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1 Abstract

2 **Objective:** Rejection sensitivity (RS) and justice sensitivity (JS) are personality traits that are
3 characterized by frequent perceptions and intense adverse responses to the negative social
4 cues. Whereas there is good evidence for an association between RS, JS, and emotional
5 problems, no longitudinal studies have investigated their association with eating disorder
6 psychopathology (EDP) so far. Thus, the aim of this study was to examine the longitudinal
7 relation between RS, JS and EDP and whether these relations were mediated by emotional
8 problems. **Method:** Participants ($N=769$) reported on their RS, JS, and EDP at age 9-19 (T1),
9 11-21 (T2), and 14-22 years (T3) and emotional problems at T1 and T2. **Results:** There were
10 longitudinal associations between EDP and particularly anxious RS, observer and victim JS
11 in latent cross-lagged models. T1 EDP predicted higher T2 anxious RS, which predicted
12 more T3 EDP. T1 observer JS predicted more T2 EDP, which in turn predicted higher T3
13 observer JS. Furthermore, T1 EDP predicted higher T2 victim JS. A latent mediation model
14 showed only a direct effect of T1 observer JS on T3 EDP and that the effects of T1 EDP on
15 T3 RS and victim JS were mediated by T2 emotional problems. **Discussion:** RS—
16 particularly anxious RS—and JS may be involved in the development and maintenance of
17 EDP and should be considered by future research and in prevention and treatment of EDP.
18 Also, mental health problems may increase JS and RS traits in the long term.

19 *Keywords:* rejection sensitivity, justice sensitivity, eating disorder psychopathology,
20 emotional problems, longitudinal

1 Justice Sensitivity and Rejection Sensitivity as Predictors and Outcomes of Eating

2 Disorder Psychopathology: A 5-Year Longitudinal Study

3 Eating disorders (e.g., anorexia nervosa, bulimia nervosa, binge eating disorder)

4 (APA, 2013) are defined as maladaptive attitudes and behavior with respect to eating, weight,
5 and body image. Eating disorders are rare, affecting less than 2% of the population (Hoek &
6 van Hoeken, 2003). However, symptoms of eating disorder psychopathology (EDP), such as
7 body shape, eating and weight concerns and restrained eating, are more prevalent,
8 particularly in adolescent girls and range from 28% to 57% (Aime, Craig, Pepler, Jiang, &
9 Connolly, 2008; Croll, Neumark-Sztainer, Story, & Ireland, 2002; Jacobi, Hayward, de
10 Zwaan, Kraemer, & Agras, 2004). They often precede EDs (Jacobi et al., 2004; Tanofsky-
11 Kraff et al., 2011) and are associated with increased psychosocial strain (Goldschmidt, Wall,
12 Loth, Bucchianeri, & Neumark-Sztainer, 2014; Sehm & Warschburger, 2018). EDs have
13 long-lasting adverse effects on physical and mental health and may even be life-threatening
14 (Berkman, Lohr, & Bulik, 2007; Swanson, Crow, Le Grange, Swendsen, & Merikangas,
15 2011). Hence, understanding risk factors for EDP is important and may aid prevention and
16 intervention efforts in EDs.

17 Several risk factors for EDP are well-established and similar to the clinical diagnosis
18 of EDs, including female gender, body mass index, sociocultural pressure to be thin, body
19 dissatisfaction, problems in interpersonal relationships, and internalizing problems that show
20 bi-directional relations with EDP (Culbert, Racine, & Klump, 2015; Jacobi et al., 2004; Krug
21 et al., 2013; Lavender, De Young, & Anderson, 2010; Marmorstein, von Ranson, Iacono, &
22 Malone, 2008; Smith et al., 2018; Stice, 2002). Personality traits—specifically neuroticism—
23 are also associated with EDP (Keel & Forney, 2013; Levallius, Clinton, Bäckström, &
24 Norring, 2015; Lilenfeld, Wonderlich, Riso, Crosby, & Mitchell, 2006), suggesting that other

1 personality traits that are related to neuroticism and internalizing problems, such as justice
2 and rejection sensitivity (Schmitt et al., 2005), may be associated with EDP as well.

3 **Rejection Sensitivity and Justice Sensitivity**

4 Rejection sensitivity (RS) is defined as the tendency to anxiously or angrily expect,
5 perceive, and react to (alleged) rejection (Downey & Feldman, 1996). Justice sensitivity (JS)
6 is defined as the disposition to frequently perceive and negatively react to injustice (Bondü &
7 Elsner, 2015; Schmitt, Gollwitzer, Maes, & Arbach, 2005). Individuals' affective responses
8 depend on the perspectives from which injustice is perceived: Victim JS, the tendency to feel
9 being unfairly treated, is primarily associated with anger; observer JS, the tendency to
10 perceiving others being unfairly treated, is primarily associated with indignation; perpetrator
11 JS, the tendency to fear unfairly treating others, is primarily associated with guilt (Schmitt et
12 al., 2005). RS and JS are narrow personality traits that are distinct from the Big Five (Schmitt
13 et al., 2010).

14 **Potential Links Between Rejection Sensitivity, Justice Sensitivity, and Eating Disorder** 15 **Psychopathology**

16 Rejection- and justice-sensitive individuals are hypervigilant to and tend to ruminate
17 about accordant cues (London, Downey, Bonica, & Paltin, 2007; Schmitt, Neumann, &
18 Montada, 1995). Negative interpretations of cues of rejection and injustice cause adverse
19 behavior that may promote impairments in social relationships (Ayduk et al., 2001; Bondü et
20 al., 2017). This, along with feelings of loneliness, hopelessness, helplessness, or guilt
21 (Bondü, Sahyazici-Knaak, & Esser, 2017; Schmitt et al., 2005), may predispose individuals
22 high in these traits to internalizing problems and EDP (Mischoulon et al., 2011).

