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Maladaptive Behavior in Autism Spectrum Disorder: The Role of Emotion Experience and Emotion Regulation

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Abstract Maladaptive behavior is common in Autism Spectrum Disorder (ASD). However, the factors that give rise to maladaptive behavior in this context are not well understood. The present study examined the role of emotion experience and emotion regulation in maladaptive behavior in individuals with ASD and typically developing (TD) participants. Thirty-one individuals with ASD and 28 TD participants and their parents completed questionnaires assessing emotion experience, regulation, and maladaptive behavior. Compared to TD participants, individuals with ASD used cognitive reappraisal less frequently, which was associated with increased negative emotion experience, which in turn was related to greater levels of maladaptive behavior. By decreasing negative emotions, treatments targeting adaptive emotion regulation may therefore reduce maladaptive behaviors in individuals with ASD.

Keywords ASD · Emotion regulation · Maladaptive behavior · Emotion experience · Mediation

Introduction

Maladaptive behavior such as temper tantrums, aggression, sleeping problems, and disobedience are common in individuals with Autism Spectrum Disorder (ASD, Konst et al. 2013). Tantrum behaviors and general irritability are key motivating factors for seeking treatment (Robb 2010). Therefore, a better understanding of the mechanisms that increase maladaptive behavior in ASD is required to improve interventions and associated outcomes. As the questions of *whether* and *how* different emotional components are related to maladaptive behavior in this disorder remain largely unanswered, the goal of the present study is to examine whether components of emotions, such as emotion experience and emotion dysregulation, might serve as explanatory constructs for maladaptive behaviors in ASD.

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Emotion Experience and Emotion Regulation

Recent advances in affective science have suggested a framework for conceptualizing and examining emotional reactivity and emotion regulation. Emotional reactivity can be seen as loosely coupled experiential, behavioral, and physiological responses (Gross and Thompson 2007). Emotions vary in their quality, duration, and intensity. One way to categorize emotions is to distinguish between positive emotional experiences on the one hand, and negative emotional experiences on the other (Watson et al. 1988). Studying individual profiles in negative and positive emotions is informative, especially in relation to psychopathology.

Emotion regulation takes place when one activates a goal to influence the emotion-generative process (Gross et al. 2011). Depending on the context, the individual, and the emotion, a specific emotion regulation strategy can be considered as adaptive or maladaptive (Aldao and Nolen-Hoeksema 2012). While there are many forms of emotion regulation (Gross 2014), two prototypical examples of such

adaptive and maladaptive strategies are widely studied in the literature. Cognitive reappraisal, on the one hand, is a strategy involving cognitive change and is generally seen as adaptive. In the other hand, expressive suppression involves modulating the outward expression of the emotional response, and can be considered as a maladaptive strategy if used on a typical basis.

Emotion Experience and Emotion Regulation in Autism Spectrum Disorder

Traditionally, emotional problems have not been seen as a defining feature of ASD. However, there is mounting evidence that emotional components are affected in this disorder. Indeed, ASD is increasingly viewed as a disorder that involves problematic emotion frequency and intensity. For example, compared to TD individuals, those with ASD infrequently display positive empathic responses (Maskey et al. 2013) and report lower levels of amusement in the context of social types of humor (Samson 2013), while anger and anxiety tend to be more frequent and more intense (Ho et al 2012; Quek et al. 2012; Samson et al. 2014c).

