False Memory in Borderline Personality Disorder

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Abstract

Background: Borderline Personality Disorder (BPD) is a mental disorder characterized by significant impairment in intrapersonal and interpersonal functioning, as well as patterns of personality pathology. Memory deficits are not recognized as a core symptom of BPD, but BPD patients have long been suspected to have inaccurate perceptions, disturbed memory processes, and an increased tendency to develop false memories.

Methods: In the present study, we examined whether there was an association between BPD and the production of false memories in the Deese-Roediger-McDermott (DRM) paradigm—a laboratory-based procedure that is frequently used to investigate false memory. We also compared the traditional and alternative model of BPD with respect to false memory. A total of 298 university students completed the McLean Screening Instrument for Borderline Personality Disorder, SCID-II Personality Questionnaire, Borderline Personality Disorder Impairment Scale, Personality Inventory for DSM-5, Beck Depression Inventory, Dissociative Experiences Scale, and Traumatic Life Events Questionnaire. The participants were also tested using both traditional DRM word lists as well as word lists that were specifically associated with BPD.

Results: Using the traditional diagnosis of BPD, BPD symptoms were correlated with higher false memory for positive information; in the alternative model of BPD, identity impairment and anxiousness were correlated with the overall false memory score. We also found that trauma and dissociation mediated the relation between BPD and false memory.

Conclusions: These findings are discussed in terms of how the consequences of trauma, such as dissociation and identity disturbance, are associated with false memory. Whether false memory rates are higher in a clinical population of patients with BPD remains to be determined.

Background

Borderline personality disorder (BPD) is a severe psychiatric condition characterized by a wide range of psychosocial impairments and psychopathological symptoms such as affective and behavioral instability, severe interpersonal problems, cognitive distortions and identity diffusion [1]. Decades of criticism about the diagnostic construct and categorical model of personality disorders has led to the development of an alternative model for assessment and diagnosis of personality disorders, including BPD [2]. The Alternative DSM-5 Model of Personality Disorders (AMPD [1]) is grounded in personality trait studies (e.g. [3, 4]), is focused on dimensional core features of personality disorders, and considers personality pathology on a continuum, rather than as an all-or-none phenomenon [5].

In the AMPD, BPD is defined based on two primarily dimensional criteria. Criterion A involves impairment in the functioning of the self (i.e. identity and self-directedness) and interpersonal relationships (i.e. empathy and intimacy). Criterion B is a pattern of maladaptive personality traits that include anxiousness, emotional liability, separation insecurity, hostility, depressivity, impulsivity, and risk taking

(DSM-5 [1]). In the current study, we examined whether there was a potential association between BPD, both as traditionally operationalized and as defined by the AMPD, and false memory as measured through Deese-Roediger-McDermott (DRM) paradigm [6, 7].

False memory in BPD

Although memory deficits are not recognized as a core symptom of BPD [8, 9], BPD patients have long been suspected of having inaccurate perception, disturbed memory processes, and an increased tendency to develop false memories [10, 11, 12]. In one study, for example, Bailey and Shriver [10] surveyed clinical psychologists about the likelihood that BPD patients tend to misremember prior events. Based on their clinical observations, the psychologists believed that, compared to other kinds of patients, individuals with BPD were more likely to misinterpret or misremember their perceptions and interpersonal interactions. On the basis of their data, Bailey and Shriver argued that some BPD symptoms (e.g. transient, stress-related paranoid ideation or severe dissociative symptoms) make the encoding and objective reporting of events difficult.

In addition to clinicians' experience, there are also other reasons that might lead us to suspect that individuals with BPD might have altered memory processing. Figure 1 provides a list of variables that are associated with BPD. For example, individuals with BPD display dissociative symptoms [13], attention deficits [14], emotion dysregulation [15], and identity impairment [16]. Individuals with BPD also typically have experienced trauma [17] that can result in posttraumatic stress disorder (PTSD [18]) and depression [13]. As we will outline below, many of these same variables have also been shown to interfere with memory.

