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Emotional Lability and Affective Synchrony in Borderline Personality Disorder

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Abstract

Extant research on emotional lability in borderline personality disorder (BPD) has focused almost exclusively on lability of individual emotions or emotion types, with limited research considering how different types of emotions shift together over time. Thus, this study examined the temporal dynamics of emotion in BPD at the level of both individual emotions (i.e., self-conscious emotions [SCE], anger, and anxiety) and mixed emotions (i.e., synchrony between emotions). One hundred forty-four women from the community completed a diagnostic interview and laboratory study involving five emotion induction tasks (each of which was preceded and followed by a 5-min resting period or neutral task). State ratings of SCE, anger, and anxiety were provided at 14 time points (before and after each laboratory task and resting period). Hierarchical linear modeling results indicate that women with BPD reported greater mean levels of SCE and Anxiety (but not Anger), and greater lability of Anxiety. Women with BPD also exhibited greater variability in lability of all three emotions (suggestive of within-group differences in the relevance of lability to BPD). Results also revealed synchrony (i.e., positive relations) between each possible pair of emotions, regardless of BPD status. Follow-up regression analyses suggest the importance of accounting for lability when examining the role of synchrony in BPD, as the relation of SCE-Anger synchrony to BPD symptom severity was moderated by Anger and SCE lability. Specifically, synchronous changes in SCE and Anger were associated with greater BPD symptom severity when large shifts in SCE were paired with minor shifts in Anger.

Keywords

Borderline Personality Disorder; Emotional Lability; Affective Synchrony; Self-Conscious Emotion; Anger

Problems in emotional functioning are a key characteristic of borderline personality disorder (BPD) pathology. Although various forms of emotional dysfunction are considered relevant

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to BPD (including heightened emotional intensity and difficulties regulating emotions; e.g., Beblo et al., 2013; Bornovalova et al., 2008; Koenigsberg et al., 2002; Linehan, 1993; Rüsch, Lieb et al., 2007), emotional lability (i.e., intense, frequent, and reactive shifts in emotions) is considered one of the core traits underlying this disorder (e.g., APA; 2013; Conklin, Bradley, & Westen, 2006; Gunderson, Zanarini, & Kisiel, 1996; Skodol et al., 2002). The marked reactivity in emotions that characterizes this trait is expected to result in sudden shifts in emotion across situations and over time (e.g., Koenigsberg, 2010).

To date, the majority of research on emotional lability in BPD has focused on unpleasant emotions in general (e.g., overall negative affect) or specific emotions individually. At these levels, there is considerable evidence that heightened lability of emotions is prominent in BPD (e.g., Santangelo, Bohus, & Ebner-Priemer, 2014; Tragesser, Solhan, Schwartz-Mette, & Trull, 2007). For instance, individuals with BPD have been found to report greater fluctuation in their mood both within and across days in a two-week daily diary study than healthy controls or individuals with depression (Cowdry, Gardner, O'Leary, Leibenluft, & Rubinow, 1991), and to exhibit higher levels of lability than healthy controls in an intensive 24-hour ambulatory assessment study (Ebner-Priemer, et al., 2007). Moreover, individuals with BPD report greater lability of anger and anxiety than individuals with other forms of personality pathology (e.g., Koenigsberg et al., 2002).

Notably, despite the large body of research on emotional lability in BPD, research at the level of mixed emotions (i.e., two or more emotions experienced together; see Larsen & McGraw, 2011) that investigates how specific types of emotions operate in relation to one another is sparse. Given that mixed emotions are a common response to numerous stimuli (e.g., meaningful life events, music; Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008; Hunter, Schellenberg, & Schimmack, 2008), research on emotional lability in BPD needs to explore the extent to which different types of emotions shift together over time. Thus, this study examined the temporal dynamics of shifts in various unpleasant emotional states in BPD, exploring the importance of and interplay between changes in various types of emotions over time.

More specifically, this study focuses on *affective synchrony* between different types of unpleasant emotions. To date, the affective synchrony literature has focused on the positive covariation of pleasant and unpleasant emotions over time (e.g., happiness with sadness, general positive affect with general negative affect; see Rafaeli, Rogers, & Revelle, 2007). Synchrony occurs when changes in pleasant emotions are experienced alongside changes in unpleasant emotions *in the same direction* (e.g., increases in pleasant emotion with increases in unpleasant emotion); by contrast, changes in pleasant emotions that are experienced alongside changes in unpleasant emotions *in the opposite direction* are said to reflect de-synchrony, and a lack of covariation between pleasant and unpleasant emotions to represent a-synchrony. There is no reason to assume, however, that these shared and unshared patterns of change can only occur in pleasant-unpleasant mixtures. Indeed, given the prominence of unpleasant emotional experiences in BPD, exploration of affective synchrony between similarly valenced emotions is especially important.