These problematic patterns of emotion intensity, duration, frequency, or type can result from difficulties regulating emotions (Konstantareas and Stewart 2006; Laurent and Rubin 2004; Mazefsky et al. 2013, 2014; Rieffe et al. 2011; Samson et al. 2012, 2014a, b). It seems that individuals with ASD suffer from emotion regulation failure (i.e., not engaging in regulation, Gross 2013), and if there is regulation, it is usually not as adaptive as in TD individuals, resulting in less effective emotion regulation patterns (Samson et al. 2014c). Several studies showed that adaptive strategies—such as cognitive reappraisal, acceptance, and problem solving—were used less frequently and less efficiently compared to TD controls (Samson et al. 2012, 2014b, c). In addition, studies have shown that individuals with ASD use maladaptive ER strategies – such as rumination or shutting down—more frequently (Kohr et al. 2014; Mazefsky et al. 2014; Samson et al. 2012, 2014b). However, the less frequent use of adaptive emotion regulation strategies and increased use of maladaptive strategies are not evident in every study. For example, one study showed similar levels of using adaptive strategies (Mazefsky et al. 2014), and expressive suppression—as one example of a generally maladaptive strategy—was more frequently used in ASD compared to TD participants in some studies (Samson et al. 2012, 2014b), but not others (Samson et al. 2014c).

Besides simply documenting differences in emotion regulation profiles in ASD compared to TD participants, some studies have examined how emotion dysregulation may affect individuals with ASD. For example, it was shown that emotion dysregulation in ASD was correlated with internalizing and externalizing behavior (Mazefsky et al. 2014; Rieffe et al. 2011), and, in a longitudinal study, with prosocial peer-engagement in the school context (Jahromi et al. 2012).

The Present Study

The goal of this study is to better understand the mechanisms that lead to maladaptive behavior in individuals with ASD. We examined the sequential effects of emotion experience and regulation to determine whether emotional experiences (i.e., high levels of negative emotion and low levels of positive emotion), use of emotion regulation strategies (more maladaptive than adaptive), or both emotional experiences and strategy use lead to maladaptive behavior. Since these emotional components (i.e., emotion experience and regulation) are intertwined and influence each other, they should be differentiated as well as examined in tandem to better understand how they give rise to maladaptive behaviors. Gaining insight into such processes will help to improve treatment for individuals with ASD. To measure maladaptive behaviors, we used the maladaptive behavior index of the Vineland Adaptive Behavior Scales (2nd Edition, VABS-2, Sparrow et al. 2005), which includes externalizing, internalizing and other behaviors that are known to interfere with adaptive behavior.

We hypothesized that individuals with ASD, compared to TD participants, would experience less positive and more negative emotions, and would use cognitive reappraisal less frequently (Samson et al. 2012, 2014b, c) based on parent and self-reports. Given the mixed findings on the use of expressive suppression, we did not formulate a hypothesis for suppression (Samson et al. 2012, 2014b, c). We expected that (parent-reported) decreased positive emotions, increased negative emotions, and less frequent cognitive reappraisal would be associated with increased maladaptive behaviors in individuals with ASD compared to TD participants. These associations were tested via 2-path mediation designs. Based on these 2-path model results, we then tested sequential effects of emotion experience and regulation on maladaptive behavior in 3-path mediation designs. Two plausible models here are that emotion experience affects emotion regulation and in turn is associated with maladaptive behavior, or that emotion regulation impacts emotion experience and in turn is associated with maladaptive behavior.

Table 1 Sample characteristics

	ASD M (SD), N or frequency, range	TD M (SD), N or frequency, range	Statistics
N	31	28	
Male/female	27/4	21/7	*ns*[a]
Age	13.26 (3.35, 8–20)	12.43 (2.77, 8–20)	$t(57) = 1.03$, *ns*
FSIQ	100.94 (17.49, 64–129)	112.14 (12.01, 92–133)	$t(57) = -2.84$, $p < .01$
SRS	97.20 (29.15, 40–149)	19.14 (14.48, 0–59)	$F(3,51) = 51.12$, $p < .001$
RBS-R	24.26 (21.63, 0–80)	2.15 (5.65, 0–28)	$F(3,52) = 11.24$, $p < .001$
Internalizing behavior (CBCL)	65.13 (8.56, 48–77)	45.46 (10.56, 33–68)	$F(3,57) = 20.04$, $p < .001$
Externalizing behavior (CBCL)	57.00 (11.32, 34–74)	44.14 (9.30, 33–65)	$F(3,57) = 8.31$, $p < .001$