23 Accordingly, particularly anxious RS was associated with social anxiety, withdrawal, and
24 depression (Bondü et al., 2017; London et al., 2007; McDonald, Bowker, Rubin, Laursen, &
25 Duchene, 2010; Zimmer-Gembeck, Nesdale, Webb, Khatibi, & Downey, 2016). Particularly

1 victim and observer JS were associated with emotional problems, depressive symptoms, low
2 self-esteem, and anxiety symptoms (Bondü & Elsner, 2015; Bondü & Esser, 2015; Bondü &
3 Inerle, in revision; Bondü et al., 2017).

4 Sensitivities to negative social cues may promote EDP also by causing stress and
5 negatively biased interpretations of the situation (Liu, Kraines, Massing-Schaffer, & Alloy,
6 2014; Normansell & Wisco, 2017). EDP may be an avoidant problem-solving strategy for
7 coping with perceptions of rejection and injustice, potentially associated negative social
8 interactions, and adverse emotions (Downey, Mougios, Ayduk, London, & Shoda, 2004;
9 Gao, Assink, Cipriani, & Lin, 2017). Finally, RS, JS, and EDP may share underlying causes,
10 such as low self-esteem, dysfunctional thoughts including striving for perfection, or
11 unfavourable attributional styles (Chango, McElhaney, Allen, Schad, & Marston, 2012).

12 Indeed, one cross-sectional study revealed an indirect link between RS and
13 dysregulated eating behavior via emotional dysregulation in a small sample of college
14 students with Borderline Personality Disorder (Selby, Ward, & Joiner Jr., 2010). The
15 association between weight-related RS and bulimic symptoms was mediated via psychosocial
16 distress (Brenchley & Quinn, 2016; no association with disordered eating). Appearance-
17 related RS predicted disordered eating behavior (Park, 2007) and was positively related to
18 friends' restrictive dieting (Webb & Zimmer-Gembeck, 2014).

19 Social-cognitive traits, such as RS and JS, reflect person-situation interactions
20 (Mischel & Shoda, 1995) and are, therefore, themselves shaped by social experiences.
21 Accordingly, depressive symptoms predicted higher subsequent anxious RS, angry RS, and
22 victim JS (Bondü et al., 2017; Marston, Hare, & Allen, 2010; McCarty, Vander Stoep, &
23 McCauley, 2007); bullying and victimization experiences predicted subsequent victim and
24 observer JS (Bondü, Rothmund & Gollwitzer, 2016). Hence, negative experiences may
25 increase expectations of similar events and increase hypervigilance to accordant cues, which

1 may in turn result in higher RS and JS (Bondü et al., 2017). Thus, associations between RS,
2 JS, and EDP may turn into a self-maintaining vicious circle.

3 **Emotional Problems as a Mediator**

4 This vicious circle may also be enhanced through emotional problems associated with
5 both RS and JS and EDP (Mitchell, Wolf, Reardon, & Miller, 2014). They may cause
6 additional strain, adverse emotional and cognitive states, as well as adverse negative social
7 perceptions, interpretations, expectations, and attributions. Accordingly, previous research
8 indicated that links between RS and EDP were explained by emotional problems (Brenchley
9 & Quinn, 2016; Selby et al., 2010). RS and JS, however, may promote emotional problems in
10 similar ways as EDP. In the present study, therefore, we examined potential bi-directional
11 mediation of the links between RS, JS, and EDP via emotional problems.

12 **The Present Study**

13 Preliminary cross-sectional evidence exists for associations between RS and EDP, but
14 several gaps in research require consideration: First, longitudinal designs in nonclinical
15 samples should examine prospective links between RS and EDP. Second, no study examined
16 the relation between JS and EDP so far. Third, the potential bi-directional mediating role of
17 emotional problems should be considered. Finally, the potential moderating role of gender
18 and age should be examined, because females are more likely to suffer from EDP than males
19 and because EDP become more prevalent during adolescence (Smink, van Hoeken, & Hoek,
20 2012). We, therefore, examined the bi-directional relations between RS, JS, and EDP in a
21 three-wave longitudinal study while considering the potential mediating role of emotional
22 problems and the potential moderating roles of gender and age. We expected:

23 1) Participants with EDP to report higher concurrent angry and anxious RS (1a, b) as well
24 as victim and observer JS than participants without EDP (1c, d);

- 1 2) T1 and T2 RS and JS to predict subsequent T2 and T3 EDP, respectively (2a), and T1
- 2 and T2 EDP to predict subsequent T2 and T3 RS and JS, respectively (2b);
- 3 3) T2 Emotional problems to mediate the association between T1 and T3 RS, JS, and EDP.
- 4 Finally, we explored gender and age differences in the links between RS, JS, and EDP.

5 Method

6 Participants

7 Participants were recruited from a previous study on developmental disorders in pre-school
8 and primary-school age. This study included a representative sample of 2,500 children from
9 the federal state of Brandenburg, Germany. We used the contact details of participating
10 families in order to recruit participants for the present study after further funding was
11 obtained. For the present study, participants were assessed between September 2011 and
12 October 2012 at ages 9-19 (T1), approximately 1.5 years later at ages 11-21 (T2), and
13 between 2015 and 2016 at ages 14-22 years (T3). Of the initial sample, 1665 children
14 participated in T1 and/or T2. In the present study, we included all 769 adolescents who
15 participated until T3 (46.2% retention rate). The mean age of these participants was 16.77
16 years ($SD=2.01$) at T3; 55.7% were females, 45.9% had parents with a university entrance
17 qualification. More males ($N=498$) than females ($N=398$) dropped out of the study ($\chi^2=20.9$,
18 $p<.001$). Two MANCOVAs including RS, JS, EDP, and T1 age (T1: $F(7, 1459)=15.263$,
19 $p<.001$, $\eta_p^2=.068$; T2: $F(6, 1276)=7.835$, $p<.001$, $\eta_p^2=.036$) showed that participants who
20 remained in the study at T2 and T3, respectively, reported significantly higher observer
21 ($p<.001$, respectively) and perpetrator ($p<.001$, respectively) JS, less angry RS ($p=.012$ and
22 $p<.001$) and EDP ($p=.001$ and $p=.019$), as well as higher T1 age ($p<.001$) than participants
23 who dropped out.