Very little is known about the role of affective synchrony in clinical difficulties or its relation to psychiatric problems. Only two studies to date have examined affective synchrony in BPD. In the first, Coifman, Berenson, Rafaeli, and Downey (2012) found that individuals with BPD have more polarized emotional responses to stressors, indicating fewer mixed pleasant-unpleasant emotion reactions (i.e., high de-synchrony). More recently, Scott and colleagues (Scott, Stepp, Hallquist, Whalen, Wright, & Pilkonis, 2015) found that in-the-moment experiences of shame occurred concurrently with experiences of hostility among adolescent girls with elevated BPD pathology, though only at average levels of socioeconomic status. However, further research examining synchrony of similarly valenced mixtures within BPD is needed.

Although individuals with BPD may exhibit dysfunction related to a range of unpleasant emotions, research suggests the particular relevance of certain types of emotions to BPD, including self-conscious emotions (SCE) and anger-related emotions (e.g., Berenson, Downey, Rafaeli, Coifman, & Paquin, 2011; Gadassi, Snir, Berenson, Downey, & Rafaeli, 2014; Peters, Geiger, Smart, & Baer, 2014; Scheel, Schneid, Tuescher, Lieb, Tuschen-Caffier, & Jacob, 2013). Unpleasant SCE include shame and guilt – emotions that are elicited when individuals negatively evaluate their personal characteristics and/or behavior (cf. Tangney & Tracy, 2012). Individuals with BPD are thought to be highly prone to SCE and to have considerable difficulty regulating SCE adaptively (Rizvi, Brown, Bohus, & Linehan, 2011). Indeed, developmental theories of BPD (e.g., Linehan, 1993; Young, 1999) assert that invalidating childhood experiences teach individuals with BPD that they are inherently “bad” and deserve to be punished – perceptions consistent with unpleasant SCE. Moreover, empirical support for a relation between BPD and unpleasant SCE is growing, with evidence of positive associations between BPD pathology and core beliefs related to shame (Jovev & Jackson, 2004), SCE in response to traumatic events (e.g., Schoenleber, Gratz, Messman-Moore, & DiLillo, 2014), and propensities for and aversions to SCE (e.g., Rüsch, Corrigan, et al., 2007; Rüsch, Lieb, et al., 2007; Schoenleber & Berenbaum, 2012a).

Anger is another emotion considered particularly relevant to BPD. Intense anger and difficulty responding adaptively to anger is a key symptom of BPD (APA, 2013), and anger lability has been found to distinguish BPD from other co-occurring disorders (e.g., Henry et al., 2001; Koenigsberg et al., 2002). For instance, abrupt shifts in hostility in a daily diary study were more strongly associated with BPD pathology than depressive symptomatology (Trull et al., 2008). Additionally, individuals with (vs. without) BPD have been found to report greater anger in response to daily interactions (Stepp, Pilkonis, Yaggi, Morse, & Feske, 2009), as well as stronger and longer lasting anger in response to laboratory inductions (Jacob et al., 2008). Individuals with BPD are also prone to anger rumination (e.g., Abela, Payne, & Moussaly, 2003), which is associated with greater symptom severity (e.g., Baer & Sauer, 2011).

Importantly, theories have long suggested a relation between SCE and anger-related experiences and expressions, which may be relevant to BPD pathology. The potential for overwhelming SCE to elicit angry and hostile reactions was initially referred to as “shame-rage” or “humiliated fury” (e.g., Lewis, 1971; Scheff, 1987). More recently, researchers have identified a possible functional relationship between SCE and anger responses, theorizing

that aggressive or hostile acts sometimes serve as defensive emotion regulation strategies for shame (see Bateman & Fonagy, 2004; Schoenleber & Berenbaum, 2012b; Velotti, Elison, & Garofalo, 2014). Several existing studies support the association between SCE and anger responses (e.g., Heaven, Ciarrochi, & Leeson, 2010; Lutwak, Panish, Ferrari, & Razzino, 2001; Tangney, Wagner, Fletcher, & Gramzow, 1992; Thomaes, Bushman, Stegge, & Olthof, 2008). For example, anger and anger rumination have been found to partially mediate the relationship between shame and BPD symptoms (Peters et al., 2014), and social rejection (an experience that has been found to elicit SCE among individuals with elevated BPD pathology; see Chapman, Walters, & Dixon-Gordon, 2014) has also been found to contribute to rage responses among individuals with BPD (Berenson et al., 2011). Finally, Scheel and colleagues found that a shame-induction task also elicited sustained anger among individuals with BPD in the laboratory (Scheel et al., 2013). Thus, there is already some evidence of a functional connection between SCE and anger-related emotions in BPD pathology.