ANCOVAS with FSIQ and age as covariates were used for group comparisons of SRS, RBS-R and CBCL

ASD Autism Spectrum Disorder, *TD* typically developing, *FSIQ* Full Scale IQ, *RBS-R* Repetitive Behavior Scale-Revised (total score), *SRS* Social Responsiveness Scale (total score), *CBCL* Child Behavior Checklist

[a] On the basis of a Fisher's exact test, two-tailed

Methods

Participants

Thirty-one individuals with ASD (four female) and 28 TD individuals (seven female) between the ages of 8 and 20 years participated in the study (see Table 1). The sample consisted of 62.7 % Caucasians, 20.3 % Asians, 5.1 % Hispanics, 1.7 % African-Americans, and 10.2 % other ethnicities. Participants with ASD were recruited from a clinic specializing in ASD and developmental disabilities as well as from a research registry. TD participants were recruited in areas that were comparable to the socioeconomic status of the participants with ASD. Participants were enrolled as part of a larger project.

Clinical Assessment

For participants with ASD, diagnosis was established through expert clinical evaluation based on the DSM-IV-TR (APA 2000) or, since May 2013, DSM-5 (APA 2013a, b) and confirmed with the Autism Diagnostic Interview-Revised (ADI-R) and Autism Diagnostic Observation Schedule (ADOS; Lord et al. 1994, 2000). Three individuals with ASD did meet inclusion criteria on the ADI-R, but missed inclusion criteria on the ADOS by one point. Since excluding these borderline cases did not affect any of the group differences and indirect effects results reported in the current paper, we decided to include all of the participants for the analysis of the current study. Individuals with secondary autism related to a specific etiology (e.g., tuberous sclerosis, Fragile X) and individuals with evidence of genetic, metabolic, or infectious disorders were excluded.

TD participants were screened using face-to-face evaluations (Kiddie-Schedule for Affective Disorders and Schizophrenia for School-Aged Children, Kaufman et al. 1997), telephone interviews, and observation during psychometric tests. Exclusion of TD participants was also performed based on medical and psychiatric history.

Cognitive functioning (FSIQ) was assessed using the Stanford Binet (5th Edition, SB5, Roid 2003). The ASD core features were assessed with the Social Responsiveness Scale (SRS, Constantino and Gruber 2005; Constantino et al. 2000) and the Repetitive Behavior Scale-Revised (RBS-R, Lam and Aman 2007). Externalizing and internalizing behavior was assessed with the Child Behavior Checklist (Achenbach 1991).

This study was approved by the University's Institutional Review Board. Written informed consent was obtained from parents and assent from all participants.

Self- and Parent-Report Questionnaires Assessing Emotion Experience, Emotion Regulation, and Maladaptive Behavior

As part of a larger study on emotional reactivity and regulation, individuals with ASD and TD controls as well as their parents were asked to fill out questionnaires online. Each participant and his or her parents received links to online surveys consisting of several questionnaires. While participants were asked to report about their own emotion experience and regulation, parents were asked to report about their children's emotion experience and regulation.

Emotion Experience

The Positive and Negative Affect Schedule (PANAS) is a 20-item self-report measure of positive and negative

emotion experience developed by Watson et al. (1988). Positive emotion experience reflects the extent to which a person feels enthusiastic, active, and alert. Negative emotion experience reflects the extent to which a person feels negative emotional states such as nervous and upset. The scale points are: 1 = "very slightly or not at all" to 5 = "very much". A number of different time frames have been used with the PANAS; in the current study the time frame adopted was 'during the past few weeks'. For the parent reports, we asked the parents to report about their child's emotion experiences.

