Enhanced memory for negative social information in Borderline Personality Disorder

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Key words: borderline personality disorder, social cognition, memory indexing, negativity bias

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Abstract

Biased social cognition towards an enhanced processing of negative social information might contribute to instability in interpersonal relationships. Such interpersonal dysfunctions are important for the understanding of several mental disorders, among them borderline personality disorder (BPD). To experimentally test enhanced memory retrieval of negative social information, using a newly developed variant of a looking-at-nothing paradigm, 45 BPD patients and 36 healthy women learned positive and negative personality traits of different target persons. In a translational memory test, participants were asked to use the learned information to evaluate statements about the target person. In addition to behavioral measures of memory performance, we investigated eye gaze patterns to decompose memory retrieval processes. We hypothesized that BPD patients would retrieve negative as compared to positive person information more accurately than healthy controls, and show increased eye gaze towards spatial locations where negative information was provided during the learning phase. Results pointed to a more accurate retrieval of negative person attributes in the patient group as compared with healthy controls (HC), thereby corroborating a negativity bias in social cognition in an exemplary sample of patients with interpersonal problems. Interestingly, the observed negativity bias for person memory was associated with BPD severity, stronger expectancies to be rejected by others, and social detachment. No group differences regarding eye fixation behaviour were found. We propose that enhanced retrieval of negative person information might be associated with dysfunctional cognitive schemas as well as reduced behavioral trust, and be of relevance for mental disorders characterized by interpersonal difficulties.

General Scientific Summary

Social cognition is altered in borderline personality disorder (BPD), which is a prominent example of a mental disorder with marked interactional problems, especially with regard to enhanced processing of negative social information. Our study points to heightened memory retrieval of negative person attributes in BPD as compared with HC, which might contribute to reduced interpersonal trust and interpersonal dysfunction.

Keywords: Borderline personality disorder, negativity bias, social cognition, person memory, memory indexing, looking at nothing, interpersonal problems

Introduction

Social cognition is "the processing of any information which culminates in the perception of the dispositions and intentions of other individuals" (Brothers, 1990). It can be integrated into an information processing framework, describing how social information is perceived, encoded, transferred to and recalled from memory, and what processes are involved when people make attributions, judgments, and decisions (Bless, Fiedler, & Strack, 2004). Biases in social cognition have been reported in many mental disorders, among them depression (Wang, Wang, Chen, Zhu, & Wang, 2008), social anxiety disorder (Hezel & McNally, 2014), eating disorders (Russell, Schmidt, Doherty, Young, & Tchanturia, 2009), and borderline personality disorder (BPD; Lazarus, Cheavens, Festa, & Rosenthal, 2014; Roepke, Vater, Preißler, Heekeren, & Dziobek, 2013). These biases in social cognition are thought to contribute substantially to interpersonal problems and are thus of central importance for the understanding of mental disorders in general.

In the present study, we recruited a sample of BPD patients to investigate potential effects of altered memory processing of negative social information, as well as its relation with interpersonal problems. Current diagnostic models stress the importance of interpersonal dysfunction for the understanding of BPD (American Psychiatric Association, 2013; Bach et al., 2017), suggesting pronounced biases across most domains of social cognition (Fossati, Somma, Krueger, Markon, & Borroni, 2017). This is in line with the results of a recent meta-analysis showing that subjects with BPD, as compared to those with other mental disorders, exhibited interpersonal dysfunction across all assessed contexts and interaction partners (Wilson, Stroud, & Durbin, 2017). Furthermore, there is a substantial body of research on social cognition in BPD, making it possible to deduce clear hypotheses for statistical testing (Lazarus et al., 2014). Accordingly, we considered BPD an ideal exemplary mental disorder characterized by interpersonal dysfunction to study basic memory processing of social information. This, however, does not imply that we argue for disorder-specificity in the

interpretation of the results. It is rather our hope to stimulate future research on recall biases in social cognition in other mental disorders, and ultimately across diagnostic categories (Kotov et al., 2017) by sharing our experimental materials, data and code.

With regard to borderline personality disorder (BPD), there is some existing research on altered social cognition, pointing to biases in the processing of social information at different levels. For example, patients with BPD show an inaccurate recognition of emotions of others (Daros, Zakzanis, & Ruocco, 2013), have reduced trust in interpersonal situations (King-Casas et al., 2008; Unoka, Seres, Aspan, Bodi, & Keri, 2009), and have dysfunctional beliefs about other people (Arntz, Dreessen, Schouten, & Weertman, 2004; Butler, Brown, Beck, & Grisham, 2002). These impairments in social cognition might contribute to a pervasive instability in interpersonal relationships, which is one of the most stable symptoms in BPD (Gunderson, 2007), and hereby aggravate further BPD symptoms. Notably, symptoms of self-injurious behavior or suicide attempts tend to exacerbate in the course of interpersonal problems (Brodsky, Groves, Oquendo, Mann, & Stanley, 2006).

It was proposed that abnormalities in social cognition are based on an exacerbated negativity bias in BPD (Krause-Utz, Winter, Niedtfeld, & Schmahl, 2014; Lazarus et al., 2014). Negativity bias is a psychological phenomenon describing that negative information has a greater weight than positive information (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). Indeed, previous findings in BPD also point to an increased processing of negative information, along with a tendency to perceive neutral or positive information more negatively than healthy controls (HC) do. More specifically, an exacerbated negativity bias in BPD was shown for several social-cognitive processes, such as attention to facial expressions (Schulze, Domes, Koppen, & Herpertz, 2013; Veague & Hooley, 2014), the perception of neutral or ambiguous facial expressions (G. Domes et al., 2008; Dyck et al., 2009; Wagner & Linehan, 1999), and theory of mind (Petersen, Brakoulias, & Langdon, 2016).

In contrast to a large body of studies on emotion recognition and theory of mind (as reviewed by Roepke et al., 2013), other social-cognitive processes, such as memory for social information, have not yet been tested experimentally in the context of mental disorders. Most studies on memory in BPD rather investigated specificity and themes of autobiographical memories, or whether patients show abnormalities in the retrieval of learned emotional words (for detailed reviews, see Bech, Elklit, & Simonsen, 2015; Winter, Elzinga, & Schmahl, 2014). Studies using word lists did not detect differences in BPD patients' abilities to *memorize* negative or positive information as compared to healthy controls (Gregor Domes et al., 2006; Sprock, Rader, Kendall, & Yoder, 2000). However, patients with BPD were less successful in *forgetting* negative or disorder-related stimuli in the directed forgetting task (Gregor Domes et al., 2006; Korfine & Hooley, 2000). For example, Korfine and Hooley (2000) found a reduced ability to forget words related to negative interpersonal situations (e.g., "cruel", "lonely", "misunderstood", "reject", "uncaring"). Also with regard to episodic memory, some studies on autobiographic memories suggest that overgeneralized memory retrieval is characteristic of patients with BPD (Maurex et al., 2010; Reid & Startup, 2010), whereas others did not find group differences in the specificity of autobiographical memories (Renneberg, Theobald, Nobs, & Weisbrod, 2005). Moreover, memories of parent-child interactions are more negative in BPD than in patients with schizophrenia (Arnow & Harrison, 1991), and are characterized by themes of neglect and abandonment (Nigg, Lohr, Westen, Gold, & Silk, 1992; Zweig & Paris, 1991). In response to rejection-related cues, patients with BPD retrieve less specific memories than healthy controls (Rosenbach & Renneberg, 2015).