24 Measures

1 **Eating Disorder Psychopathology.** We measured EDP with the German version of
2 the Eating Disorder Examination adapted for children (ChEDE) (Bryant-Waugh, Cooper,
3 Taylor, & Lask, 1996; Hilbert et al., 2013) in all participants at T1 and T2 and in participants
4 below 17 years of age at T3. Participants 17 years and older at T3 completed the adult Eating
5 Disorder Examination (EDE) (Fairburn & Beglin, 2008; Hilbert, de Zwaan, & Braehler,
6 2012). Both versions have good internal consistencies, high inter-rater reliability, and/or good
7 validity in detecting early-onset eating disorders (Frampton, Wisting, Overas, Midsund, &
8 Lask, 2011; Hilbert et al., 2013). Both include 28 items on 4 subscales measuring eating
9 behavior problems (“Have you tried not to eat any foods that you like in order to change your
10 weight?”) and negative body image (“You were dissatisfied with your weight?”) in the last
11 28 days using different response options. We computed mean scores for all subscales and a
12 total score. Correlation patterns for participants who completed the same measure at all time
13 points and the ones who used a different measure at T3 were almost identical, suggesting that
14 the change in instrument did not influence ratings (Table 1). For cross sectional group-
15 comparisons, we used a cut-off score of +1.5 *SD* of the total score separately for each point of
16 measurement as an indicator of EDP. We chose this cut-off rather than the suggested mean
17 value of 22 that comes closer to a clinical definition of ED instead of reflecting sub-clinical
18 EDP. For all other analyses, we used continuous scores.

19 **Rejection Sensitivity (RS).** We measured RS using a short version of the Child
20 Rejection Sensitivity Questionnaire (Downey, Lebolt, Rincon, & Freitas, 1998) in all
21 participants at T1 and T2 and in participants below 17 years of age at T3. The scale captured
22 anxious and angry RS with five situations including a possibility of rejection. Participants
23 indicated how anxious and angry they would feel (1=*not anxious/angry*, 6=*very*
24 *anxious/angry*) and how likely they think rejection would be (1=*very unlikely*, 6=*very likely*).
25 Anxious and angry RS scores were computed by adding the multiplied degree of

1 anxiety/anger and the likelihood of rejection per situation, divided by five (range: 0-30). The
2 questionnaire has good reliability and validity (Bondü et al., 2017; Downey & Feldman,
3 1996). Participants 17 years and older at T3 completed the adult version of the questionnaire
4 (Berenson et al., 2009) with nine situations including a possibility of rejection. Participants
5 indicated how anxious and angry they would feel (1=*not anxious/angry*, 6=*very*
6 *anxious/angry*) and how likely they think a positive interaction would be (1=*very unlikely*,
7 6=*very likely*). RS scores were computed by adding the multiplied degree of anxiety/anger
8 and the reversed score for the likelihood of positive interactions per situation, divided by
9 nine. The questionnaire has good validity and reliability (Berenson et al., 2009; Bondü &
10 Richter, 2016). Correlation patterns for participants who completed the same measure at all
11 time points and the ones who used a different measure at T3 were almost identical,
12 suggesting a comparability of ratings and an adequate reflection of the underlying trait (Table
13 1).

14 **Justice Sensitivity (JS).** We measured JS with the 5-item short version of the Justice
15 Sensitivity Inventory for Children and Adolescents (Bondü & Elsner, 2015; Schmitt et al.,
16 2010) at all measurement points. The scale captures emotional and cognitive reactions to the
17 perception of injustice from the victim (“It makes me angry when I am treated worse than
18 others”), observer (“I am upset when someone is...”), and perpetrator (“I feel guilty when I
19 treat someone...”) perspective with five items each. Response options ranged from 0=*totally*
20 *disagree* to 5=*totally agree*. The scale has good validity and reliability (Bondü & Elsner,
21 2015; Schmitt, Baumert, Gollwitzer, & Maes, 2010). We computed three separate mean
22 scores.

23 **Emotional Problems.** We measured emotional problems at T1 and T2 by the 5-item
24 subscale (e.g., “I am often unhappy, depressed or tearful”) of the Strengths and Difficulties
25 Questionnaire (Goodman, 1997, 2001). Response options ranged from 0 *not true* to 2

1 *certainly true*. At T1, only participants from 11 years onwards ($N=569$) rated their emotional
2 problems. The measure has well-established reliability and validity (Goodman & Scott, 1999;
3 Klasen, Woerner, Rothenberger, & Goodman, 2003; Klasen et al., 2000).

4 **Covariates.** We included parents' highest educational achievement as an indicator of
5 socio-economic status and BMI standard deviation scores (BMI-SDS), computed as weight in
6 kilograms divided by the height in meters squared adjusted to percentiles of general weight
7 for each sex based on a German reference sample (Kromeyer-Hauschild et al., 2001).

8 **Procedure**

9 All participants attended voluntarily and with informed written consent. The
10 procedure was approved by the university ethics committee and the school ministry. Data can
11 be made available upon request.

12 **Analysis**

13 We first examined differences in our measures between participants with and without
14 EDP ($+1.5 SD$) controlling for gender and age, as well as gender differences controlling for
15 age at each time point via separate MANCOVAs.

16 We then conducted latent longitudinal analyses using *Mplus 8* (Muthén & Muthén,
17 1998-2015). RS subscales, JS subscales, and emotional problems were indicated by test-
18 halves, EDP was indicated by the four measure subscales. Standardized scores accounted for
19 differences in T3 measurements. Correlations between corresponding T1, T2, and T3
20 indicators, corresponding indicators of RS and JS subscales within one point of measurement,
21 T1 and T2 predictors, and T3 RS and JS subscales were allowed and estimated. We used a
22 maximum likelihood estimator. Missing data was replaced using the Full Information
23 Maximum Likelihood procedure.