Emotion Regulation

The *Emotion Regulation Questionnaire* (ERQ, Gross and John 2003) is a 10-item measure of two types of emotion regulation in which six items assess frequency of reappraisal usage, i.e., the ability to modify or change emotions and experiences ("I control my emotions by changing the way I think about the situation I'm in") and four items assess the use of expressive suppression, i.e., the ability to avoid or prevent the expression of emotions ("I control my emotions by not expressing them"). Responses are scored on a seven-point scale from 1 = "totally disagree" to 7 = "totally agree". For the parent reports, we have reformulated the items, e.g., "My child controls his or her emotions by changing the way he or she thinks about the situation he or she is in".

Maladaptive Behavior

Maladaptive behavior was assessed with the Parent/Caregiver Rating Form of the Vineland Adaptive Behavior Scales, 2nd Edition (VABS-2, Sparrow et al. 2005). The scale measures adaptive behavioral functioning in several domains (socialization, communication, daily living skills, motor skills) and provides an overall adaptive behavior composite score. For the purpose of the present study, we focused on the maladaptive behavior index of the VABS-2 which includes a composite of externalizing (e.g., "Has temper tantrums," "Is impulsive (acts without thinking),"), internalizing (e.g., "Is overly anxious or nervous," "Is sad for no clear reason"), and other undesirable behavior (e.g., "Swears," "Is truant from school or work") potentially interfering with one's adaptive behavior. Responses are scored on a three-point scale from 0 = "never", 1 = "sometimes", to 2 = "often", with scale scores indicating average (<18), elevated (18–20), or clinically significant (21–24) levels of maladaptive behavior.

Statistical Analyses

Group differences in emotion, emotion regulation, and maladaptive behavior between ASD and TD were examined using ANCOVAs, in which FSIQ and age were included as covariates.

The relationships among group, emotion experience, emotion regulation, and maladaptive behavior were examined via path analyses of 2- and 3-path mediation designs. Four 2-path models were tested to examine whether group membership was linked to maladaptive behaviors via positive emotion, negative emotion, cognitive reappraisal, and expressive suppression. In addition, two 3-path models were tested to examine the sequence of effects as indicated from the 2-path model results: (1) Group membership as influencing cognitive reappraisal, which then influences negative emotions, and in turn, maladaptive behavior. (2) Group membership as influencing negative emotions, which then influences cognitive reappraisal, and in turn, maladaptive behavior. FSIQ and age were included as covariates in all analyses. For consistency, we used parent reports of emotion and emotion regulation.

All indirect effects of group membership on maladaptive behavior via emotion/emotion regulation were tested for significance using bootstrapping methods. Bias-corrected confidence intervals were generated from 10,000 resamples using the SPSS PROCESS macro (Hayes 2013). If the resulting 95 % confidence interval did not include zero, the indirect effect was declared statistically significant at $p < .05$.

Results

Preliminary Analyses

The two groups did not differ in age or gender. Individuals with ASD scored significantly lower on Full Scale IQ (FSIQ), showed significantly more restricted and repetitive behaviors (via RBS-R; Lam and Aman 2007), social and communication deficits (via SRS, Constantino and Gruber 2005; Constantino et al. 2000), and externalizing and internalizing behavior (via CBCL; Achenbach 1991) compared to TD participants (see Table 1).

Group Differences in Emotion Experience

Parent Reports

ANCOVA (with FSIQ and age as covariates) results indicated that individuals with ASD experience less positive emotion [$F(3,56) = 5.78$, $p < .01$], and more negative emotion [$F(3,56) = 7.31$, $p < .001$] compared to TD

Table 2 Means and standard deviations of emotion experience and emotion regulation for individuals with autism spectrum disorder (ASD) and typically developing (TD) participants in parent-reported and self-reported questionnaires