While negativity bias in memory retrieval has not been tested explicitly in mental disorders, there is a large body of studies on negative-positive asymmetries in healthy subjects (Baumeister et al., 2001; Rozin & Royzman, 2001). The respective findings are discussed controversially and seem to depend on the domain investigated (e.g., autobiographical memory retrieval vs memory for social information), and on the length of the retention interval. Taylor

(1991) emphasized a positivity bias in memory with regard to autobiographical negative and positive events, due to compensatory processes selectively erasing bad memories. This compensatory effect was shown to increase with time and longer retention intervals (Holmes, 1970; Walker, Vogl, & Thompson, 1997). In contrast, studies investigating memory for social information (e.g., impression formation) tend to show a negativity bias. That is, studies on person memory show that negative behaviors of a fictional person (e.g., “cheated on his final exams”) were memorized better than neutral or positive behaviors (e.g., “returned a lost wallet intact”) (Bless, Hamilton, & Mackie, 1992; Dreben, Fiske, & Hastie, 1979; Skowronski & Carlston, 1987). Furthermore, there is strong support that negative person information (e.g., sadistic, mean) often consumes more attentional resources than positive person attributes (e.g., kind, sincere), which results in a more elaborate processing of potentially threatening information and finally results in a more accurate retrieval (Kuhbandner, Spitzer, & Pekrun, 2011; Pratto & John, 1991).

In accordance with these observations, theoretical models argued that enhanced memory for negative information about other persons is an evolutionary advantage because it enables subjects to detect cheaters, and therefore avoid exploitation (Cosmides & Tooby, 1992). Another line of memory research also emphasizes the importance of correctly retrieving information about the trustworthiness of other people (Bell, Buchner, & Musch, 2010). Interestingly, memory for faces of other individuals was not only modulated by the general trustworthiness (i.e., cheater, cooperators), but also by participants’ positive or negative expectancies towards these persons (Bell, Buchner, Kroneisen, & Giang, 2012). Translating these findings to patients with difficulties to forget negative information, as well as memory biases regarding interpersonal situations, we hypothesize that those patients would memorize negative, but not positive, information about other individuals more accurately than healthy controls. We decided to operationalize negative and positive content by attributes that describe personality traits according to the five factor model (FFM) of personality (McCrae & Costa,

1999). With regard to FFM, some authors argued that positive and negative valence is not covered by the Big Five model of personality and should be added as additional personality factors (Tellegen & Waller, 2008), but others stated that negative valence was in fact an extreme form of Big Five traits (e.g. low agreeableness, high neuroticism)(McCrae & Costa Jr, 1995; West, 1993; Widiger, 1993a, 1993b). In our study, we follow the latter argumentation, using well-validated trait descriptors of the Big Five traits (Saucier, 2002) that are negative (i.e., socially undesirable) and positive (i.e., socially desirable) as stimulus material, in order to test negativity bias for social information.

To investigate differences in the *retrieval* of social information between patients with BPD and healthy controls, we used a newly developed variant of a “looking-at-nothing” paradigm (Renkewitz & Jahn, 2012). This paradigm consisted of two phases. In the first phase, participants had to memorize personality attributes (arranged within spatial frames) of fictitious target persons. After successful learning the attributes, participants were asked to use the learned information to evaluate different statements about the target persons. Importantly, trials in this second phase only comprised a picture of the target person and empty spatial frames. Previous studies with comparable paradigms found that the retrieval of information from memory is associated with a longer fixation of the original spatial location of the information, even though the information is no longer present (Richardson & Spivey, 2000; Spivey & Geng, 2001). In other words, when participants retrieved no longer visible information, they preferably fixated locations at which this information was provided during the learning phase. The analysis of gaze patterns during the retrieval phase thus allows to make inferences about information search in memory (Renkewitz & Jahn, 2012). In addition to our first hypothesis on enhanced retrieval of negative information, we hypothesized that compared to healthy controls patients with BPD would preferentially fixate spatial locations where negative and not positive information was provided.

To summarize, the present study assessed behavioral measures of performance (i.e., accuracy) as well as gaze patterns (i.e., fixation of spatial areas-of-interest) to investigate the retrieval of negative and positive social information. We hypothesized that patients with a high amount of interactional problems would be characterized by a more accurate retrieval of negative information, as well as a preferential fixation of spatial locations where negative information was provided.

Methods

Sample

We enrolled 49 unmedicated women diagnosed with BPD according to the DSM-IV (APA, 2013) and 39 healthy women in the study. Sample size was determined for the corresponding grant proposal (see <http://gepris.dfg.de/gepris/projekt/256645687?language=en>) by an a priori power analysis and was conducted with the software G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Since both hypotheses refer to an interaction of the between-subjects factor group (two factor levels) and the experimental within-subjects factor valence (two factor levels), and assuming a small-to-medium sized interaction effect ($f = .175$) in a mixed ANOVA design (setting the type-I-error to the conventional level of .05), while requiring a satisfactory statistical power of $1 - \beta = .90$, the power analysis resulted in a total sample size of $N=88$. Unfortunately, data of seven participants (4 BPD, 3 HC) had to be excluded from all analyses after recruitment was finished: Two patients and one healthy participant stopped the study during the learning phase, one patient and one healthy control had to be excluded due to a positive drug urine test after participation, one patient had to be excluded due to psychotropic medication, and one healthy control was excluded because she fulfilled criteria for an anxiety disorder. Thus, the final sample for behavioral analyses comprised 45 patients with BPD and 36 healthy controls. The sample for eye-tracking analyses was limited due to technical problems

(36 BPD and 30 HC, see paragraph on eye-tracking analyses for details). The groups did neither differ significantly in age (Wilcoxon-Test, $W = 751$, $p = .578$), nor in their educational level (Wilcoxon-Test, $W = 923$, $p = .256$). For detailed demographic and clinical characteristics, see Table 1.