One strategy to establish a link between psychopathology and false memory has been to identify disorders that are characterized by emotion dysregulation and deficits in emotional memory retrieval (e.g. BPD, antisocial personality disorder/psychopathy). When individuals with these disorders have been asked about their emotionally-negative memories, they have been shown to display less automatic associative activation in their knowledge base than do individuals without these disorders (for review see [19]).

Considering Figure 1 more carefully, more than 70% of BPD patients have experienced early childhood trauma [17] and 46–56% of them also have PTSD [18, 20]. Given this high co-morbidity, some authors have proposed including BPD in the list of 'trauma-related disorders' [21] and some view PTSD and trauma-related disorders as a disorder of memory [22, 23], emphasizing the importance of memory in the maintenance of psychopathology. Based on Otgaar et al. [19], one prediction would be that PTSD, or a trauma history can make individuals more vulnerable to the creation of false memories [19, 24].

In addition to trauma, up to 75% of BPD patients also suffer from dissociative symptoms, with disturbances in perception and of cognition, including memory [25, 26].

It has been argued that dissociation is correlated with increased false memories and may impede the encoding and retrieval of events [10].

Moreover, the lifetime prevalence rates of depressive and anxiety disorders in BPD patients is estimated to be 85% [27], and even after treatment, 61% of BPD patients meet criteria for major depression [28]. BPD patients also ruminate [29], and the existing literature shows that both depression severity and rumination are negatively related to memory specificity in BPD patients. These findings suggest that the more severe an individual's depressive symptoms are, and the more that individual ruminates, the less capable they are of retrieving specific autobiographical memories [13] and the more readily they generate negative false memories [30]. Despite the logic of the argument for a relation between history of trauma, dissociative experiences, and depressive symptoms and false memories, the research findings regarding false memory susceptibility in these conditions has been inconsistent (see online supplement for a summary of studies that have investigated the link between false memories and BPD-related symptomology). In some studies, researchers have reported a link between heightened levels of false memories and PTSD (e.g. [31]), depression (e.g. [32]), dissociative experiences (e.g. [33]), while in other studies, they have not (e.g. [34]).

One of the most frequently-used paradigms to investigate spontaneous false memories is the Deese/Roediger–McDermott (DRM) paradigm [6, 7]. In this paradigm, participants are presented with lists of words (e.g. bed, rest, pillow, night, etc.) that are all semantically linked to a non-presented critical lure word (e.g. sleep). The typical outcome during a subsequent memory test is that participants often falsely recall and/or recognize the non-presented critical lure word. More specifically, false recall or recognition may occur when participants confuse internally-generated items (critical lure words) with externally-presented items (studied words). Activation (during encoding) and reactivation (during retrieval) of the critical lure word enhance its familiarity, leading to a heightened vulnerability to DRM-induced false memories [35].

Research regarding the susceptibility of BPD patients to false memory errors in the DRM paradigm is scarce. In one study, Schilling et al. [12] examined false memory susceptibility in individuals with BPD using a visual version of the DRM paradigm. Participants diagnosed with BPD and control participants were shown two black and white images and asked to remember as many details as possible from the images. One image depicted a beach scene (a positive image), while the other depicted a surveillance scene (a negative image). The images were later presented with additional details added to them (e.g. a towel where there previously was no towel). Participants were asked whether certain details were old or new, and to rate the level of confidence they had for the decision of whether a detail was old or new. Individuals with BPD and controls showed similar rates of false memories (i.e. remembering a detail that was not previously in the image), however, individuals with BPD were more confident when deciding that details were new. To the best of our knowledge, there has been no other research on false memory susceptibility in individuals with BPD using the DRM or any other false memory paradigm.

Aims

The goals of the present research were three-fold. First, we examined whether individuals who score high on the traditional BPD scale are more prone to producing false memories. Second, because there is a clear need to compare the utility of the dimensional approach with the categorical approach to operationalizing BPD [36], we compared the relation between the traditional and AMPD operationalization of BPD and the production of false memory. Third, we examined whether individuals who score high on the BPD are more prone to producing false memory for neutral information or for information that is more related to the BPD construct (e.g. trauma-related). Finally, we examined whether BPD indirectly predicts the creation of false memory through the mediating role of particular BPD-related symptoms (i.e. depression, traumatic experiences, and dissociation).