Observer	Subscale	ASD		TD		*p*
		N	*M (SD)*	*N*	*M (SD)*	
Emotion experience (PANAS)						
Parent-report	Positive	30	3.18 (0.77)	27	3.69 (0.48)	$p < .01$
	Negative	30	2.25 (0.76)	27	1.59 (0.48)	$p < .001$
Self-report	Positive	30	3.03 (0.80)	26	3.41 (0.72)	*ns*
	Negative	30	2.01 (0.76)	26	1.81 (0.52)	*ns*
Emotion regulation (ERQ)						
Parent-report	Reappraisal	27	3.10 (1.27)	26	4.98 (0.96)	$p < .001$
	Suppression	27	2.99 (1.23)	26	2.46 (0.95)	*ns*
Self-report	Reappraisal	26	4.04 (1.07)	25	4.67 (1.05)	$p < .05$
	Suppression	26	3.25 (1.44)	25	3.43 (1.35)	$p < .05$

PANAS positive and negative affect schedule, *ERQ* emotion regulation questionnaire

individuals (see Table 2). The covariate FSIQ was not associated with positive emotion experience [$F(1,56) = 2.46$, *ns*] or negative emotion experience in ASD [$F(1,56) = 2.45$, *ns*). Age had a significant effect on experiencing positive emotions [$F(1,56) = 5.65$, $p < .05$] and on negative emotions [$F(1,56) = 3.73$, $p = .06$, trending effect].[1]

Child Reports

ANCOVA results indicated that children and adolescents with ASD did not differ in positive [$F(3,55) = 1.69$, *ns*] or negative emotion experience [$F(3,55) = .99$, *ns*] compared to TD individuals.[2]

Group Differences in Emotion Regulation

Parent Reports

ANCOVA results showed that individuals with ASD used cognitive reappraisal less frequently [$F(3,52) = 12.78$, $p < .001$] but did not differ in their use of expressive suppression [$F(3,52) = 1.50$, *ns*, see Table 2]. Age [$F(1,52) = 2.48$, *ns*] and FSIQ [$F(1,52) = .01$, *ns*] had no significant effect on cognitive reappraisal.

Child Reports

ANCOVA results indicated that individuals with ASD used cognitive reappraisal [$F(3,50) = 3.97$, $p < .05$] and expressive suppression [$F(3,50) = 2.81$, $p < .05$] less frequently. While the covariate FSIQ had no effect on cognitive reappraisal [$F(1,50) = .25$, *ns*] or expressive suppression [$F(1,50) = .80$, *ns*], age significantly affected the use of cognitive reappraisal [$F(1,50) = 6.81$, $p < .05$] and suppression [$F(1,50) = 6.89$, $p < .05$].[3,4]

Group Differences in Maladaptive Behavior

ANCOVA results showed that individuals with ASD ($M = 20.04$, $SD = 2.14$, range 17–23) had significantly more maladaptive behavior (bordering on "clinically significant") compared to TD participants with "average" levels of maladaptive behavior [$M = 14.74$, $SD = 2.16$, range 12–18, $F(3,45) = 22.90$, $p < .001$]. The covariates age [$F(1,45) = .03$, *ns*] and FSIQ [$F(1,45) = .71$, *ns*] were not associated with maladaptive behavior.

Sequential Effects of Emotion Experience and Regulation on Maladaptive Behavior

The 2-path indirect effects of group membership on maladaptive behavior via negative emotions and cognitive reappraisal were significant (*p*s < .05; see Fig. 1). Compared to TD participants, ASD reported higher levels of negative emotion, which in turn resulted in increased maladaptive behavior (**ab** = .97, 95 % CI [.30; 1.94]). Similarly, ASD participants reported less use of cognitive

[1] Partial correlations controlling for group revealed less positive emotion with increasing age [$r(56) = -.31$, $p < .05$], but no significant association between age and negative emotions [$r(56) = -.22$, *ns*].

[2] Even after excluding the two participants that had lower FSIQ than 70, these findings remained consistent for positive emotions [$F(3,53) = 2.16$, *ns*] and for negative emotions [$F(3,53) = .97$, *ns*].