- Insert Table 1 about here -

BPD patients were recruited throughout Germany in the context of the German Clinical Research Unit situated at the Department of Psychosomatic Medicine, Central Institute of Mental Health (CIMH) in Mannheim (Schmahl et al., 2014). None of the BPD patients was in inpatient treatment or received psychotropic medication at the time of the study. Healthy participants were recruited by newspaper advertisement. All participants underwent diagnostic interviews with the Structured Clinical Interview for DSM-IV Axis-I (Wittchen, Wunderlich, & Gruschwitz, 1997) and the International Personality Disorder Examination (IPDE, Loranger et al., 1998) administered by trained psychologists. Interrater reliability established for randomly selected video-taped diagnostic interviews was excellent (Cicchetti, 1994), with intraclass correlations (ICCs) of .978 for the number of BPD criteria. Exclusion criteria for healthy subjects were a current or lifetime diagnosis of any mental disorder. Exclusion criteria for patients with BPD comprised current schizophrenia, current or lifetime bipolar disorder, current substance abuse or substance dependency, and a current severe major depressive episode. Co-morbid mental disorders ($AM=2.02$) were mild to moderate current depressive episodes ($n=12$); dysthymia ($n=9$); agoraphobia ($n=5$); specific phobia ($n=5$); social phobia ($n=7$); obsessive-compulsive disorder ($n=5$); posttraumatic stress disorder ($n=13$); somatoform disorders ($n=1$); eating disorders ($n=11$); substance abuse lifetime, abstinence for at least 2 months ($n=13$); substance dependency lifetime ($n=10$). All participants had a negative drug urine screening.

We assessed BPD symptom severity with the Borderline Symptom List-23 (BSL-23, Bohus et al., 2009), features of borderline personality with the Personality Assessment Inventory - Borderline Features Scale (PAI-BOR, Groves & Engel, 2007), dissociative symptoms with the Dissociation Tension Scale (DSS, Stiglmayr et al., 2010), and rejection sensitivity with the German version of the Rejection Sensitivity Questionnaire (RSQ, Berenson et al., 2009), see Table 1. Results from the Personality Inventory for DSM-5 (PID-5) for the group of patients with borderline personality disorder (Zimmermann et al., 2014) are presented in Supplemental Table 4. Please note, data from the PAI-BOR were missing for three patients and data from the RSQ were missing for four patients.

Participants received a full description of the study protocol and gave their written informed consent prior to participation. The study protocol was conducted in compliance with the Declaration of Helsinki and approved by the ethics committee of the Medical Faculty Mannheim, Ruprecht-Karls-University Heidelberg (protocol no. 2013-654N-MA).

Memory Paradigm and Procedure

The experimental paradigm consists of two different phases. In the first phase of the experiment, participants learned five personality attributes of seven fictitious target persons (all female). Participants were informed that they would need to remember the attributes to answer questions about the person later on. For instance, Sonja was described as “talkative”, “demanding”, “organized”, “nervous”, and “complex” (see Figure 1 for an example trial of the learning phase). The presented attributes corresponded to the Big Five personality traits (*extraversion, agreeableness, conscientiousness, neuroticism, and openness*), and were taken from a well-validated set of adjectives representing the Big Five (Saucier, 2002). From this adjective set, we chose 35 different attributes with positive (n=18) or negative (n=17) valence. The valence ratings of these attributes were based on the results of a web-based evaluation study with n=123 participants. In this study, participants rated each attribute on a five-point Likert scale

(1=positive, 2=somewhat positive, 3=neutral, 4=somewhat negative, 5=negative). For example, ratings of attributes corresponding to *conscientiousness* showed that the attributes „careless“, „disorganized“, „sloppy“, and „unsystematic“ were rated as negative, whereas the attributes “neat”, “systematic”, and “organized” were rated as positive (for further information, see supplemental material).

As stated, participants learned five attributes for each of the seven target persons. The presentation location of the personality traits was constant across trials and participants. For example, attributes corresponding to the personality trait “extraversion” were always presented at the top center of the monitor. In contrast, the location of the valence of the attributes was randomized across trials. Attributes for each target person were presented until response. After the presentation of all attributes, participants had to reproduce the learned attributes location by location (clockwise) for each of the seven target persons (i.e., enter attribute via keyboard). Learning of attributes proceeded until one successful reproduction of all attributes for all target persons with less than two errors. The learning phase lasted approximately half an hour (BPD: AM = 38.65 +/- 8.77 minutes, HC: AM = 36.16 +/- 12.59 minutes). Groups did not differ in the number of trials for learning the attributes (BPD: AM = 257.45 +/- 57.62, HC: AM = 259.11 +/- 72.01; Wilcoxon-Test, $W = 851.5$, $p = .42$).

- Insert Figure 1 about here -

The second phase of the experiment comprised the memory test. Specifically, participants were asked to use the learned information in order to evaluate different statements about each target person. In each trial, the participants saw a screen with the target person and now empty attribute boxes (cf. Figure 1, box size = 300x80px). Then, the participant was presented an audio file via headphones containing a statement about the target person (e.g., “She likes order”), and was asked to decide whether this statement is correct (by button presses for “yes” or “no”). In the example provided in Figure 1, the learned attribute “organized”

(positive valence, corresponding trait *conscientiousness*) is the most valid cue, and the correct response is “yes”.

The statements presented during the memory retrieval phase also corresponded to the Big Five personality structure of the attributes and were derived from established instruments to assess personality traits (Buck & Bierhoff, 1986; Goldberg et al., 2006). These sentences were changed from a first-person perspective ("I rarely feel fearful or anxious") into a third-person perspective ("She rarely feels fearful or anxious"). A detailed list of all statements presented is provided in the online materials. To summarize, participants answered 35 decision trials (7 target persons x 5 decisions) in a blocked fashion (one decision for each target 1-7, five rounds) asking for attributes with negative (n=18) or positive (n=17) valence and corresponding to Big Five personality traits (n=7 per trait).

Eye-tracking

Throughout the retrieval phase, we assessed eye movements with an SMI RED250 eye tracker, which was mounted to a 22'' widescreen-monitor (resolution: 1280x1024 Pixel, distance = 50 cm, no fixation of the head), and has an accuracy of 0.4 degrees. This setup allowed to investigate whether memory retrieval of personality attributes was associated with a differential pattern of fixation behavior between the two groups.