Aims of the Present Study

The overarching aim of the present study was to examine temporal dynamics of emotions in relation to BPD pathology, considering changes in types of emotions both individually and as mixed emotion experiences. Based on existing theory and research, we hypothesized that individuals with BPD would demonstrate greater emotional lability than those without BPD. We also expected that individuals with BPD would exhibit greater synchrony between SCE and anger-related emotions over time. Further, as the importance of synchrony may depend on whether each individual type of emotion is changing over time, we hypothesized that synchrony between SCE and anger would be especially relevant to BPD symptom severity when the lability of one or both of these emotions was high. Finally, to examine the specificity of SCE and anger-related emotions (and their interplay) to BPD pathology, we also examined anxiety-related emotions and their synchrony with both SCE and anger in relation to BPD diagnosis and symptom severity. Specifically, given the relevance of anxiety to BPD and the prominence of this emotion in the clinical presentation of this disorder (e.g., Gunderson & Singer, 1975; Koenigsberg et al., 2002; Snyder & Pitts, 1988), anxiety is a useful comparison emotion. However, no specific hypotheses regarding anxiety were made a priori.

Method

Participants

Participants were drawn from a large multi-site study of emotion dysregulation and sexual revictimization among young adult women (the population most at risk for sexual victimization; see Breslau et al., 1998; Pimlott-Kubiak & Cortina, 2003). The larger study includes a representative community sample of young adult women drawn from four sites in the Southern and Midwestern United States (including Mississippi, Nebraska, and Ohio). Women were recruited for a study of “life experiences and current adjustment.” Recruitment methods included random sampling from the community, as well as community advertisements.

Participants for the current study included 144 young adult women who were recruited from the Mississippi site, all of whom completed a diagnostic interview for BPD and a series of emotion-inducing laboratory tasks (see Procedures). Participants ranged in age from 18 to 25 years (M = 21.8, SD = 2.0) and were ethnically diverse (74.3% African American; 21.5% White; 2.8% Multiracial; 1.4% Latina). The majority of participants were single (87.5%).

Measures

Diagnostic interview for DSM-IV personality disorders (DIPD-IV; Zanarini, Frankenburg, Sickel, & Young, 1996)—The BPD module of the DIPD-IV was administered to obtain an interview-based assessment of BPD diagnostic status, as well as to compute a score for BPD symptom severity (i.e., the number of BPD criteria with threshold ratings). Past research indicates that the DIPD-IV demonstrates good inter-rater and test-retest reliability for the assessment of BPD (Zanarini et al., 2000), with an inter-rater kappa coefficient of .68 and a test-retest kappa coefficient of .69. All interviews were conducted by bachelors- or masters-level clinical assessors trained to reliability with the last author ($\kappa \geq .80$). Discrepancies (found in fewer than 10% of cases) were discussed as a group and a consensus was reached. Twenty-two women (15.3%) met full diagnostic criteria for BPD.

Positive and negative affect schedule (PANAS; Watson, Tellegen, & Clark, 1988)—The negative affect (NA) subscale of the PANAS was administered a total of 14 times in order to assess state levels of unpleasant emotions over the course of a laboratory session (see Procedures). The items on the NA subscale can be conceptualized as composing three specific types of emotions: (1) Self-Conscious Emotion (i.e., *ashamed, guilty*), (2) Anger (i.e., *hostile, irritable*), and (3) Anxiety (i.e., *nervous, jittery, afraid, scared*)[1] This hypothesized structure was examined using a principal components analysis using direct oblimin rotation. Results largely supported the conceptual distinctions between these types of emotion, as shown in Table 1. However, the item *jittery* cross-loaded (i.e., > .30) on both the Anger and Anxiety components, and it was therefore removed before computing Anxiety scores. Mean scores were computed for SCE, Anger, and Anxiety, respectively, for each of the 14 PANAS administrations, and these scores were used in further computations and subsequent analyses.