[3] Partial correlations controlling for group revealed increased use of cognitive reappraisal [$r(48) = .35$, $p < .05$] and suppression [$r(48) = .37$, $p < .01$], with increasing age.

[4] Even after excluding participants with FSIQ scores below 70, these findings remained consistent. ANCOVA results indicated that individuals with ASD used cognitive reappraisal [$F(3,48) = 4.45$, $p < .01$] and expressive suppression [$F(3,48) = 2.73$, $p = .06$, trending effect] less frequently. While the covariate FSIQ had no effect on cognitive reappraisal [$F(1,48) = 1.05$, *ns*] or expressive suppression ($F(1,48) = .02$, *ns*), age significantly affected the use of cognitive reappraisal [$F(1,48) = 7.41$, $p < .01$] and suppression [$F(1,48) = 7.35$, $p < .01$].

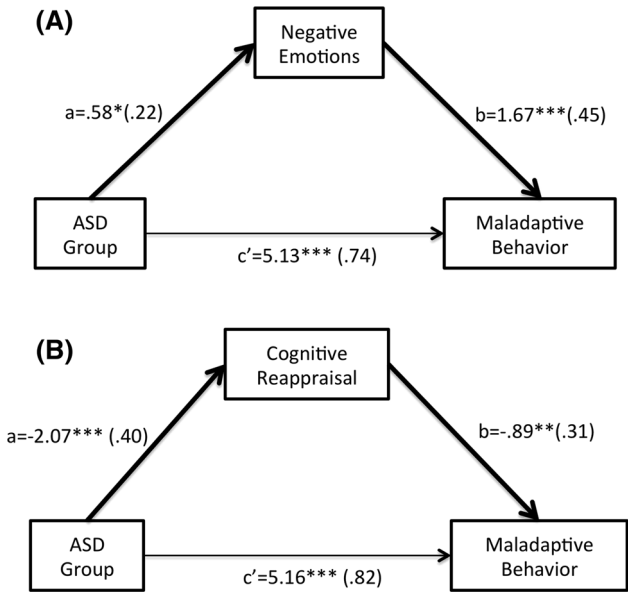

Fig. 1 Regression coefficients (βs) from 2-path models depicting **a** an indirect effect of group on maladaptive behavior via negative emotional experiences and **b** an indirect effect of group on maladaptive behavior via cognitive reappraisal. Group is coded as 1 = ASD, 0 = TD. Covariate effects of FSIQ (βs from −.02 to 0) and age (βs from −.10 to .04) were non-significant. Bold lines indicate significant indirect effects. Unstandardized estimates are displayed. $*p < .05$, $**p < .01$, $***p < .001$

reappraisal, which resulted in increased maladaptive behavior (**ab** = 1.84, 95 % CI [.70; 3.18]). Group membership did not indirectly affect maladaptive behavior via positive emotions (**ab** = .23, 95 % CI [−.41; 1.04]) and expressive suppression (**ab** = −.05, 95 % CI [−.89; .32]).

Given the 2-path model results, we examined the sequence of effects involving group, negative emotion, cognitive reappraisal, and maladaptive behavior. A significant 3-path indirect effect of group on maladaptive behavior via cognitive reappraisal and negative emotions in sequence was observed (see Fig. 2); ASD participants used less reappraisal (than TD), which resulted in greater negative emotions experienced, and in turn, increased maladaptive behavior ($a_1d_{21}b_2$ = .92, 95 % CI [.36; 2.06]). However, when reversing the order of reappraisal and negative emotion variables, no 3-path indirect effect of group on maladaptive behavior was observed ($a_1d_{21}b_2$ = .23, 95 % CI [−.02; 1.04]). No significant covariate effects of FSIQ and age were observed on emotion, emotion regulation, and maladaptive behavior in any of the 2- and 3-path models.

