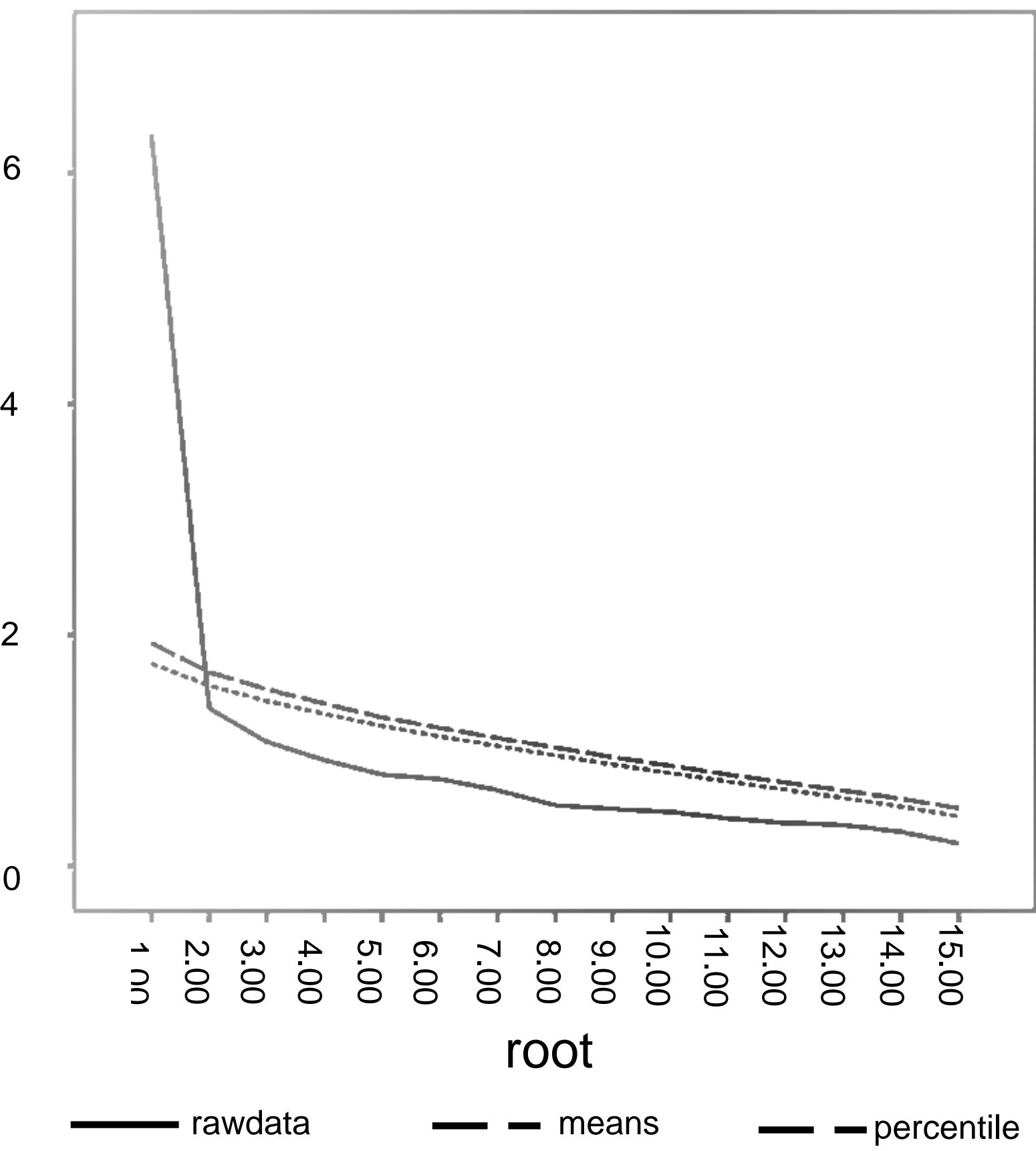
Figure

Figure 1 Results of the Eigenvalue Monte Carlo Simulation of RFS-A