For the purposes of this study, we used these means to generate scores reflecting the temporal dynamics of these emotions both at an individual level (i.e., lability) and at a mixed emotion level (i.e., synchrony). Specifically, lability scores for each type of emotion were computed as the mean squared successive difference (MSSD; Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009; von Neumann, Kent, Bellinson, & Hart, 1941). Although several methods of computing lability have been proposed (e.g., flux, spin, and pulse; Moskowitz & Zuroff, 2004), MSSD is unique in that it captures three contributors to emotional lability: a) the effect of temporal dependency of scores, b) the amplitude, or degree of change, and c) the frequency of score changes. Additionally, in order to examine the interaction between temporal dynamics at the level of individual types of emotion with

[1]The PANAS-NA subscale additionally includes the items *distressed* and *upset*. As these items reflect general unpleasant emotion, rather than a specific type of unpleasant emotion, they were not used in the present study.

temporal dynamics at the level of mixed emotions, synchrony scores for each possible pair of emotions (i.e. SCE-Anger, SCE-Anxiety, Anger-Anxiety) were computed as the within-subject intraclass correlation (ICC; Shrout & Fleiss, 1979), using consistency agreement and based on responses from all PANAS administrations; all ICCs were transformed to Fisher's Z' scores for subsequent use. Thus, synchrony scores captured the degree to which two emotions changed together across the course of the laboratory session.

Procedures

All methods received prior Institutional Review Board approval. After providing written informed consent, participants completed the diagnostic interview and several questionnaires. Next, participants completed a series of emotion induction tasks (described below) that were chosen for their potential to elicit a range of emotions. Of note, neutral activities were completed between each task to allow participants to return to baseline levels of emotion prior to subsequent emotion inductions. Participants also completed the PANAS-NA subscale a total of 14 times (before and after all baseline activities and emotion inductions) in order to assess state levels of unpleasant emotions over the course of the laboratory session. Participants were reimbursed $75 for participating in the session.

Laboratory emotion induction tasks—All participants completed a total of five tasks expected to elicit emotions. Each induction was preceded and followed by a 5-min resting period or neutral task (word puzzles) to reduce carryover of emotions from one task to the next. Participants were first exposed to three video clips (3–4 min each) previously found to elicit the specific emotions of sadness ("The Champ"), fear ("Silence of the Lambs"), and amusement ("The Money Pit;" see Gross & Levenson, 1995; Orsillo, Batten, Plumb, Luterek, & Roessner, 2004). The order of presentation of the video clips was counterbalanced across participants.

For the fourth emotion induction, participants completed the Paced Auditory Serial Addition Task – Computerized Version (PASAT-C; Lejuez, Kahler, & Brown, 2003). During this task, numbers are sequentially flashed on a computer screen, and participants are instructed to sum the most recent number with the previous number (using the computer mouse to click on the correct answer). After providing each sum, the participant must ignore the sum and add the following number to the most recently presented number. If an incorrect answer is provided, or if the participant fails to provide an answer before the next number is presented, an "explosion" sound is played and the score does not change. The version of the PASAT-C used here consisted of three levels with increasingly shorter latencies between number presentations (from a 3-s latency in the first level to a 1-s latency in the final level). Because the correct answer must be provided prior to the presentation of the next number in order to obtain a point, the final level is designed to make it virtually impossible for participants to provide a correct answer prior to the presentation of the next number (thereby inducing distress). In support of its use as an emotion induction, this task has been shown to induce emotional distress in the form of anxiety, anger, frustration, and irritability among clinical (including individuals with BPD) and nonclinical samples (Bornovalova et al., 2008; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2010; Lejuez et al., 2003).

Finally, for the fifth emotion induction, participants completed the Risk Perception Survey (RPS; Messman-Moore & Brown, 2006), a computer-administered vignette depicting a sexual assault. In this task, participants are asked to imagine themselves in the situation and think about how they would respond. For the purposes of this study, only emotional reactivity to this task was examined.

Results

Affective Lability and Synchrony in BPD

Given the hierarchical nature of the dataset (i.e., assessments nested within persons), initial analyses were conducted using hierarchical linear modeling performed in HLM 7.01 (Scientific Software International, 2011). Total-sample within-person mean emotion ratings were calculated using unconditional (e.g., no predictor) two-level models. Adding an indicator variable of DIPD-IV-assessed BPD status (0 = No BPD, 1 = BPD) at level 2 provided mean emotion scores for individuals who met and did not meet BPD diagnostic criteria. Following the convention established by Raudenbush and Bryk (2001), the multiple equation form of the models with the level 2 indicator is presented below:

$$Y_{ij} = \beta_{0j} + r_{ij} \quad \text{Level 1}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{BPD Status}) + \mu_{0j} \quad \text{Level 2}$$

Within these models, Y_{ij} represents assessment i for person j and β_{0j} represents the mean for individual j. Individual means become outcomes at level 2, where γ_{00} represents the group mean for individuals who did not meet BPD diagnostic criteria and γ_{01} represents the mean change associated with meeting BPD diagnostic criteria. As shown in Table 2, participants with BPD reported significantly higher levels of SCE, $t(140) = 2.183$, $p = .03$, and Anxiety, $t(140) = 2.904$, $p = .004$, than those without BPD. However, no significant mean difference was found for Anger ($t[140] = 1.91$, $p = .06$).