Due to technical problems, such as insufficient calibration of the eye tracker, we had no valid eye-tracking data for six patients with BPD and four healthy controls. Quality of the available eye-tracking data (i.e., tracking ratio) was checked with box-and-whisker plots (DiLalla & Dollinger, 2006). We excluded data below the lower whisker (“mild outliers”). At the participant level, we had to exclude three patients with BPD and two healthy controls. These participants had a tracking ratio below the lower whisker of 67.2% (range: 44.1%-62.6%).

Thus, eye-tracking data was analyzed for 36 patients with BPD and 30 healthy controls. We also checked the data quality at the trial level using again the lower whisker of the tracking

ratio (71%) to determine trials with poor data quality. This resulted in the exclusion of 5.8% of all trials in BPD and 5.3% of all trials in the control group. After data clearing, the final tracking ratio was 92.66 +/- 4.96 in the BPD group, resp. 91.76 +/- 4.82 in the control group. For these data, we extracted net dwell time (i.e., sum of fixation durations) for each of the spatial location of the personality attributes. More specifically, we defined the exact locations of the empty boxes as areas-of-interest (AOI), and extracted data from the start of each trial until a response was made. Data extraction was realized with SMI software (BeGaze Version 3.3.56), and detection of fixations and saccades was performed according to BeGaze default settings.

Statistical Analyses

Experimental materials, the full data set as well as the statistical syntax and results are available at https://osf.io/e3rxz/?view_only=e9cb2ccd49af42d590860b4aa8f86343. Experimental data were analyzed with (generalized) linear mixed-effects models ([G]LMM, Baayen, Davidson, & Bates, 2008). All statistical analyses were conducted in the R environment (R Core Team, 2017) applying the following packages: *afex* (Singmann, Bolker, Westfall, & Aust, 2018), *broom* (Robinson & Hayes, 2018), *DT* (Xie et al., 2018), *emmeans* (Lenth, 2018), *lme4* (Bates, Maechler, Bolker, & Walker, 2015), and *tidyverse* (Wickham, 2017).

First, we analyzed the effects of group (BPD vs HC), valence (positive vs negative¹), and the interaction of group by valence on accuracy and response latencies. Barr and colleagues (2013) suggested that linear mixed-effects models generalize best when including the maximal random effects structure justified by the design, whereas underspecified models present an increased Type-I error rate. For this reason, we started with the definition of the full model of random effects followed by a stepwise simplification until the estimation procedure converged (for a discussion on how to deal with non-convergence issues, see Barr et al., 2013, p. 276). We

¹ This analysis was repeated using dimensional scores of attribute valence, which did not change the main results reported in the results section.

considered random effects for the participants and the identity of the targets. For a detailed presentation of the stepwise procedure see our online materials. Significant main effects and interactions were followed by calculation of post-hoc tests. Degrees of freedom for the t- and F-statistics of linear mixed-effect models were approximated using the Satterthwaite and Kenward-Rogers methods, respectively (i.e., the default settings of the afex-package for these tests). Unfortunately, due to the way that variance is partitioned in linear mixed models (Rights & Sterba, 2018), there does not exist an agreed-upon way to calculate standard effect sizes for individual model terms such as main effects or interactions. We nevertheless decided to primarily employ mixed models in our analysis because mixed models are vastly superior in controlling for Type I errors than alternative approaches and consequently results from mixed models are more likely to generalize to new observations (Barr, Levy, Scheepers, & Tily, 2013; Judd, Westfall, & Kenny, 2012).

Second, we analyzed whether patients with BPD show a longer fixation of AOIs with previously presented negative attributes as compared to AOIs with positive attributes. We defined the exact locations of the empty boxes where attributes were presented during the learning phase as AOIs. Since each trial was presented until a response was made, we used percentage of fixation behavior per AOI rather than raw time units. An initial analysis established that patients with BPD and healthy controls did not differ in their general fixation of whitespace (i.e. non-AOIs, BPD: $AM=89.45\% \pm 15.96$, HC: $AM=89.22\% \pm 14.60$; $\chi^2(1) = 0.05$, $p = .82$). Initially, we tested whether memory retrieval of personality attributes was associated with a longer fixation of the original spatial location of the information (i.e., the presence of a “looking-at-nothing” effect). Then, we calculated the mean fixation of negative compared to positive AOIs per trial, which was of primary interest. For these two analyses, we started by calculating the mean fixation of the whitespace as well as of (ir-)relevant AOIs. This was followed by calculating the mean difference between fixation of (ir-)relevant AOIs (i.e. negative vs positive attributes; relevant vs irrelevant information). Trials with no fixation of the

AOIs suggested no preference for certain AOIs, and were thus also included in the final analyses. The resulting difference scores at the trial level were used as dependent variable in a multi-level design with the main effect of group. Again, we considered random effects for the participants and the identity of the targets. In addition, we estimated split-half reliabilities for the difference scores used in both statistical analyses of the eye-tracking data (but see also Trafimow, 2015 for alternative procedures). Thus, we first calculated difference scores at the trial level. This was followed by the calculation of separate multilevel models based on half of the trials (odd-even procedure). Spearman-Brown corrected estimates yielded $r = .72$ for the valence score and $r = .41$ for the “looking-at-nothing” score.

Finally, we calculated several additional exploratory statistical analyses. First, we analyzed dimensional associations of negative memory retrieval with psychopathological and social-cognitive disturbances. Since both groups differed substantially in most questionnaires (range of Cohen’s d : 1.15 – 5.39, cf. Table 1), we calculated the respective correlations in the BPD group only. Second, we analyzed effects of clinician-rated personality pathology, as assessed by the diagnostic interview IPDE (Loranger et al., 1998), with negative memory retrieval. Finally, we compared the effects of personality traits (agreeableness, conscientiousness, extraversion, neuroticism, and openness) of the corresponding trait attributes on memory retrieval between both groups.

Results

Effects of valence on retrieval performance

The generalized mixed-effects model yielded a significant interaction of group by valence ($\chi^2(1) = 5.92, p = .01$). As predicted in our first hypothesis, post-hoc tests showed that compared to healthy controls patients with BPD were more accurate in the retrieval of negative attributes ($Z = 2.25, p = 0.02$; Odds-Ratio = 1.57 [CI: 1.06; 2.32]), but not in the retrieval of positive information ($Z = -0.33, p = 0.75$; Odds-Ratio = 0.96 [CI: 0.73; 1.25]). Main effects of group and valence were not significant (all p 's $> .13$). For a visualization see Figure 2.

- Insert Figure 2 about here -

An additional analysis with the logarithm of response latencies highlighted a faster retrieval of negative compared to positive attributes across all participants (main effect of valence: $F(1,2743.82) = 14.44, p < .001$). The main effect of group as well as the interaction of group by valence were not significant (all p 's $> .40$).