Methods

In the present study, we conducted three independent experiments to examine false memory susceptibility in BPD. First, we conducted two preliminary experiments to construct BPD-related DRM word lists that were consistent with the clinical description of BPD (see online supplementary materials for more details). Having compiled BPD-related wordlists, we then conducted the main experiment in which we examined false memory in BPD for these word lists as well the more standard word lists that are commonly used in the DRM paradigm. Below, we describe the methodology for the main experiment; the details of the two preliminary experiments that we conducted to develop the word lists are available as online supplementary materials.

Participants

A total of 300 undergraduate students were recruited for this experiment via an online recruitment database. All participants were required to be native speakers of English: two participants were excluded from the experiment because they did not meet this criterion. The final sample (N = 298) consisted of 211 females (M age = 21.22 years; SD = 3.12) and 87 males (M age = 21.55 years; SD = 3.80); no participants identified as gender-diverse. Participants identified as New Zealand European (66.4%), Māori (4.7%), Asian (13.8%), or "Other" (19.8%), which included those of other European descent. Using embedded validity indicators, no participants were excluded from the experiment due to suspected random or noncontent-based responding. All participants provided written, informed consent; and were tested individually using online Qualtrics (www.qualtrics.com) and E-Prime (Psychology Software Tools, Inc., 2012) software. They were reimbursed $40 NZD for their time. The research was reviewed and approved by the University's Human Ethics Committee (Health).

Self-Report Measures

Descriptive statistics for each scale score appear in Tables 1 and 2.

McLean Screening Instrument for Borderline Personality Disorder (MSI-BPD). The MSI-BPD [37] is a 10-item yes/no questionnaire designed to assess the symptoms of borderline personality disorder. Responses are summed to create an overall score ranging from 0–10 with higher scores indicating a

greater experience of symptoms of borderline personality disorder. Although the MSI-BPD is as a continuous measure, a cut-off score of 7 has been used to identify individuals experiencing significant subthreshold symptoms of BPD [37]. The MSI-BPD is frequently used in research and has good psychometric properties. Reliability analysis (Cronbach's α) indicated adequate internal consistency (α = .74).

SCID-II Personality Questionnaire (SCID-II). The SCID-II [38] is a 119-item true/false questionnaire designed to assess 10 personality disorders according to the DSM-IV diagnostic criteria. In the current study, only the BPD scale from the SCID-II was used; the BPD scale consists of 15 items and was initially designed as a screening device [39] for BPD based on the DSM-IV [40]. Responses are summed to create an overall score ranging from 0−15 with higher scores indicating a greater experience of symptoms of BPD. A cut-off score of 6 or greater is frequently used to identify individuals experiencing significant subthreshold symptoms of BPD [41]. Reliability analysis (Cronbach's α) indicated adequate internal consistency for the BPD sub-scale (α = .79).

Borderline Personality Disorder Impairment Scale(BPD-IS). The BPD-IS [42] is an 11-item self-report rating scale developed to assess BPD impairment according to DSM−5 Section III Criterion A. Based on the Section III model, there are two broad domains (self, interpersonal) and four scales (identity, self-direction, empathy, intimacy) of functional impairment. Accordingly, in each of the four scales, individuals rate their level of functional impairment on several items which represent the four traits of functional impairment included in the DSM−5 Section III model. Participants indicated how much they agreed with 5 items. Each item asks individuals to choose one of five statements of ascending severity ranging from 0 (*no impairment*) to 4 (*extreme impairment*). Responses are averaged, with higher scores indicating greater levels of self- and interpersonal impairment [42]. Reliability analysis (Cronbach's α) indicated adequate internal consistency for total score (α = .79). Due to brevity of the items in each subscale, we did not calculate internal consistency for the subscales.