Within-person lability scores were next considered using MSSD scores. Initially, squared successive difference scores (SSD; i.e., the square of $X_i - X_{i-1}$) were calculated within participants for each emotion. SSDs were entered into two level hierarchical linear models, as described above. Thus, γ_{00} represents the MSSD for individuals who did not meet BPD diagnostic criteria and γ_{01} represents the change in MSSD associated with meeting BPD diagnostic criteria. As displayed in Table 2, participants with BPD reported significantly more lability in Anxiety, $t(140) = 2.02$, $p < .05$, than those without BPD. No significant difference between groups was found for lability of SCE, $t(140) = 1.30$, $p = .20$, or Anger, $t(140) = 1.96$, $p = .05$. However, scores for all three emotions were significantly more variable in the BPD group (SCE: $Z = 11.73$, $p < .001$; Anger: $Z = 10.62$, $p < .001$; Anxiety: $Z = 19.01$, $p < .001$). In other words, regardless of average mean lability levels, women with BPD reported a wider range of lability than women without BPD.

We next considered affective synchrony, the degree to which each pair of emotions (i.e., SCE-Anger, SCE-Anxiety, Anger-Anxiety) covaried over time within individuals. To accomplish this, group mean centered level 1 predictors were added to the HLM models:

$$Y_{ij}=\beta_{0j}+\beta_{1j}(\text{Emotion2})+r_{ij} \quad \text{Level 1}$$

$$\beta_{0j}=\gamma_{00}+\gamma_{01}(\text{BPD Status})+\mu_{0j}\ \beta_{1j}=\gamma_{10}+\gamma_{11}(\text{BPD Status})+\mu_{0j} \quad \text{Level 2}$$

In this case, γ_{10} represents the within person relation between emotions 1 and 2 (e.g., between SCE and Anger) for individuals at their own mean of emotion 2, and who did not meet BPD diagnostic criteria. γ_{11} represents the change in this relation associated with meeting BPD diagnostic criteria. Results indicated positive relations between each emotion mixture in the full sample (see Table 2). However, there were no between-group differences in the relations of any pair of emotions (SCE-Anger: $\gamma = -.01$, $t[140] = -.142$, $p = .887$; SCE-Anxiety: $\gamma = -.04$, $t[140] = -.482$, $p = .631$; Anger-Anxiety: $\gamma = -.03$, $t[140] = .290$, $p = .772$), suggesting that individuals with and without BPD reported similar patterns of relations between emotions during the laboratory session.

Interplay between Lability and Synchrony in Relation to BPD Symptom Severity

Because the association between BPD pathology and synchrony may be influenced by the degree to which emotions are demonstrating change at an individual level, we conducted a series of hierarchical multiple regression analyses to examine the interactions of emotional lability and synchrony in relation to BPD symptom severity. Each analysis considered one possible pair of emotions. Specifically, MSSD scores for both of the involved emotions (i.e., their labilities) and the ICC for that pair of emotions (i.e., synchrony between the two emotions) were entered in Step 1, followed by the two-way interactions in Step 2, and the three-way interaction between the lability variables and synchrony in Step 3. The distribution of the BPD symptom severity variable was well within the acceptable range of normality for both skewness (.986) and kurtosis (.052), and all independent variables were centered prior to creating the interaction terms. Significant interactions were probed using simple slopes analyses, following Aiken and West (1991).

SCE and Anger—With regard to the analysis exploring SCE and Anger, only Anger lability was associated with BPD symptom severity in Step 1 (see Table 3). Greater Anger lability was associated with higher levels of BPD pathology. In Step 2, none of the two-way interactions were significant. However, as predicted, there was a significant three-way interaction of SCE lability, Anger lability, and SCE-Anger synchrony in Step 3. Simple slopes analyses indicated that when Anger lability was high, there was no significant association between SCE-Anger synchrony and BPD symptom severity regardless of whether SCE lability was low, $\beta = .41$, $p = .41$, or high, $\beta = -.41$, $p = .20$. However, when Anger lability was low, there was a significant negative association between SCE-Anger synchrony and BPD symptom severity when SCE lability was also low, $\beta = -1.07$, $p = .02$, but a significant positive association when SCE lability was high, $\beta = 1.38$, $p = .004$. Thus,

more synchronous changes in SCE and Anger are associated with lower levels of BPD symptoms when these emotions are relatively unchanging over time, but with higher levels of BPD symptoms when relatively large changes in SCE are paired with relatively small changes in Anger.