Fixation behavior

In line with previous studies, we found a preferential fixation of spatial locations where the relevant attribute was previously presented across all participants ($t(16.31) = 2.89, p = .01$). This original “looking-at-nothing” effect did not differ between patients with BPD and healthy controls ($t(63.51) = -0.58, p = .57$).

A linear mixed-effects model with the difference score (i.e., percent fixation of AOIs with negative minus positive attributes at the trial level) yielded neither a preferential fixation of negative compared to positive AOIs, nor a significant group difference between patients with BPD and healthy controls (all p 's $> .16$). Therefore, we could not confirm our second hypothesis.

Exploratory analyses

In alignment with current discussions in the context of replicability crisis (de Groot, 2014), we refrain from p-values when reporting exploratory analyses, but report all results with medium or large effect sizes, according to Cohen (1977). For the full set of exploratory analyses and corresponding inferential statistic, as well as bootstrapping results for selected questionnaires, see https://osf.io/e3rxz/?view_only=e9cb2ccd49af42d590860b4aa8f86343.

Effects of psychopathology on retrieval performance

A more accurate retrieval of negative personality attributes was associated with higher scores for the expectancy to be rejected by others (RSQ: Expectancy, $r = .31$), as well as with stronger disengagement from social situations (PID-5: Withdrawal, $r = .32$) in the BPD group. We found only small associations (all r 's $< |.19|$) with different forms of psychopathology (symptoms of borderline personality disorder [BSL-23, PAI-BOR], depression [BDI], or social anxiety [SPIN]).

Moreover, we included clinician-rated personality pathology as assessed by the respective diagnostic interview IPDE (Loranger et al., 1998). The BPD dimensional score was related to a more accurate retrieval of negative personality attributes ($r = .30$). Likewise, the IPDE interpersonal item “inhibited in new situations” also correlated with enhanced retrieval of negative trait attributes ($r = .38$). We found no relevant associations with other IPDE items assessing interpersonal dysfunction.

Effects of personality attributes on retrieval performance

We ran an exploratory analysis testing the influence of specific Big Five personality factors of the stimulus material on accuracy scores. To this end, we compared retrieval rates of the respective personality trait of each attribute (agreeableness, conscientiousness, extraversion, openness and neuroticism), dependent of the diagnostic group. The respective exploratory comparisons illustrated more accurate retrieval of attributes corresponding to agreeableness (Cohens $d=.62$) and extraversion (Cohens $d=.58$) in patients with BPD as compared to healthy controls.

Discussion

The present study investigated person memory and the retrieval of positive or negative person information to gain deeper insight in the role of social information processing in mental disorders that are characterized by interpersonal dysfunction, such as BPD. More specifically, we assessed behavioral measures of memory performance (i.e., accuracy) and gaze patterns (i.e., fixation of spatial areas-of-interest) in a newly developed variant of the “looking-at-nothing” paradigm.

As predicted, we found that those with BPD were more accurate in the retrieval of negative person attributes than HC, which corroborates assumptions about an exacerbated negativity bias in BPD (Krause-Utz et al., 2014; Lazarus et al., 2014). With regard to positive person attributes, we found no significant differences between the groups, which might be explained by the short delay of recall in our study (Walker et al., 1997). While an enhanced negativity bias has already been demonstrated for the recognition of emotional states or theory-

of-mind processes in BPD, here we provide empirical support that this also translates to an additional component of social information processing, that is, person memory.

Importantly, enhanced retrieval of negative person information might be associated with reduced behavioral trust and problems in patients' interpersonal relationships (Fertuck, Fischer, & Beeney, 2018; Jeung, Schwieren, & Herpertz, 2016). In line with this proposition, we found within our exploratory analyses that more accurate retrieval of negative person information was associated with a more fearful expectancy to be rejected. It has to be noted that high rejection sensitivity is not specific for BPD, but was reported for many clinical phenomena like depressive symptoms (Ayduk, Downey, & Kim, 2001), social anxiety (Fang et al., 2011), or eating disorders (De Paoli, Fuller-Tyszkiewicz, & Krug, 2017), but also anger and reactive aggression (Ayduk, Downey, Testa, Yen, & Shoda, 1999). In the same vein, we also found that negative memory bias was related to social withdrawal in our exploratory analyses. More specifically, we found the same association for self-reported withdrawal from social situations, as well as for clinician-rated inhibition in new interpersonal situations, as assessed via structured clinical interview. Importantly, both are related to the same domain of maladaptive personality, namely detachment (Krueger, Derringer, Markon, Watson, & Skodol, 2012; Sanislow, da Cruz, Gianoli, & Reagan, 2012). Like rejection sensitivity, social withdrawal/detachment was discussed with regard to depression (Girard et al., 2014), social anxiety (Rubin & Burgess, 2001), and was reported for other PDs like avoidant and schizoid PD (Fossati, Krueger, Markon, Borroni, & Maffei, 2013). Finally, although the reported memory bias was also related to BPD dimensional score, we do not argue that this proves disorder specificity, since it could also be interpreted as an effect of general psychopathology (Sharp et al., 2015).

Our exploratory results, connecting memory bias for negative social information with dysfunctional personality traits, suggest that either a) an enhanced retrieval of negative

situations might shape future interactions and maladaptive personality traits correspondingly, or b) that maladaptive personality traits might result in a more pronounced memory retrieval for negative information. However, the exact direction of the association remains to be elucidated, and our exploratory findings warrant replication based on confirmatory analyses. Nevertheless, our results are probably also relevant for other mental disorders characterized by interpersonal difficulties, high rejection sensitivity, and social detachment.

Interestingly, previous work on person memory suggested that individuals are particularly accurate in the retrieval of rare and negative person information since those traits are more predictive for other individuals' personality and behavior than common and positive traits (Fiske, 1980; Ito & Cacioppo, 2005; Skowronski & Carlston, 1989). To form an impression about others, individuals retrieve information from memory to test several different hypotheses regarding the traits and abilities of others, with traits predictive of one's behavior being memorized more accurately (for a detailed discussion, see Prager, Krueger, & Fiedler, 2018). Thus, it might be assumed that negative attributes were more heavily weighted in the prediction of others' personality and behavior in our patient group than in healthy controls.