Discussion

The present study aimed to better understand group differences in emotion experience and regulation, as well as

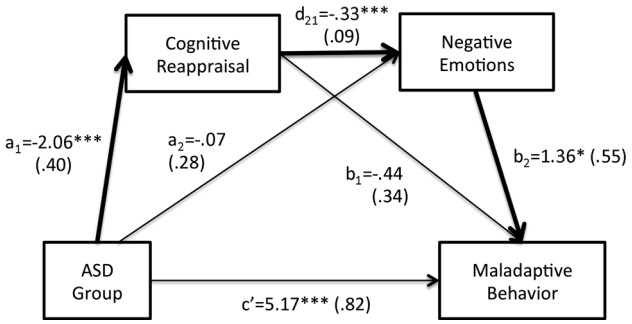

Fig. 2 Regression coefficients (βs) from one 3-path model depicting an indirect effect of group on maladaptive behavior via cognitive reappraisal and negative emotional experiences. Group is coded as 1 = ASD, 0 = TD. Covariate effects of FSIQ (βs from −.01 to 0) and age (βs from −.11 to .03) were non-significant. Bold lines indicate significant indirect effects. Unstandardized estimates are displayed. $*p < .05$, $**p < .01$, $***p < .001$

the underlying mechanisms that lead to increased maladaptive behaviors in individuals with ASD. This is the first study to examine the sequential effects of emotion experience and regulation on maladaptive behavior in children and adolescents with ASD. More specifically, we wanted to better understand whether patterns in positive and negative emotion experience as well as adaptive and maladaptive emotion regulation function as a link between group (ASD vs. TD) and maladaptive behavior. The findings suggest that individuals with ASD use cognitive reappraisal less frequently, which is an adaptive emotion regulation strategy, resulting in increased negative emotions, and in turn leading to elevated levels of maladaptive behavior. As our data are cross-sectional, we are not inferring causality but exploring the potential directionality of effects.

The Role of Emotion Regulation in Maladaptive Behavior in ASD

Psychopathology, and in a narrower sense maladaptive behavior, is often conceptualized as resulting from, or maintained by deficits in the ability to regulate one's own emotions appropriately and effectively (Gross and Jazaieri 2014). Emotion dysregulation in ASD, and especially the lack of successful implementation of cognitive reappraisal seems to increase negative emotional experiences, which were associated with maladaptive behavior. While a previous study showed that anxiety and depression were strongly correlated with aggression and tantrums in children with ASD (Quek et al. 2012), the present study suggests that less use of adaptive emotion regulation strategies is crucial for increased negative emotions, and in turn, is associated with increased maladaptive behavior in ASD. Interestingly, two previous studies reported that the use of

maladaptive emotion regulation strategies only were associated with internalizing behaviors (Rieffe et al. 2011) and with emotional and behavioral problems (Kohr et al. 2014), but not the use of adaptive strategies. However, another study found that both adaptive and maladaptive emotion regulation strategies were associated with internalizing and externalizing behavior (Mazefsky et al. 2014). These mixed findings may be related to various factors such as using different emotion regulation measures or focusing on different outcome measures. The advantage of the present study is to examine sequential, combined effects of emotion experience and regulation to better understand underlying mechanisms that are associated with maladaptive behaviors in ASD.

While the present study provides further evidence of decreased use of adaptive emotion regulation strategies in individuals with ASD compared to TD individuals, also in line with previous studies (Mazefsky et al. 2014; Samson et al. 2012, 2014b, c), we did not find conclusive evidence that individuals with ASD use expressive suppression more frequently as previously documented in adult, child, and adolescent samples (Samson et al. 2012, 2014b). Interestingly, we did not observe group differences in parent-reported use of expressive suppression, and moreover, ASD participants reported even less use of expressive suppression. In one prior study that used parent interviews and child daily diaries, group differences in using expressive suppression were not evident either (Samson et al. 2014c). At this point, the role of expressive suppression in individuals with ASD (vs. TD) participants still appears to be inconclusive. Differences between studies may be due to the difficulty to report about other people's use of suppression (and distinguishing it from not *experiencing* emotions or blunted affect, see also Samson et al. 2014c) when considering parent reports. Another possibility is that controlling emotion expressions is generally more difficult for children and adolescents compared to adults which may partly explain that we cannot replicate the findings of Samson et al. (2012). In general, differences between studies may be related to the methods used to assess these strategies but it also shows that more research is needed to clarify the use of expressive suppression in ASD.