SCE and Anxiety—With regard to the analysis exploring SCE and Anxiety, only Anxiety lability was associated with BPD symptom severity in Step 1 (see Table 3). None the two-way interactions nor the three-way interaction were significantly associated with BPD symptom severity.

Anger and Anxiety—With regard to the analysis exploring Anger and Anxiety, only Anxiety lability was associated with BPD symptom severity in Step 1 (see Table 3), with higher anxiety lability being associated with greater BPD symptom severity. In Step 2, the two-way interaction between Anger lability and Anger-Anxiety synchrony was significant, $\beta = .19$, $p = .043$, and the interaction between Anxiety lability and Anger-Anxiety synchrony fell just short of significance, $\beta = -.19$, $p = .05$. The three-way interaction among Anger lability, Anxiety lability, and Anger-Anxiety synchrony was not significant in Step 3. Simple slopes analyses were used to probe both of the two-way interactions involving Anger-Anxiety synchrony. Results indicated that both interaction effects were driven by the fact that the associations between Anger-Anxiety synchrony and BPD symptom severity were in opposing directions when lability of Anger or Anxiety, respectively, were low versus high. More specifically, for the interaction between Anger lability and Anger-Anxiety synchrony, results revealed a negative association between Anger-Anxiety synchrony and BPD symptom severity when Anger lability was low, $\beta = -.57$, $p = .09$, but a positive association when Anger lability was high, $\beta = .44$, $p = .12$. Conversely, for the interaction between Anxiety lability and Anger-Anxiety synchrony, results revealed a positive association between Anger-Anxiety synchrony and BPD symptoms when Anxiety lability was low, $\beta = .47$, $p = .10$, but a negative association when Anxiety lability was high, $\beta = -.60$, $p = .11$. Ultimately, however, none of the associations between Anger-Anxiety synchrony and BPD symptom severity reached significance, regardless of levels of Anger lability or Anxiety lability.[2]

Discussion

The temporal dynamics of emotion appear to be important for understanding the nature of emotional dysfunction in BPD pathology. At the level of individual types of emotions, our findings are largely consistent with past work emphasizing the role of emotional lability in BPD (e.g., Koenigsberg et al., 2002; Tragesser et al., 2007), revealing greater anxiety lability over the course of the study among women with BPD (consistent with past research; e.g., Koenigsberg et al., 2002). In contrast to past findings of heightened anger lability in BPD (e.g., Henry et al., 2001; Koenigsberg et al., 2002), results revealed no differences in anger or SCE lability between women with and without BPD in our sample. However, results did

[2]Findings remained the same when controlling for the intensity of the relevant emotions (as indexed by mean levels of these emotions) in the first step of the models, with two exceptions. Specifically, the main effects of both Anger Lability in the SCE-Anger analysis and Fear Lability in the SCE-Fear analysis failed to reach significance when accounting for mean levels of the relevant emotions (βs = .14 and .22, *ps* = .19 and .059, respectively).

reveal greater variability in emotional lability across all three types of emotions among women with BPD, suggesting notable heterogeneity in the frequency and intensity of shifts in emotion within BPD. As such, findings suggest that emotional lability may be more relevant to some individuals with BPD than others.

The present study extends past research on both emotional dysfunction in BPD and mixed emotions in general by examining the temporal dynamics of similarly valenced mixtures of emotions. Contrary to our initial hypotheses, results revealed no significant between-group differences in affective synchrony, with similar patterns of relations between emotions found for women with and without BPD. Instead, our results suggest that an understanding of the relevance of synchronous emotional change in BPD may need to take into consideration the extent to which the involved emotions demonstrate change over time. Specifically, we found that synchrony between SCE and anger-related emotions was associated with lower BPD symptom severity when both of these types of emotions changed only minimally over time. By comparison, intense shifts in SCE that were paired with relatively smaller shifts in anger-related emotions were positively associated with BPD symptom severity.

Our findings regarding this particular mixed emotional experience (i.e., large shifts in SCE co-occurring with milder shifts in anger) are consistent with the literature on SCE more generally. This combination of emotions is similar to descriptions of humiliation, which involves feelings of self-consciousness and lowered worth that are attributed partly to the hostile intent or unfairness of others (see Elison & Harter, 2007). As such, humiliation seems to reflect a mixed emotional state whereby shame is elicited due to the exposure of possible flaws and anger is elicited due to a perceived attack by another person. Notably, research suggests that humiliation is associated with outcomes that are common among individuals with BPD, including aggression, self-injury, and suicidal behavior (e.g., Elison & Harter, 2007; Harter, Low, & Whitesell, 2003).