Possibly related to increased memory for negative attributes, previous studies on impression formation suggest that patients with BPD evaluate other people as untrustworthy and hostile (Arntz & Veen, 2001; Barnow et al., 2009; Fertuck, Grinband, & Stanley, 2013; Miano, Fertuck, Arntz, & Stanley, 2013; Nicol, Pope, Sprengelmeyer, Young, & Hall, 2013). The more accurate retrieval of negative person information is also congruent with the dysfunctional beliefs about other people in BPD (Arntz et al., 2004; Butler et al., 2002), which are related to trust and attachment. Previous studies suggested that BPD patients assume that others are hostile and untrustworthy, that they themselves will be rejected and abandoned, and that they have to protect themselves to prevent negative events (Butler et al., 2002). Thus, it is interesting that our exploratory analysis indeed suggested a more accurate memory performance

for attributes related to agreeableness in the patient group. While we cautiously propose that person information in line with cognitive schemas might be of enhanced relevance for memory biases, this clearly needs further investigation.

Notably, only few previous studies investigated memory performance for negative and positive information in BPD. A very early study on semantic memory used positive, negative, and neutral word lists and tested free recall as well as recognition in patients with BPD and comorbid major depression (MDD) as compared to HC. The authors report that only BPD patients with comorbid MDD remembered fewer words than healthy controls, while they, similarly to control participants, recalled positive words better than negative words (Kurtz & Morey, 1999). Another study showed higher recall rates in BPD for negative nouns as compared to HC (Gregor Domes et al., 2006). However, another study with a similar design did not detect significant differences in the recall of positive, negative, or neutral words (Korfine & Hooley, 2000). Synthesizing previous research on valence-dependent memory functioning with our results on memory for person attributes, we propose that information with negative valence might have higher importance only in the context of social information because it relates to dysfunctional beliefs about other people (Arntz et al., 2004; Butler et al., 2002). For instance, a previous study investigating attentional interference with the emotional stroop test, found stronger interference in BPD patients by schema-related words, such as “reliable” and “powerful” (Sieswerda, Arntz, Mertens, & Vertommen, 2007).

While the present study had a number of strengths, including the first investigation of person memory in a group of patients with interpersonal dysfunction, it is also limited in some ways. First, this study investigated only female subjects and did not include a clinical control group. Therefore, findings cannot be generalized to male patients, and cannot be attributed specifically to BPD pathology. While additional analyses found that the enhanced memory retrieval of negative person information might be associated with problematic personality traits,

it should be considered that these results are exploratory by nature and require confirmatory replication by a different study.

Next, due to dropouts, we analyzed fewer subjects than determined by the a priori power analysis. Thus, as determined by a sensitivity power analysis with the same parameters as mentioned in the methods section, the smallest detectable effects in this study are somewhat larger than originally intended ($f=0.18$ for behavioral data, $f=0.20$ for eye-tracking data). However, medium sized effects ($f=.25$) were still reliably detectable ($1 - \beta = .99$ for behavioral data, $1 - \beta = .95$ for eye-tracking data), as revealed by a post-hoc power analysis.

Furthermore, negative stimuli often elicit higher arousal (Rozin & Royzman, 2001) and therefore comprise higher salience in memory than positive information (Bradley, Greenwald, Petry, & Lang, 1992; Kensinger & Corkin, 2004). The chosen experimental design does not allow to clearly disentangle whether the enhanced memory retrieval is specifically due to the negative valence or might be rather explained by a greater salience of the respective information, leading to deeper processing during memory encoding. While previous work by Pratto and John (1991) found that processing of negative social information (i.e., trait descriptors) still required more attention than positive trait descriptors when controlled for salience, future studies should try to disentangle the effects of valence and salience on enhanced memory retrieval.

Although our experimental design explicitly tested memory retrieval, the observed effects can be caused by differences in memory storage, as well as differences in retrieval processes. We ensured that all participants memorized the adjectives before the retrieval phase started, but cannot rule out differences in memory storage. Since our experiment utilized a short retention interval, further studies should also investigate the positive-negative asymmetries for social information with regard to longer retention intervals (Taylor, 1991; Walker et al., 1997). Moreover, it would be useful to investigate different memory processes (i.e., storage, retrieval)

for social information more closely. Future research might also assess individual ratings of personality adjectives, which might aid our understanding of potential mediating effects on memory retrieval.

Finally, although the looking-at-nothing effect was present in the overall sample (Richardson & Spivey, 2000), there were many trials in which subjects did not look into any of the AOIs (i.e., attribute locations). This severely skewed the gaze fixation data. In addition, we were required to analyze difference scores in the fixation analyses, which had poor reliability for the looking-at-nothing effect. Consequently, the null finding regarding group differences in fixation behavior should be interpreted very cautiously. Future research should use an alternative setup for the assessment of fixation behavior that allows the definition of larger areas-of-interest.

To summarize, we found higher accuracy in an exemplary sample of patients with interpersonal dysfunction as compared to HC when negative (but not positive) person attributes had to be recalled. Exploratory analyses linked this memory bias with pathological personality traits that are of transdiagnostic relevance, namely rejection sensitivity and social detachment. With regard to eye-tracking analyses, we confirmed the presence of a looking-at-nothing effect, but found no differential effects between diagnostic groups. We conclude that increased memory performance for negative person information in patients with interpersonal dysfunction might perpetuate dysfunctional cognitive schemas, result in reduced behavioral trust, and thereby contribute to interpersonal dysfunction.

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Table 1: Demographic and clinical characteristics

	Borderline Personality Disorder (n=45)	Healthy Controls (n=36)	Statistics		
			Test-Statistic		Cohen's d [95% CI]
Demographics					
Age	29.78 (6.84)	29.86 (9.49)	W = 751,	p = .578	0.01 [-0.46; 0.43]
Education			W = 923	p = .256	
Lower secondary school	0	1			
Intermediate secondary school	14	8			
Higher education entrance qualification	19	12			
University degree	12	15			
Clinical characteristics					
BSL-23	1.78 (0.76)	0.11 (0.15)	W= 6.5,	p <.001	2.89 [2.25; 3.52]
PAI-BOR	53.91 (7.65)	13.78 (7.21)	W= 0,	p <.001	5.39 [4.42; 6.36]
Affective Instability	15.5 (2.47)	2.69 (2.68)	W= 5,	p <.001	4.98 [4.07; 5.90]
Identity Problems	14.69 (2.34)	4.28 (2.53)	W= 3.5,	p <.001	4.29 [3.47; 5.11]
Negative Relationships	13.21 (2.74)	3.92 (2.01)	W= 8,	p <.001	3.83 [3.07; 4.59]
Self-Harm	10.5 (3.68)	2.89 (2.17)	W= 53,	p <.001	2.47 [1.87; 3.07]
DSS	1.74 (0.83)	1.02 (0.06)	W= 214.5,	p <.001	1.15 [0.67; 1.63]
RSQ	14.61 (6.63)	4.38 (2.72)	W= 84.5,	p <.001	1.97 [1.42; 2.53]
Anxiety	3.93 (0.96)	1.94 (0.63)	W= 57,	p <.001	2.42 [1.82; 3.02]
Expectation	3.31 (1.02)	1.95 (0.88)	W= 1243.5,	p <.001	1.42 [0.91; 1.93]

BSL-23=Borderline Symptom List-23, PAI-BOR=Personality Assessment Inventory - Borderline Features Scale, DSS= Dissociation Tension Scale, RSQ=Rejection Sensitivity Questionnaire.