24 Control variables were correlated, all other variables were regressed on the control
25 variables. $P < .05$ was considered significant for path coefficients (2-sided). To evaluate the

1 goodness of fit, we considered χ^2 tests and absolute fit indices (CFI, TLI, RMSEA, and
2 SRMR). We tested the significance of indirect pathways using the MODEL INDIRECT
3 command. We ran the models for the total group and then examined the moderating role of
4 sex and age (children: 9-12 years, adolescents: ≥ 13 years) in multi-group models with path
5 coefficients constrained to be equal and allowed to vary between groups. Furthermore, we
6 computed multi-group models for the two groups who used the same measures over time and
7 who used the adult versions at T3 to check whether results remained the same. Since results
8 hardly differed from results for age, we only report these findings.

9 In order to ensure that our measures had the same meaning across points of
10 measurement, we tested configural (parameters freely estimated), weak (factor loadings
11 constrained equal), strong (factor loadings and intercepts constrained equal), and strict (factor
12 loading, intercepts, and residual variances constrained equal) measurement invariance (MI)
13 separately for RS, JS, and EDP across the three time points and emotional problems across
14 two time points (T1 and T2). Given strong differences in the RS measures between T1/T2
15 and T3, we repeated the analyses only considering T1 and T2. To assess the model fit, we
16 inspected χ^2 , χ^2 -difference test and values of and changes in absolute fit indices. Non-
17 significant chi square values, CFI/TLI>0.95, RMSEA<0.05, SRMR<0.06, lower AIC/BIC,
18 and CFI decreases <.01 indicated good or negligible decreases in model fit (Cheung &
19 Rensvold, 2002).

20 We then analysed longitudinal associations between RS, JS, and EDP using cross-
21 lagged panel models including covariance terms, stability paths, and cross-lagged paths.
22 Thus, the model examined bi-directional associations between study variables while
23 controlling for their effects at earlier points in time. Finally, we used latent mediation models
24 including covariances, stability paths, and cross-lagged paths to examine whether T2

1 emotional problems mediated the longitudinal associations between T1 and T3 RS, JS, and
2 EDP. We adjusted all models for BMI-SDS and parental education.

3 **Results**

4 **Descriptive Data**

5 At T1, participants with EDP (6.9%) reported significantly higher anxious RS, angry
6 RS, victim JS, and emotional problems than the control group. At T2, individuals with EDP
7 (7.1%) reported higher anxious RS, angry RS, victim JS, observer JS, and emotional
8 problems. At T3, participants with EDP (9.9%) reported higher anxious and angry RS (Table
9 2). Girls reported higher observer JS, perpetrator JS, and EDP than boys at all measurements,
10 higher anxious RS at T2 and T3, and more emotional problems at T1 and T2. Anxious RS,
11 angry RS, victim JS, observer JS, and EDP as well as emotional problems were positively
12 correlated at all assessment points. RS and JS subscales were positively correlated (Table 3).

13 **Measurement Invariance**

14 Inspections of absolute fit indices and changes in indices suggested strong MI for
15 T1/T2/T3 JS and EDP and T1/T2 RS using z -standardized scores (Table 4). Hence, we
16 assumed strong MI for all three variables in structural-equation models. When assuming
17 strong MI also for T3 RS, results regarding MI and of subsequent models were almost
18 identical. Due to the strong changes in measurement at T3 for parts of the sample, however,
19 we continue with presenting findings for strong MI in RS only between T1 and T2. Although
20 our analyses indicated strict MI for emotional problems, we only assumed weak MI in the
21 mediation model, because the model assuming strong MI did not converge.

22 **Cross-Lagged Analysis**

23 Table 5 shows the fit indices for models in the total sample and for multi-group
24 analyses. All models fit the data well. RS, JS, and EDP had moderate to high stabilities over
25 time. Concerning the prediction of EDP from the sensitivity measures, T1 observer JS

1 predicted T2 EDP ($\beta=.104^*$) and T2 anxious RS predicted T3 EDP ($\beta=.139^*$). Concerning
2 the prediction of sensitivity measures from EDP, T1 EDP predicted T2 anxious RS ($\beta=.103^*$)
3 and victim JS ($\beta=.122^{**}$) and T2 EDP predicted T3 anxious RS ($\beta=.105^*$) and observer JS
4 ($\beta=.089^*$). Figure 1 reports all statistically significant paths for the total sample. For ease of
5 interpretation, non-significant parameters and links between RS and JS subscales were
6 omitted from the figure but retained in the model (all estimates reported in Table S1).

7 **Mediation Model including Emotional Problems**

8 Figure 2 shows the significant coefficients in the mediation model including T1 and
9 T2 emotional problems for the total sample (Table S2 for all estimates). Higher T1 observer
10 JS predicted more T3 EDP ($\beta=.17^{**}$). More T1 EDP ($\beta=.17^{**}$) predicted stronger T2
11 emotional problems. Stronger T2 emotional problems predicted higher T3 angry RS
12 ($\beta=.24^{***}$), anxious RS ($\beta=.43^{***}$), victim JS ($\beta=.22^{***}$), and EDP ($\beta=.34^{***}$). There were
13 significant indirect effects from T1 EDP on T3 anxious RS ($\beta=.07^*$), angry RS ($\beta=.04^*$), and
14 victim JS ($\beta=.04^*$) via T2 emotional problems.

15 **Differences by Gender and Age**

16 Regarding the multi-group models examining the potential moderating role of gender
17 and age, models with paths allowed to vary between groups showed better fits than models
18 with paths constrained to be equal (Table 5). Regarding gender differences, in males, higher
19 EDP predicted lower RS, but higher emotional problems predicted higher RS and lower
20 observer JS. In females, JS also predicted subsequent EDP. Regarding age differences, there
21 was a direct association between T1 observer JS and T3 EDP ($\beta=.23^{**}$) and an indirect link
22 between T1 EDP and T3 anxious RS in children, whereas there were no associations between
23 JS, RS and EDP in adolescents (Table 6).