Results of this study are also consistent with theory and research highlighting the importance of anxiety to BPD (Gunderson & Singer, 1975; Koenigsberg et al., 2002; McGlashan et al., 2000; Snyder & Pitts, 1988; Tomko et al., 2014), indicating that individuals with BPD experienced frequent shifts in anxiety, in particular, over the course of the laboratory session. A possible explanation for the prominence of anxiety lability (vs. anger or SCE lability) in this study may relate to our choice of emotion inductions (three of which elicit anxiety spectrum emotions, including the “Silence of the Lambs” video clip, PASAT-C, and RPS). The fact that three of the five inductions targeted anxiety-related emotions in particular may have enhanced our ability to detect between-group differences in anxiety lability, relative to the other forms of emotional lability examined here. Regardless, given findings of the unique relation of anxiety lability to BPD symptom severity (above and beyond SCE and anger lability, respectively), research examining the temporal dynamics of anxiety specifically is warranted.

The results of this study also highlight several directions for future research on mixed emotions in psychopathology, including BPD. First, in line with the literature on humiliation, these results draw attention to the importance of examining the role of mixed emotions in the prediction of specific behaviors associated with BPD and/or other disorders.

Consistent with the concept of “shame-rage” or “humiliated fury,” mixtures of SCE and anger may be especially relevant to self-injury or hostility and aggression toward others. Second, future work should consider additional combinations of emotions; most notably, mixtures involving feelings of sadness warrant investigation in the context of BPD, given that mood disorders are highly comorbid with BPD (e.g., Tomko et al., 2014). Third, future research examining emotional lability and synchrony in naturalistic settings outside of the laboratory is needed to better understand the dynamics of emotional processes in real-life situations. Finally, further research examining mixed emotions in general in relation to clinical difficulties is needed. Indeed, affective synchrony is only one component of a mixed emotional experience, and our operationalization of affective synchrony considered only one feature of the possible temporal dynamics shared by a pair of emotions. Specifically, although affective synchrony as defined here reflected simultaneous changes in emotions, Oceja and Carrera (2009) suggest that mixed emotion processes sometimes play out in a somewhat sequential fashion. Thus, shared temporal dynamics in a mixed emotion experience may not always or only involve simultaneous changes in two emotions. Future work is needed to consider alternative patterns of related change between emotions (e.g., SCE onset preceding anger onset, then followed by simultaneous changes). In particular, although the inclusion of resting periods or neutral tasks following each emotion induction in the present study limits the carryover of emotions and precludes examination of sequential changes in emotions over the course of the study, laboratory studies combining an emotion induction with intensive ecological momentary assessment (EMA) of various emotions for 1–2 hours afterward (either in the laboratory or in the participants’ natural environment) or brief but intensive EMA studies of naturally occurring emotions may be particularly useful for determining the sequential versus synchronous nature of affective changes over time.

The present study also has some limitations that need to be addressed in future research. First, subsequent work needs to consider the role of mixed emotions in BPD among clinical samples. Although the use of a diverse community sample of women with a range of BPD symptom severity is arguably an asset of this study (as research in this area has generally focused on patient samples), it is unclear whether these findings are generalizable to patients with BPD. Moreover, extending this research to clinical samples will provide further information on the temporal dynamics of emotion and mixed emotion processes among individuals with particularly severe symptoms.

This study was also limited in its use of the standard PANAS items to assess state levels of emotion, which restricts the types of emotions we were able to examine and potentially conflates some distinct emotions. In addition to an absence of items related to sadness, the PANAS does not assess other unpleasant emotions that may be relevant to BPD in real-world contexts (e.g., jealousy). Moreover, the PANAS relies on the respondent’s pre-existing knowledge of the distinction among emotional terms. Although “guilty” and “ashamed” are often used interchangeably in common discourse, they are considered distinct emotions in the scholarly literature; similar concerns arise when considering items comprising our Anxiety subscale, which includes terms reflecting both anxiety and fear.

Finally, given that our data were drawn from another investigation, none of the tasks used were specifically designed to elicit SCE. Not including a task with high likelihood of

eliciting SCE may have limited our ability to examine the relevance of SCE-related temporal dynamics as effectively as possible. Although our use of several different emotion induction tasks with the potential to elicit a wide range of emotions was a strength, future research can improve upon the present study by including tasks that target SCE and its triggers (e.g., social rejection, ethical indiscretions) more directly, such as the O-Cam task (Goodacre & Zadro, 2010) or individualized emotional scripts (see Kuo, Neacsiu, Fitzpatrick, & MacDonald, 2014).