Personality Inventory for DSM-5 Short Form (PID-5-SF). The PID-5-SF [43] is a 100-item self-report inventory, that was extracted from the original 220-item PID-5 [44], developed to assess the five DSM−5 Section III personality domains and their respective traits found in Criterion B. PID-5-SF covers the 25 personality traits facets as well as the five DSM-5 Section III personality domains (Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism). Participants are asked to rate the extent to which they agree with each item using a Likert scale ranging from 0 (*very false or often false*) to 3 (*very true or often true*). The PID-5 is frequently used in research and has good psychometric properties (e.g. [45]). Reliability analysis (Cronbach's α) indicated good internal consistency for each trait scale (α's = .80 for *hostility* and *separation insecurity*; .84 for *impulsivity* and *risk-taking*; and .86 for *anxiousness*, *emotional liability*, and *depressivity*).

Beck Depression Inventory (BDI). The BDI [46] is a 21-item questionnaire developed to assess multiple aspects of depression, including cognitive, emotional, behavioral, and physical domains. For each item on the BDI, participants selected from one of four statements. Items were summed to create an overall

score ranging from 0-63 with a higher score indicating greater experiences of symptoms of depression. A score of 10 or more is considered indicative of clinically significant levels of depressive symptoms [46]. Reliability analysis (Cronbach's α) indicated good internal consistency (α = .91).

Dissociative Experiences Scale (DES). The DES [47] is a 28-item self-report questionnaire developed to measure dissociative experiences. Each item describes a kind of experience that the subjects may have had. Participants rate their agreement with each item using a 10-point scale (Never = 0% to Always = 100%). Items are summed to create a total score. The total is multiplied by 10, then divided by 28 to calculate the average score. Studies have shown that a score higher than 15 needs more investigation to diagnose dissociation, a score higher than 30 indicates the high probability of dissociative disorders and PTSD, and scores over 40 express high probability of dissociative identity disorder [47]. Reliability analysis (Cronbach's α) indicated good internal consistency for the total score (α = .93).

Traumatic Life Events Questionnaire (TLEQ). The TLEQ [48] is a 23-item yes/no questionnaire assigned to assess the history of 22 potentially traumatic events (ranging from physical abuse, being stalked, or robbery involving a weapon, to exposure to warfare) and a 23rd category of "other events" with examples. For every event that is endorsed, participants are asked to answer questions about the event's frequency (ranging from "never" to "more than 5 times"), the severity of the traumatic experience based on DSM-IV diagnostic criteria (i.e. whether they felt intense fear, helplessness, or horror during the event), and characteristics of perpetrator (e.g. stranger, relative). Participants are also asked to nominate the event that caused them the most distress and their age when the event first and last occurred.

Validity indicator. Given that these data were collected on computer and that none of the measures used in this study had built-in validity indicators, it was important to determine if individuals were responding appropriately to the item content (i.e. not randomly responding). For this reason, we distributed a series of questions throughout the protocol, to which most individuals should respond in a non-affirmative way, such as "Do you live on Mars?" or "I am allergic to water." None of the participants were excluded based on their responses to the validity indicator questions.

False memory (DRM) task: material and procedure

We used 12 word lists in the DRM task (3 each for BPD-related, trauma-related, negative, and positive lists). The BPD-related word lists (e.g. Loneliness, Self-harm) were chosen based on the findings of our preliminary experiment to develop DRM word lists for BPD (see online supplementary materials). Two each of the negative (e.g. Lie, Sick) and positive (e.g. Happy, Nice) lists were taken from Zhang et al. [49] and one each from Palmer and Dodson [50]; the trauma-related lists (e.g. Rape, Sex) were taken from Goodman et al. [51]. Each word list was 10-words long and the words on each list were shown in the same serial order to all participants. All of the words in each word list were shown in the descending order of their BAS values so that the first word on the list was the one most associated with the critical lure, the second word was the one next most associated, and so on.