While there was correspondence between parent and child reports regarding the use of cognitive reappraisal in the present study, children and adolescents with ASD did not report decreased positive and increased negative emotions, as reported by the parents. Previous studies using both, parent and child reports, found good correspondence between parent and self-report (Kohr et al. 2014) and at times even more robust effects in the self-report data (Mazefsky et al. 2014). Rieffe et al. (2011) emphasized the importance of letting children report about their emotional experiences. We suggest that it is most informative to include both parent and child reports in order to get a better picture about several emotional components, since some components might be more easily reported by children (e.g., internalizing symptoms, see Achenbach et al. 1987), while other components might be more easily reported by their parents (e.g., maladaptive behavior).

Limitations and Future Directions

While this study provides insight into how different emotional components contribute to maladaptive behavior in ASD, there are a few limitations to be addressed.

First, the present study is cross-sectional; this design is useful for exploring potential directional relationships among emotion experience, regulation, and maladaptive behavior, but does not allow for drawing conclusions about causality. Longitudinal designs could provide stronger evidence of directional relationships (with the potential to infer causality) between emotional components and maladaptive behavior. In addition, the current study relied mainly on observational data. However, experimental in contrast to observational study designs would help to further examine the underlying mechanisms that lead to maladaptive behavior.

Second, our study used a relatively small sample of individuals with ASD. Although an advantage of the current study is that we included a few individuals with FSIQ < 70 resulting in a broader range of individuals with ASD, this was nonetheless a higher functioning sample on average. Future studies should include larger samples with a broader range of cognitive functioning. This would allow a deeper understanding of emotion experience and regulation in relation to maladaptive behavior in the ASD population. In addition, future research could look at how associations among emotion experience, regulation, and maladaptive behavior may be conditional on higher and lower functioning individuals using moderation analyses.

Third, while the present study examined individuals with ASD compared to age and gender group matched TD participants, we did not include a psychiatric control group. Future studies need to include psychiatric controls to get a better idea about the specificity of the effects for the ASD population and to learn more about possible effects of ASD core features on emotional problems and resulting maladaptive behavior.

Fourth, the present study focused on positive versus negative emotional experiences only and included a narrow range of emotion regulation strategies. Especially regarding negative emotions, it is possible that experiencing anger and experiencing sadness, for example, are differentially related to maladaptive behaviors. Moreover, expressive suppression is one form of generally maladaptive emotion regulation, but

other maladaptive emotion regulation strategies may be more strongly associated with maladaptive behavior. Future studies should examine more closely a variety of different types of emotions, as well as include a broader range of emotion regulation strategies to gain further insight into mechanisms that lead to maladaptive behavior in ASD. Finally, the present study used the maladaptive behavior index of the VABS-2 (Sparrow et al. 2005) to assess maladaptive behavior, which includes internalizing, externalizing, and other behavior. Future studies are warranted that distinguish between specific effects of emotion regulation and experience on internalizing and externalizing behavior separately in larger sample sizes.

The current study suggests that interventions targeting the ability to use cognitive reappraisal may improve emotion experience as well as decrease maladaptive behavior in individuals with ASD. These interventions may further elucidate the underlying mechanisms of successful treatments in ASD (e.g., cognitive behavioral therapy to ease anxiety; Sofronoff et al. 2005).

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Conflict of interest The work with human subjects complies with the guiding policies and principles for experimental procedures endorsed by the NIH.

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