24 **Discussion**

1 The present study is the first to investigate longitudinal associations between rejection
2 sensitivity (RS), justice sensitivity (JS), and eating disorder psychopathology (EDP).
3 Participants with EDP reported higher RS at all measurement points, higher T1 and T2 victim
4 JS and higher T2 observer JS than controls. EDP was bi-directionally associated with
5 observer JS and anxious RS in cross-lagged models. When emotional problems were
6 considered, only T1 observer JS was directly associated with T3 EDP, whereas T1 EDP had
7 indirect effects on T3 angry RS, anxious RS, and victim JS via T2 emotional problems. Thus,
8 emotional problems are an important mediator in the association between RS, JS, and EDP.
9 The pattern of findings differed between males and females: EDP was a predictor of RS in
10 males, but an outcome of JS in females. Finally, associations between RS, JS, and EDP (and
11 emotional problems) were more pronounced in children than in adolescents.

12 **Links and Potential Ways of Effect**

13 Longitudinal, bi-directional links between anxious RS and EDP suggest a self-
14 maintaining circle of the two. This finding is in line with previous research showing bi-
15 directional links between depressive symptoms and RS (Bondü et al., 2017). Thus, targeting
16 anxious RS in therapy may help preventing EDP and counteract the emergence of a
17 potentially self-maintaining vicious circle of perceived rejection and EDP. Findings from the
18 mediation model, however, suggest that EDP may be a predictor rather than a consequence of
19 RS because only the indirect effects of EDP on angry and anxious RS remained evident.

20 Our findings add to the existing research showing mostly indirect links between RS
21 and EDP (McClure Brenchley & Quinn, 2016; Park, 2007; Selby et al., 2010; Webb &
22 Zimmer-Gembeck, 2014). In line with expectations, emotional problems also mediated the
23 link from EDP on the sensitivity traits. Contrasting previous research, emotional problems
24 did not mediate the link from RS or JS to EDP. This is presumably due to the fact that unlike
25 previous research, we controlled for the (high) stability of emotional problems. When T1

1 emotional problems were not considered in the mediation model, indirect links from T1
2 anxious and angry RS to T3 EDP were also evident.

3 Among JS perspectives, observer JS revealed the strongest links with EDP: a direct
4 link held stable even when emotional problems were considered. Hence, the present study
5 adds to the growing body of research relating JS to mental health problems (Bondü & Elsner,
6 2015; Bondü et al., 2017) and showing its unique addition to incremental variance.
7 Individuals high in observer JS negatively respond to witnessing others' unfair treatment
8 (Schmitt et al., 2005), an often uncontrollable event. Self-controllable behavior, such as
9 eating behavior, may then be used to compensate for the perceived loss of control in social
10 contexts. In addition, individuals with eating disorders may engage in behavior, such as
11 restricting, to change or avoid negative emotions (Wildes, Ringham, & Marcus, 2010). In
12 addition, EDP indirectly predicted higher victim JS. Hence, mental health problems may
13 increase the vulnerability to feeling negatively treated, which may then work to maintain
14 existing mental health problems.

15 Our findings suggest that RS and JS may be the result or symptom of mental health
16 problems, including EDP and emotional problems. Increased mental strain, negative
17 emotions, and dysfunctional cognitions associated with these problems may hinder the ability
18 to adequately cope adverse social experiences, impede social relationships due to the
19 tendency to adversely respond towards others' behavior, or promote perceptions of rejection
20 and injustice by increasing negative interpretations of ambiguous cues (Bondü et al., 2017).
21 Indeed, the sensitivity to negative social cues, the tendency to make more unfavorable social
22 comparisons, and feelings of shame were higher in individuals with eating disorders in
23 comparison to controls (Cardi, Di Matteo, Gilbert, & Treasure, 2014; Treasure, Corfield, &
24 Cardi, 2012).

25 **Moderating Effects of Gender and Age**

1 In boys, EDP predicted lower RS in the mediation model, whereas emotional
2 problems predicted higher RS, suggesting that emotional problems, rather than EDP, foster a
3 vulnerability to social problems in boys. In girls, observer JS predicted higher and perpetrator
4 JS predicted lower EDP. These findings suggest that particularly girls suffer from
5 uncontrollable negative social experiences and that EDP may be the consequence of these
6 experiences or a strategy to cope with them. More research is needed to disentangle these
7 differential gender effects. More associations between RS, JS, and EDP (and emotional
8 problems) were found in children than in adolescents. Increases in EDP (and emotional
9 problems) are often observed at the transition from childhood to adolescence which is
10 represented in the childhood group (Aime et al., 2008; Allen, Byrne, La Puma, McLean, &
11 Davis, 2008). Thus, being sensitive to social cues may make particularly vulnerable during a
12 developmental period that is burdened with a number of challenges, including changes in
13 appearance, the emergence of sexual attraction, growing independence, and increasing
14 academic demands.

15 **Limitations and Outlook**

16 The strengths of the current study include a large sample size, longitudinal
17 assessments of RS, JS, and EDP, considering the mediating effect of emotional problems, and
18 examining moderator effects. Limitations include the large number of drop-outs and the use
19 of different RS measures. However, an adaptation at T3 seemed necessary in order to account
20 for relevant rejection experiences in this age range including partner interactions.
21 Furthermore, findings suggested a strong correspondence between measures. Splitting the
22 sample reduced statistical power in highly complex multi-group models. Similarly,
23 controlling for T1 emotional problems in the mediation model resulted in the need to replace
24 numerous missing data. Therefore, we were also unable to include all T2 measures in the
25 mediation model. Thus, future research should replicate the present findings in a larger

1 sample, may focus on other age groups, specific eating problems, other forms of internalizing
2 problems, should examine potential explanations for differential links between EDP and
3 sensitivities among girls and boys, and include neuroticism as a covariate to investigate
4 whether the links between RS, JS, and EDP remain stable.