We used E-Prime to present participants with the word lists (120 words in total). Prior to conducting the experiment, the experimenter explained the procedure and then participants completed a neutral-word practice list. The presentation order of the word lists was partially counterbalanced across participants; that is, half of the participants learned the three BPD-related word lists, followed by the three positive lists, the three trauma-related lists, and the three negative word lists, and the other half of the participants learned the word lists in the reverse order (see also [49]). Each word was presented for 2 seconds on the computer screen and after all of the words in the word list were presented, a message came up warning the participant that the next word list was about to appear. Participants were asked to remember all 12 word lists. Between the learning phase and the test phase, participants completed a 5-minute subtraction exercise.

Following Zhang et al. [49], the recognition test contained 36 studied words from serial positions 1, 4, and 8 of each word list; and 36 non-studied words. The non-studied words consisted of 12 critical lures and 24 non-related lures that were unrelated to any list words; the positive and negative non-related lures were taken from Brainerd et al. [52] and the neutral ones were taken from Roediger et al. [53]. The presentation order of the 72 test words was completely random. Participants were asked to make an "Old" decision if they thought a word had been presented in the study phase and to make a "New" decision if they thought a word had not been presented in the study phase.

Analytic strategy

We analyzed all of the data using IBM SPSS Statistics 25 (IBM, USA) and Hayes' (2018) PROCESS macro v3.4 for SPSS. For all of the analyses, $p < .05$ was set as the level of significance. The findings of the current study are presented in two major sections. In the first section, we conducted a series of bivariate correlations to examine false memory in 1) the traditional model of BPD, as the index of full disorder of BPD (i.e. SCID-II and MSI-BPD), and 2) BPD impairment in personality functioning (i.e. Criterion A), as well as 3) BPD personality traits (i.e. Criterion B), as the indices of AMPD-BPD. In the second section, we tested four separate mediation models to examine the indirect effect of BPD on false memory. To do this, we used Hayes' PROCESS to run a series of simple mediation models (Model 4, 10,000 bootstrap resamples); statistical significance for an indirect effect is assumed if zero is not included in the bias-corrected 95% confidence interval for the indirect effect.

Results

The descriptive statistics and acorrelations between the traditional and AMPD indices of BPD and participants' false recognition rates are shown in Table 1. With respect to traditional BPD scores, we found a positive relation between false memory for positive word lists and participants' scores on the SCID-II and MSI-BPD. With respect to the AMPD-BPD Criterion A impairment facets, identity impairment was correlated with overall false memory in general, and with BPD-related as well as trauma-related false memory, in particular. Examining AMPD-BPD Criterion B, only Anxiousness was correlated with overall false memory.

Next, we examined whether BPD was indirectly associated with false memory through the mediating roles of depression, traumatic experiences, and dissociation. For this purpose, first, we conducted a series of bivariate correlations between participants' false memory and their scores on BPD-related variables including depression, trauma, and dissociation (see Table 1). As shown in Table 1, there were no correlations between depression symptoms and false memory on any type of word list. There was, however, a significant positive correlation between false memory and participants' history of traumatic experiences and dissociation.

Analysis of indirect effects. Next, we examined whether BPD was indirectly associated with false memory through the mediating roles of dissociation and traumatic experiences (Figure 2). Because depression was not correlated with false memory on any of the word lists, we did not include it in the models. In four separate models, we tested whether BPD (as measured by SCID-II) and false memory on each of the four word lists was indirectly associated via scores on the measures of dissociation and traumatic experiences. Figure 2 illustrates the hypothesized mediation model of BPD and false memory.

Not surprisingly, participants' scores on the SCID-II was a strong predictor of their scores on the dissociation (ß = .50, $p < .001$) and traumatic experiences (ß = .36, $p < .001$) scales. Furthermore, dissociation contributed significantly to the prediction of BPD-related false memory (ß = .15, $p < .05$) and traumatic experiences contributed significantly to the prediction of negative false memory (ß = .16, $p < .05$). Regarding the indirect effects, we found that the effect of BPD (as measured by SCID-II) on false memory was mediated by dissociation (ß = 0.07, 95% CI = 0.007, 0.151) for BPD-related word lists, and was mediated by traumatic experiences (ß = 0.05, 95% CI = 0.013, 0.110) for negative word lists. Table 2 shows the path standardized coefficients, p-values, and confidence intervals for mediation models.