Learning Phase

Retrieval Phase

„She likes order“

Effects of valence on retrieval performance

Negative traits

Positive traits

Supplemental Material for

Enhanced memory for negative social information in Borderline Personality Disorder

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Web-based valence ratings of personality attributes

Methods

We used a web-based design that followed standards proposed for internet experimentation (Reips, 2002) and complied with APA ethical standards. Participants were recruited via social networks as well as BPD-related websites. Participants provided basic socio-demographic information, completed the German version of the Personality Assessment Inventory – Borderline (PAI-BOR, Groves & Engel, 2007), and rated 40 attributes on a five-point Likert scale (1=very positive, 2=somewhat positive, 3=neutral, 4=somewhat negative, 5=very negative). These attributes were taken from a well-validated adjective marker set (Saucier, 2002).

Statistical Analysis

We analyzed N=123 participants (78.3% female), who needed 7.02 ± 2.01 minutes to provide the respective answers. On average, participants were 30.92 ± 9.76 years old and had a mean score of 38.46 ± 3.97 points on the PAI-BOR. Participants recruited from BPD-related websites had higher PAI-BOR scores than participants recruited via social networks ($t_{62.66} = 3.26$, $p = .002$, Cohen's $d = 0.70$). In our sample, 61% of the participants scored above or equal to the cut-off of 38 points on the PAI-BOR indicating clinically significant borderline features.

Descriptive results of all adjectives are reported in Supplemental Table 1. Based on the evaluation of the participants, we selected 35 adjectives for use in the main experiment. We also analyzed whether individual borderline features had systematic effects on the valence ratings. Mixed models with ratings scores of the positive or negative adjectives as the dependent variable showed no significant effects of dimensional (PAI-BOR score; all p 's

>.40) or categorical (high or low PAI-BOR score; all p 's > .41) predictors of borderline features and ratings scores of the items as the dependent variable.

Finally, we analyzed whether lexical features of the adjectives differ between valence categories. The respective information was extracted from <https://dlexdb.de>. In particular, we analyzed the number of letters and syllables, the log10 normalized word form frequency, the normalized cumulative bigram frequency, and the normalized number of orthographic neighbours. The descriptive information for these features is provided in Supplemental Table 2. None of the Wilcoxon rank sum tests was significant (all p 's > .20).

Supplemental Table 1: Descriptive results of web-based valence ratings for each attribute

Items (german)	Items (english)	N	Mean	SD	Median	IQR	Skewness	Kurtosis
aengstlich	anxious	123	3.805	0.938	4	1.0	-0.861	3.674
anspruchslos	undemanding	123	3.285	1.156	3	2.0	-0.250	2.122
besorgt	fearful	123	2.984	1.101	3	2.0	-0.153	2.102
desorganisiert	disorganized	123	4.041	0.853	4	1.0	-0.952	4.365
effizient	efficient	123	2.236	1.033	2	2.0	0.368	2.168
empfindlich	touchy	123	3.520	1.133	4	1.0	-0.644	2.623
extrovertiert	extraverted	123	2.772	1.158	3	1.5	0.324	2.345
fordernd	demanding	123	3.902	1.028	4	2.0	-0.487	2.057
freundlich	kind	123	1.390	0.609	1	1.0	1.518	5.204
gefuehlsbetont	emotional	123	2.341	1.039	2	1.0	0.692	3.034
gelassen	unexcitable	123	1.805	0.796	2	1.0	0.851	3.886
gereizt	fretful	123	4.496	0.729	5	1.0	-1.838	7.607
gespraechig	talkative	123	2.285	1.105	2	2.0	0.481	2.170
introvertiert	introverted	123	3.089	0.914	3	1.0	-0.113	3.047
kreativ	creative	123	1.455	0.781	1	1.0	1.804	6.194
kuehl	cold	123	3.943	1.002	4	1.5	-1.013	3.800
kuehn	bold	83	2.566	0.886	3	1.0	0.010	2.269
kuenstlerisch	artistic	123	1.780	0.795	2	1.0	0.607	2.422
mitfuehlend	sympathetic	123	1.407	0.838	1	1.0	2.647	10.422
mitleidslos	unsympathetic	83	4.434	0.940	5	1.0	-1.760	5.414
nachlaessig	careless	123	4.350	0.653	4	1.0	-0.674	3.228
neidlos	unenvious	123	2.130	1.056	2	2.0	0.453	2.121
nervoes	nervous	123	3.943	0.813	4	0.0	-0.632	3.144
ordentlich	neat	123	2.057	0.926	2	2.0	0.447	2.261
organisiert	organized	123	2.057	1.027	2	2.0	0.707	2.747

philosophisch	philosophical	123	2.301	0.914	2	1.0	0.083	2.126
planlos	unsystematic	123	4.114	0.802	4	1.0	-0.878	4.140
planvoll	systematic	123	1.984	0.839	2	1.5	0.615	3.274
praktisch	unreflective	123	1.967	0.839	2	1.0	0.646	3.328
reserviert	reserved	123	3.602	0.866	4	1.0	-0.354	3.180
ruhig	quiet	123	2.041	0.970	2	2.0	0.514	2.208
schlicht	simple	123	3.041	1.019	3	2.0	-0.128	2.727
schludrig	sloppy	123	4.276	0.761	4	1.0	-0.732	2.818
schroff	harsh	123	4.407	0.788	5	1.0	-1.559	5.930
schuechtern	shy	123	3.138	0.881	3	1.0	-0.489	2.973
selbstbeobachtend	introspective	123	2.244	1.089	2	2.0	0.423	2.181
tiefgruendig	deep	123	1.699	0.839	2	1.0	1.364	5.390
ungehenmt	unrestrained	123	3.228	1.172	3	2.0	-0.051	1.990
vielschichtig	complex	123	2.024	1.020	2	2.0	0.696	2.732
warm	warm	123	1.496	0.706	1	1.0	1.350	4.387

Supplemental Table 2: Descriptive results of lexical features summarized for negative and positive attributes