5 Our findings highlight bi-directional links and that interpersonal sensitivity factors
6 may be involved in the development and maintenance of EDP. Practitioners and researchers
7 should consider their role in order to disentangle the vicious circle between negative social
8 experiences and EDP and in prevention and intervention measures in order to minimize the
9 burden associated with EDP and eating disorders.

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Table 1. *Bivariate correlations between a) Eating Disorder Psychopathology at all assessment points for participants who used the same measure and who used a different measure at T3 and b) Rejection Sensitivity at all assessment points for participants used the same measure and who used a different measure at T3*

	1	2	3
<i>Eating Disorder Psychopathology</i>			
Same measure at all measurement points			
1. T1	1		
2. T2	.58**	1	
3. T3	.26**	.56**	1
Different measure at T3			
1. T1	1		
2. T2	.58**	1	
3. T3	.56**	.63**	1
<i>Anxious Rejection Sensitivity</i>			
Same measure at all measurement points			
1. T1	1		
2. T2	.46**	1	
3. T3	.30**	.42**	1
Different measure at T3			
1. T1	1		
2. T2	.46**	1	
3. T3	.30**	.45**	1
<i>Angry Rejection Sensitivity</i>			
Same measure at all measurement points			
1. T1	1		
2. T2	.42**	1	
3. T3	.28**	.40**	1
Different measure at T3			
1. T1	1		
2. T2	.42**	1	
3. T3	.29**	.39**	1

** $p < .01$

Table 2

Internal Consistencies, Mean Values, Standard Deviations, and Group Differences for all Measures

T1	α	Total (N=708) M (SD)	EDP (N=49, 6.9%) M (SD)	Controls (N=659, 93.1%) M (SD)	F	η_p^2	Boys (N=315, 44.5%) M (SD)	Girls (N= 393, 55.5%) M (SD)	F	η_p^2
Victim JS	.78	2.67 (1.12)	3.16 (1.04)	2.64 (1.12)	6.03*	.008	2.69 (1.13)	2.66 (1.12)	0.621	.001
Observer JS	.84	3.05 (1.11)	3.28 (1.04)	3.03 (1.12)	0.48	.001	2.81 (1.13)	3.24 (1.06)	24.913***	.034
Perpetrator JS	.88	3.57 (1.19)	3.52 (1.09)	3.57 (1.20)	0.48	.001	3.30 (1.23)	3.78 (1.11)	31.176***	.042
Anxious RS	.67	7.47 (3.33)	9.12 (3.80)	7.35 (3.26)	15.02***	.021	7.23 (3.28)	7.66 (3.36)	3.652	.005
Angry RS	.71	4.44 (2.58)	4.98 (3.12)	4.39 (2.53)	5.34*	.008	4.66 (2.67)	4.26 (2.49)	3.207	.005
Emot. Prob.	.61	2.27 (1.85)	3.88 (2.21)	2.13 (1.75)	29.40***	.050	1.74 (1.53)	2.69 (1.99)	36.45***	.061
EDP ¹	.87	8.84 (4.39)	[21.84 (4.09)]	7.87 (2.46)]			7.88 (3.46)	9.61 (4.89)	25.625***	.035
T2	α	Total (N=702) M (SD)	EDP (N=50, 7.1%) M (SD)	Controls (N=652, 92.9%) M (SD)	F	η_p^2	Boys (N=321, 45.7%) M (SD)	Girls (N= 381, 54.3%) M (SD)	F	
Victim JS	.80	2.74 (1.06)	3.45 (0.87)	2.69 (1.05)	21.14***	.029	2.66 (1.07)	2.82 (1.04)	2.948	.004
Observer JS	.88	3.01 (1.10)	3.47 (0.94)	2.97 (1.10)	5.02*	.007	2.74 (1.08)	3.22 (1.06)	34.701***	.047
Perpetrator JS	.89	3.53 (1.17)	3.44 (1.16)	3.53 (1.17)	2.26	.003	3.23 (1.22)	3.76 (1.06)	36.502***	.050
Anxious RS	.68	7.05 (3.12)	8.51 (3.33)	6.89 (3.02)	11.45***	.016	6.53 (2.81)	7.40 (3.22)	16.805***	.023
Angry RS	.69	3.82 (2.15)	4.20 (2.37)	3.75 (2.06)	3.96*	.006	3.86 (2.02)	3.71 (2.14)	0.421	.001
Emot. Probl.	.70	2.37 (2.02)	4.30 (2.43)	2.22 (1.91)	37.29***	.051	1.62 (1.57)	3.00 (2.14)	90.198***	.114
EDP ¹	.90	9.32 (4.97)	[23.50 (4.21)]	8.23 (2.84)]			7.72 (3.09)	10.65 (5.71)	65.744***	.086
T3	α	Total (N=686) M (SD)	EDP (N=68, 9.9%) M (SD)	Controls (N=618, 90.1%) M (SD)	F	η_p^2	Boys (N=295, 43.0%) M (SD)	Girls (N= 391, 57.0%) M (SD)	F	
Victim JS	.77	2.98 (0.98)	3.28 (0.83)	2.95 (0.99)	3.12	.005	2.82 (0.98)	3.11 (0.95)	14.599***	.021
Observer JS	.87	3.18 (1.03)	3.46 (1.08)	3.14 (1.02)	1.19	.002	2.91 (1.02)	3.38 (1.00)	35.718***	.050
Perpetrator JS	.88	3.63 (1.09)	3.69 (1.28)	3.62 (1.08)	0.84	.001	3.35 (1.14)	3.84 (1.02)	33.468***	.047
Anxious RS ¹	.80/.78	6.93 (3.84)	10.12 (5.17)	6.58 (3.50)	39.73***	.055	5.86 (3.14)	7.75 (4.12)	44.933***	.062
Angry RS ¹	.73/.81	3.66 (2.19)	4.77 (2.82)	3.53 (2.08)	19.45***	.028	3.58 (2.08)	3.72 (2.28)	0.788	.001
EDP ¹	.90/.92	9.89 (5.84)	[24.49 (5.82)]	8.88 (3.35)]			7.97 (3.29)	12.27 (6.59)	105.116***	.133

Note: MANCOVA results comparing participants above the cut off (+ 1.5 *SD*) in eating disorder psychopathology (EDP) and controls as well as boys and girls. All multivariate main effects significant. EDP scores not included in the MANCOVAs on differences between participants above the cut-off and controls. ¹Internal consistencies separately for the different measures for participants up to/older than 16 years of age.