Discussion

To the best of our knowledge, there has been no other research on false memory susceptibility in BPD using the standard DRM paradigm, a task that is known to elicit a high rate of false memory (cf. [12] who used a visual-imagery version of the DRM paradigm). Here, we predicted that participants who scored high on the traditional BPD scale would be more prone to producing false memories. Using scores on the SCID-II and MSI-BPD, we found that the magnitude of the correlations between traditional measures of BPD and false memory were positive, albeit small. These small correlations are typically observed in personality and performance studies (e.g. [54]), and our study is nevertheless novel because of the inclusion of the AMPD-BPD. The traditional BPD system does not allow us to explore whether specific components of BPD might be related to false memory; using the dimensional system with its constituent traits, on the other hand, allows us to take a closer look at which particular BPD symptoms might predict higher levels of false memory.

In the past, some researchers have reported a relation between traditional, categorical BPD diagnosis and memory errors. For example, Ebner-Priemer et al. [55] found that BPD symptoms and recall bias were related, but they failed to identify which features of BPD were associated with recall bias. Similarly, Beblo

et al. [25] found that BPD symptoms were correlated with subjective memory complaints in a clinical sample of BPD patients, however, they did not specify which particular BPD trait(s) were associated with memory problems. Park et al. [56] found that dimensional scores of BPD were positively correlated with aspects of subjective memory impairment (i.e. heightened worry about memory and a lack of confidence in memory) in a non-clinical community sample, but they did not report which BPD traits were associated with memory impairment. Korfine and Hooley [57] found that the BPD group recalled significantly more borderline words when they were instructed to forget. Korfine and Hooley also discussed their findings in terms of increased encoding for salient words and suggested that BPD patients tend to remember the themes which are related to BPD. But again, they did not examine which BPD traits predict remembering BPD-related themes, and none of these studies examined the AMPD.

Accordingly, here, we predicted that there might be particular constituent traits of BPD as opposed to the full "disorder" that might be related to false memory. To test this hypothesis, we included the BPD-IS and PID-5 trait scales that measure the AMPD criteria for BPD. Recall that in the DSM-5 AMPD operationalization of BPD, self-functioning is defined by the two constructs of "identity" and "self-direction." We found that identity impairment was associated with higher rates of false memories in general, and with BPD-related and trauma-related false memories, in particular. To be more specific, identity impairment was only correlated with the rate of false memories for the BPD- and trauma-related word lists, but not with the rate of false memory for the other word lists.

Although we recognise that the size of the corrletions between identity impairment and false memory are small, we nonetheless argue that they are potentially important because they involve what many have argued is the core feature of BPD. The importance of identity impairment in developing and maintaining BPD is so critical that some scholars have argued that the core pathology of BPD patients can be found in an impairment of their identity integration [58, 59]. The basic assumption is that because many BPD individuals have experienced trauma during childhood and because these individuals experience dissociation to cope with trauma, they are unable to internalize different components of the self and important others into an integrated identity [58, 59]. While having a coherent sense of self requires understanding the self in relation to the past and in relation to one's psychological states such as emotions and attitudes [60], BPD is characterized by a lack of understanding of mental states, thoughts, and actions in one's self and others; an inability to integrate them; and by having multiple versions of the self [61].

The sense of self in BPD is also commonly disturbed (i.e. frantic effort to avoid abandonment and self-harm behavior), unstable (i.e. unstable self-image and affective instability), empty (i.e. chronic feelings of emptiness), traumatic and dissociated [62]. On the basis of these findings, we might conclude that BPD individuals appear not to have the capacity to correctly retrieve memories especially when they encounter information which is the cause (e.g. traumatic experiences) or effect (e.g. self-harm behavior) of their disturbed identity. Moreover, consistent with the fuzzy-trace theory (FTT)[1] of false memory [63], the relation between identity impairment and false memory might be due to gist extraction; that is, the

thematic word lists that are salient to BPD individuals or that are consistent with their clinical description encourage gist-based responding and thereby increase false memories.