Despite these limitations and the need for further research on mixed emotions in BPD, our findings have potential implications for clinical intervention. In particular, they highlight the possible utility of monitoring the frequency and composition of mixed emotional states in patients. Understanding each patient's mixed emotional experiences and their interrelations may inform the selection of more effective emotion regulation strategies, as well as the prediction of likely behavioral responses. For example, the behavioral responses that follow mixed emotional experiences may differ from those enacted in response to a singular emotional experience. Chain analyses can also be used to explore the specific temporal dynamics of mixed emotional experiences for a given patient, and to distinguish between primary and secondary emotions. Moreover, although SCE are generally thought to precede anger (e.g., Peters et al., 2014; Velotti et al., 2014), there is no reason to assume that mixed emotions are experienced in this sequential fashion by all patients or that an initial emotional reaction is "finished" prior to the onset of a secondary emotional response. For example, it is possible that SCE both precede anger and change synchronously with anger over the course of time (a suggestion partially supported by the work of Scheel and colleagues, 2013). Overall, exploring the complexity of mixed emotional experiences with patients has the potential to increase patients' understanding of their own emotional experience (i.e., improve emotional clarity), as well as improve clinicians' abilities to assist patients in responding to their emotional experiences in an adaptive manner.

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Table 1

Principal Component Analysis Pattern Matrix for the PANAS Negative Affect Items

Item	SCE	Anger	Anxiety
Guilty	**.909**	−.077	.019
Ashamed	**.795**	.147	.041
Irritable	.034	**.899**	−.082
Hostile	.075	**.796**	−.014
Scared	.036	−.073	**.888**
Afraid	.033	−.067	**.881**
Nervous	.054	.113	**.743**
Jittery	−.088	**.504**	**.405**

Note: Bold print indicates significant loading on the factor; SCE = Self-Conscious Emotions.

Table 2

Associations between Emotions over Time (i.e. Synchrony) and BPD Group Differences in Emotion Means & Lability

	Synchrony			Total	No BPD[b]	BPD[c]	
	SCE	**Anger**	**Anxiety**	**Sample *M***	***M***	***M***	t***d***
Mean Levels							
SCE	--	.19**[a]	.20**[a]	1.119	1.105	1.191	2.183*
Anger		--	.32**[a]	1.491	1.452	1.728	1.914
Anxiety			--	1.278	1.230	1.538	2.904*
Lability				Total Sample γ	No BPD γ	BPD γ	
MSSD SCE				.23	.21	.37	1.30
MSSD Anger				.54	.50	.85	1.96
MSSD Anxiety				.42	.31	.50	2.02*

Note. SCE = Self-Conscious Emotions; BPD = Borderline Personality Disorder; MSSD = Mean Square Successive Difference.

[a] unstandardized HLM regression coefficients (i.e., $\beta 1_j$), representing relation between emotions.

[b] n = 122.

[c] n = 22.

[d] t = 140 for Mean Level analyses; t = 141 for Lability analyses.

* $p < .05$.

** $p < .001$.

Table 3

Summary of Regression Analyses Examining Main and Interactive Relations of Emotional Lability and Synchrony to BPD Symptom Severity

	BPD Symptoms			BPD Symptoms			BPD Symptoms	
	β	ΔR^2		β	ΔR^2		β	ΔR^2
Step 1		.08*	*Step 1*		.11**	*Step 1*		.11**
SCE Lability	.14		SCE Lability	.14		Anger Lability	.11	
Anger Lability	.21*		Anxiety Lability	.27**		Anxiety Lability	.25**	
SCE-Anger Synchrony	−.07		SCE-Anxiety Synchrony	−.12		Anger-Anxiety Synchrony	.02	
Step 2		.01	*Step 2*		.01	*Step 2*		.04
SCE Lab. x Anger Lab.	.11		SCE Lab. x Anxiety Lab.	−.06		Anger Lab. x Anxiety Lab.	.13	
SCE Lability x Sync.	.05		SCE Lability x Sync.	−.09		Anger Lability x Sync.	.19*	
Anger Lability x Sync.	−.17		Anxiety Lability x Sync.	−.03		Anxiety Lability x Sync.	−.19*	
Step 3		.08**	*Step 3*		.01	*Step 3*		.00
3-way Interaction	−.73**		3-way Interaction	−.17		3-way Interaction	.15	

Note. Lab. = Lability; Sync. = Synchrony; SCE = Self-Conscious Emotions; BPD = Borderline Personality Disorder.

* $p < .05$.

** $p < .01$.