Lexical feature	Index	Negative	Positive
Number of letters	Mean	8.824	9.889
	SD	2.789	3.160
Number of syllables	Mean	2.471	2.889
	SD	1.068	0.963
normalized number of orthographic neighbours (Coltheart definition)	Mean	1.385	1.451
	SD	1.479	2.712
log10 normalized word form frequency	Mean	0.190	0.337
	SD	0.902	1.080
normalized cumulative bigram frequency (in corpus)	Mean	413.194.283	362.944.975
	SD	219.619.529	197.593.652

Supplemental Table 3: Descriptive results for each domain and facet of the Personality Inventory for DSM-5 (PID-5)

	Scale	Mean	SD
domain	Negative affectivity	24.61	4.89
domain	Antagonism	10.50	7.42
domain	Detachment	15.73	5.78
domain	Disinhibition	20.08	5.16
domain	Psychoticism	13.97	5.54
facet	Restricted affectivity	3.68	2.7
facet	Anhedonia	5.83	2.78
facet	Anxiousness	7.18	2.15
facet	Attention seeking	5.24	3.14
facet	Callousness	1.82	2.08
facet	Deceitfulness	4.13	3.73
facet	Depressivity	6.68	2.85
facet	Distractibility	8.08	2.75
facet	Eccentricity	7.42	2.69
facet	Grandiosity	2.34	2.39
facet	Hostility	7.18	2.53
facet	Impulsivity	7.47	2.19
facet	Intimacy avoidance	4.37	3.51
facet	Irresponsibility	4.53	2.7
facet	Emotional lability	9.68	1.89
facet	Manipulativeness	4.03	3.04
facet	Perceptual dysregulation	3.34	2.07
facet	Rigid perfectionism	6.82	2.64
facet	Perseveration	5.97	2.66
facet	Risk taking	6.11	2.53
facet	Separation insecurity	7.74	3.43
facet	Submissiveness	6.32	3.00
facet	Suspiciousness	5.34	3.00
facet	Unusual Beliefs & Experiences	3.21	2.37
facet	Withdrawal	5.53	2.58

Note, this scale was assessed in patients with borderline personality disorder only (n=38)

Supplemental Table 4: Estimated marginal recall probabilities for valence and group

Valence category	Index	HC	BPD
Negative	Probability	.67	.76
	SE	.05	.04
Positive	Probability	.71	.70
	SE	.05	-.05

Supplemental Table 5: Estimated marginal recall probabilities for big-5 dimension and group

Big-5 category	Index	HC	BPD
Agreeableness	Probability	.69	.81
	SE	.04	.03
Conscientiousness	Probability	.68	.68
	SE	.04	.04
Extraversion	Probability	.64	.76
	SE	.05	.04
Neuroticism	Probability	.59	.61
	SE	.05	.05
Openness	Probability	.75	.67
	SE	.04	.04

Supplemental Table 6: Descriptive statistics for attribute valence per item and group

Trial	Corresponding Statement Recall	Attribute	Valence	Big-5	HC		BPD	
					Mean	SD	Mean	SD
1	She takes everything very seriously at work.	careless	negative	conscien	0.75	0.44	0.80	0.40
2	She has no difficulty in understanding abstract ideas.	deep	positive	open	0.42	0.50	0.31	0.47
3	She often forgets to return things to their place.	neat	positive	conscien	0.75	0.44	0.78	0.42
4	She is quiet among strangers.	unrestrained	negative	extra	0.81	0.40	0.91	0.29
5	She insults people.	harsh	negative	agree	0.61	0.49	0.87	0.34
6	She is easy to stress.	nervous	negative	neuro	0.67	0.48	0.67	0.48
7	If she promised to do me a favor, she would keep it.	unsystematic	negative	conscien	0.53	0.51	0.60	0.50
8	She is full of ideas.	creative	positive	open	0.83	0.38	0.82	0.39
9	If I told her what I was afraid of, she would not think my fears were stupid.	warm	positive	agree	0.81	0.40	0.82	0.39
10	She gets upset easily.	touchy	negative	neuro	0.44	0.50	0.49	0.51
11	She's always prepared.	systematic	positive	conscien	0.67	0.48	0.62	0.49
12	If she thought that I had not handled a situation properly, she would not criticize me in front of other people.	harsh	negative	agree	0.64	0.49	0.80	0.40
13	She has a rich vocabulary.	complex	positive	open	0.81	0.40	0.78	0.42
14	She does not talk much.	quiet	positive	extra	0.69	0.47	0.82	0.39
15	She is in such a way that others feel comfortable in her presence.	kind	positive	agree	0.89	0.32	0.93	0.25
16	She likes order.	disorganized	negative	conscien	0.47	0.51	0.62	0.49
17	I could confide in her with the certainty that she wants to listen to me.	cold	negative	agree	0.56	0.50	0.73	0.45

18	If she knew what things hurt my feelings, I would not be afraid that she would use them against me.		positive	agree	0.31	0.47	0.42	0.50
19	She is easily disturbed.	sympathetic	positive	neuro	0.56	0.50	0.33	0.48
20	If we agreed to meet for lunch, I would be sure she would come.	organized	positive	conscien	0.78	0.42	0.62	0.49
21	She makes plans and sticks to them.	unsystematic	negative	conscien	0.75	0.44	0.71	0.46
22	She is relaxed most of the time.	anxious	negative	neuro	0.56	0.50	0.80	0.40
23	She is not worried about others.	warm	positive	agree	0.61	0.49	0.80	0.40
24	She spends time thinking about things.	introspective	negative	open	0.75	0.44	0.62	0.49
25	She is not interested in other people's problems.	sympathetic	positive	agree	0.81	0.40	0.80	0.40
26	She pays attention to detail.	sloppy	negative	conscien	0.75	0.44	0.76	0.43
27	She is messy.	organized	positive	conscien	0.64	0.49	0.53	0.50
28	She does not like to draw attention to herself.	quiet	positive	extra	0.42	0.50	0.53	0.50
29	I could speak freely to her knowing that she wants to listen to me.	kind	positive	agree	0.89	0.32	0.96	0.21
30	She talks at parties with a lot of different people.	reserved	negative	extra	0.39	0.49	0.56	0.50
31	She rarely feels with others.	cold	negative	agree	0.53	0.51	0.69	0.47
32	She gets angry fast.	fretful	negative	neuro	0.83	0.38	0.82	0.39
33	She has good ideas.	unreflective	positive	open	0.67	0.48	0.53	0.50
34	She usually has little to say.	talkative	negative	extra	0.81	0.40	0.84	0.37
35	She has a good imagination.	artistic	positive	open	0.92	0.28	0.87	0.34

Agree=agreeableness, conscien=conscientiousness, extra=extraversion, neuro=neuroticism, open=openness