Table 3
Bivariate Correlations Between Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1. Age																								
2. Gender	.06																							
3. Education	.07	-.09*																						
4. BMI-SDS	.09**	-.03	-.12**																					
Victim Justice Sensitivity																								
5. T1	.25**	-.01	.01	-.03																				
6. T2	.20**	.08*	.00	-.03	.43**																			
7. T3	.08*	.13**	.05	-.04	.35**	.45**																		
Observer Justice Sensitivity																								
8. T1	.11**	.19**	-.02	.09*	.43**	.20**	.21**																	
9. T2	.10*	.23**	-.03	.04	.20**	.41**	.18**	.44**																
10. T3	.13**	.21**	.04	.02	.18**	.23**	.42**	.37**	.44**															
Perpetrator Justice Sensitivity																								
11. T1	-.05	.20**	-.01	-.01	.08*	.08	.06	.52**	.35**	.25**														
12. T2	.05	.23**	.01	-.01	.05	.14**	.03	.35**	.61**	.31**	.48**													
13. T3	.11**	.20**	.03	.04	.10*	.12**	.18**	.30**	.37**	.55**	.33**	.47**												
Anxious Rejection Sensitivity																								
14. T1	-.11**	.05	-.07	.06	.20**	.09*	.12**	.10*	.06	-.001	.04	.00	.01											
15. T2	-.15**	.15**	-.14**	.02	.12**	.24**	.15**	.07	.11**	.03	.04	.04	.01	.46**										
16. T3	-.05	.24**	-.08	.03	.11**	.16**	.22**	.14**	.09*	.07	.04	.03	.05	.29**	.43**									
Angry Rejection Sensitivity																								
17. T1	-.16**	-.09*	-.08	.04	.23**	.11**	.11**	.04	.01	-.07	-.08*	-.06	-.04	.70**	.32**	.18**								
18. T2	-.23**	-.02	-.18**	.02	.10**	.17**	.08*	.06	.03	-.04	-.02	-.09*	-.09*	.32**	.68**	.24**	.42**							
19. T3	-.04	.02	-.12**	.05	.13**	.17**	.20**	.10**	.004	-.01	-.05	-.09*	-.04	.23**	.31**	.62**	.28**	.38**						
Emotional Problems																								
20. T1	.10*	.25**	-.08	.10*	.25**	.17**	.19**	.20**	.14**	.14**	.13**	.11**	.16**	.29**	.31**	.28**	.18**	.19**	.14*					
21. T2	.12**	.35**	-.04	.06	.20**	.28**	.18**	.18**	.18**	.12**	.11**	.09*	.07	.22**	.39**	.34**	.11**	.22**	.16**	.52**				
Eating Disorder Psychopathology																								
22. T1	.20**	.19**	-.05	.34**	.20**	.16**	.11**	.08*	.08*	.09*	-.05	-.03	.04	.18**	.16**	.16**	.11**	.12**	.07	.40**	.33**			
23. T2	.12**	.29**	-.05	.29**	.13**	.26**	.14**	.14**	.17**	.12**	.03	-.01	-.003	.08*	.22**	.23**	.02	.12**	.15**	.28**	.42**	.58**		
24. T3	-.01	.36**	-.01	.23**	.12**	.18**	.18**	.18**	.13**	.12**	.07	.02	.03	.11**	.19**	.42**	.03	.08*	.25**	.27**	.34**	.40**	.58**	

Gender: 1=male, 2=female; **p<.01; *p<.05; T1: Time1, T2: Time 2; T3; Time 3

Table 4

Measurement Invariance for Justice Sensitivity, Rejection Sensitivity, and Eating Disorder Psychopathology

	χ^2	<i>df</i>	<i>p</i>	χ^2 -difference test	RMSEA	CFI	TLI	SRMR	BIC	AIC
<i>Justice Sensitivity</i>										
Configural	91.125	63	.012		.024 [.012; .034]	.997	.992	.019	29158.115	28572.834
Weak	98.140	69	.020	$\Delta\chi^2(6)=7.015, p=.319$	.022 [.009; .032]	.997	.993	.019	29122.259	28564.849
Strong	99.227	75	.032	$\Delta\chi^2(6)=1.087, p=.982$	.020 [.006; .031]	.997	.994	.019	29086.475	28556.935
Strict	121.220	81	.003	$\Delta\chi^2(6)=21.993, p<.001$	.025 [.015; .034]	.995	.991	.025	29068.598	28566.929
<i>Rejection Sensitivity</i>										
Configural	40.492	21	.007		.035 [.018; .051]	.996	.988	.016	14285.476	13964.964
Weak	41.702	25	.019	$\Delta\chi^2(4)=1.210, p=.876$	.029 [.012; .045]	.997	.991	.016	14260.105	13958.174
Strong	41.890	30	.073	$\Delta\chi^2(5)=0.188, p=.999$	.023 [.000; .038]	.998	.995	.016	14227.068	13948.362
Strict	48.985	33	.036	$\Delta\chi^2(3)=7.095, p=.068$	.025 [.007; .039]	.997	.994	.019	14214.227	13949.457
<i>Emotional Problems</i>										
Configural	15.908	1	<.001		.140 [.085; .204]	.973	.837	.025	6864.004	6803.702
Weak	15.936	2	<.001	$\Delta\chi^2(1)=.028, p=.867$	.096 [.056; .141]	.975	.924	.025	6857.393	6801.731
Strong	15.936	3	.001	$\Delta\chi^2(1)=.000, p=1.00$	.075 [.042; .113]	.976	.953	.025	6850.755	6799.731
Strict	16.062	4	.003	$\Delta\chi^2(1)=.126, p=.723$	.063 [.033; .096]	.978	.967	.025	6844.242	6797.856
<i>Eating Disorder Psychopathology</i>										
Configural	139.000	39	<.001		.058 [.048; .068]	.987	.978	.030	16621.262	16384.363
Weak	162.372	45	<.001	$\Delta\chi^2(6)=23.372, p=.001$	.058 [.049; .068]	.985	.978	.036	16604.764	16395.735
Strong	163.387	51	<.001	$\Delta\chi^2(6)=1.015, p=.985$	.054 [.044; .063]	.985	.981	.036	16565.907	16384.749
Strict	167.055	53	<.001	$\Delta\chi^2(2)=3.668, p=.159$	.053 [.044; .062]	.985	.982	.038	16556.286	16384.418

Please note that findings presented above show measurement invariance across all assessment points for justice sensitivity and eating disorder psychopathology, and across T1 and T2 for rejection sensitivity

Table 5
Model Fit Indices for the Cross-Lagged Panel Analysis and the Mediation Model

	χ^2	<i>df</i>	<i>p</i>	RMSEA	CFI	SRMR
<i>Cross-Lagged Analysis (Covariance, stability & cross-lags)</i>						
Model 1 Total sample	1155.83	723	<.001	.028 [.025; .031]	.980	.035
Model 2 Multi-group analysis by sex- all paths free	2406.40	1482	<.001	.040 [.037; .043]	.956	.052
Model 3 Multi-group analysis by sex- all paths equal	2526.27	1588	<.001	.039 [.036; .042]	.955	.060
Model 4 Multi-group analysis by age- all paths free	2372.55	1482	<.001	.041 [.038; .044]	.958	.049
Model 5 Multi-group analysis by age- all paths equal	2535.87	1588	<.001	.041 [.038; .044]	.955	.057
<i>Mediation Analysis</i>						
Model 1 Total sample	627.235	407	<.001	.027 [.022; .031]	.984	.033
Model 2 Mediation model by sex-all paths equal	1477.468	909	<.001	.040 [.037; .044]	.958	.058
Model 3 Mediation model by sex-all paths free	1359.857	845	<.001	.040 [.036; .044]	.962	.052
Model 4 Mediation model by age-all paths equal	1431.410	909	<.001	.040 [.036; .044]	.962	.054
Model 5 Mediation model by age-all paths free	1345.976	845	<.001	.040 [.036; .045]	.964	.048

Notes. χ^2 , chi-square; *df*, degrees of freedom; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

*Control variables were age at first assessment and BMI-SDS.

Table 6
Significant Effects in the Sub-Group Analysis by Sex and Age for the Cross-Lagged Panel Model and the Mediation Model

	β	SE	<i>p</i>
Cross-Lagged Panel Analysis			
Sex			
<i>Male</i>			
EDP T1 \longrightarrow Observer JS T2	.14	.07	.038
EDP T2 \longrightarrow Observer JS T3	.15	.06	.018
Angry RS T2 \longrightarrow EDP T3	.18	.09	.045
<i>Female</i>			
EDP T1 \longrightarrow Anxious RS T2	.15	.07	.027
EDP T2 \longrightarrow Perpetrator JS T3	-.12	.06	.038
Age			
<i>Childhood</i>			
Observer JS T1 \longrightarrow EDP T2	.18	.07	.008
Anxious RS T2 \longrightarrow EDP T3	.27	.11	.012
EDPT2 \longrightarrow Anxious RS T3	.19	.06	.002
<i>Adolescence</i>			
EDP T2 \longrightarrow Observer JS T3	.13	.06	.034
Mediation Model			
Sex			
<i>Male</i>			
<i>Direct Effects</i>			
EDP T1 \longrightarrow Anxious RS T3	-.24	.07	.001
EDP T1 \longrightarrow Angry RS T3	-.18	.08	.016
Emotional Problems at T2 \longrightarrow EDP T3	.24	.07	.001
Emotional Problems at T2 \longrightarrow Anxious RS T3	.40	.07	<.001
Emotional Problems at T2 \longrightarrow Angry RS T3	.25	.08	.002
Emotional Problems at T2 \longrightarrow Observer JS T3	-.18	.07	.013
<i>Indirect Effects</i>			
Perpetrator JS T1 \longrightarrow EDP T3	-.08	.04	.048
<i>Female</i>			
<i>Direct Effects</i>			
Observer JS T1 \longrightarrow EDP T3	.24	.08	.002
Perpetrator JS T1 \longrightarrow EDP T3	-.14	.07	.050
EDP T1 \longrightarrow Emotional Problems T2	.18	.09	.034
Emotional Problems at T2 \longrightarrow EDP T3	.25	.08	.001
Emotional Problems at T2 \longrightarrow Anxious RS T3	.31	.08	<.001
Emotional Problems at T2 \longrightarrow Angry RS T3	.20	.08	.018
Age			
<i>Children</i>			
<i>Direct Effects</i>			
Observer JS T1 \longrightarrow EDP T3	.23	.08	.003
Emotional Problems T2 \longrightarrow EDP T3	.54	.09	<.001
EDP T1 \longrightarrow Emotional Problems T2	.23	.10	.017
Emotional Problems T2 \longrightarrow Anxious RS T3	.64	.10	<.001
Emotional Problems T2 \longrightarrow Angry RS T3	.41	.09	<.001
Emotional Problems T2 \longrightarrow Victim JS T3	.30	.09	<.001
<i>Adolescents</i>			
<i>Direct Effects</i>			
Emotional Problems T2 \longrightarrow EDPT3	.31	.12	.011
Emotional Problems T2 \longrightarrow Anxious RS T3	.27	.12	.024

EDP: Eating Disorder Psychopathology; RS: Rejection Sensitivity; JS: Justice Sensitivity; T1: Assessment at Time 1; T2: Assessment at Time 2; T3: Assessment at Time 3.