The correlation between identity disturbance and false memory can be further explained by the results of the test of our third hypothesis, where we found that the effect of BPD on false memory was mediated by traumatic and dissociative experiences. Dissociation allows individuals to mentally escape from overwhelming emotional or physical agony caused by trauma, where no actual physical escape is possible [68, 69]. In dissociation, the link between experience, memory, and identity is severed [69]. One of the underlying correlates of dissociation is identity disturbance, including an altered sense of self [70], which also occurs as a response to trauma [58, 59, 71). These parallel consequences of trauma are associated with disturbed memory encoding on free-recall tests, deficits in retrieving autobiographical memory, and difficulty in determining whether the remembered event is real or a pseudo-memory [26, 70, 72]. Thus, increased levels of false memory in BPD via the mediating role of trauma and subsequent dissociative states might be due to the difficulties that individuals have in monitoring the source of their memories in the DRM paradigm. In other words, due to increased activation of BPD- and trauma-related words, they are more likely to generate false memories that are consistent with the gists of these lists.

Regarding the role of depression in BPD-related false memories, in contrast to some studies [32] and in line with some others [24,73], we did not find any correlation between depressive symptoms and higher false recognition for any type of word list. This finding can be potentially explained by mood-congruent theory, which argues that individuals with high rates of negativity, such as individuals with BPD, are more sensitive to negative information and less likely to falsely remember information with a similar negative valence [73]. Also, in contrast to previous studies (e.g. [31, 74]), we did not find a correlation between traumatic experiences and higher false memory for trauma-related stimuli. Moreover, the mediation models of BPD also failed to predict false memories for trauma-related information. Windmann and Krueger [75] suggest that traumatized individuals not only are more inclined to falsely recognize critical lures for trauma-related information but also, they tend to over-interpret many non-trauma-related stimuli as trauma-related. In the present study, however, we did not find support for a response bias for trauma-related information. Goodman et al. [51], who constructed the trauma-related word lists that we used, argued that these word lists motivate more relational processing for free recall and consequently induced increased false memory, but in a recognition task, these word lists induced greater item-specific processing and subsequently result in reduced false memory. Moreover, it is also possible that nature of the trauma-related word lists (e.g. rape, sex) which are distinctive and taboo might cause even more item-specific processing (e.g. sick, lie; [51]). Correspondingly, those individuals with a history of traumatic experiences showed better memory for trauma-related word lists than for simple negative word lists. In a similar vein, some researchers have found that individuals with traumatic experiences have a memory bias which supports accurate memory for trauma-related information but they are more prone to produce false memories for other information (e.g. [76]).

Limitations And Future Directions

Clearly, our conclusions need to tempered by some potential limitations of our study. First and foremost, our significant effects were small; we believe that the size of these correlations is likely owing to the hetero-method design of the current study. Indeed, personality and performance data associations are often in this range (e.g. [54]). Second, all of the BPD measurement was via self-report measures. Although this approach is commonplace, self-report has been associated with high false positive rates of BPD symptomatology relative to structured clinical interviews [77]. Finally, a non-clinical sample of university students might both influence the results as well as limit their generalizability. For example, non-clinical participants manifest BPD symptoms to a much lesser degree, which introduces range restriction, likely in both BPD symptoms and in false memory dysfunction, potentially attenuating the magnitude of the correlations. In future studies, we plan to use structured clinical interviews to measure BPD to investigate DRM false memory in clinical populations.

Conclusions

Taken together, the findings of the current study suggest that there might be a role for identity impairment, and traumatic and dissociative experiences in increasing the likelihood of false memory in the context of Borderline Personality Disorder. Because of what we know about the role of memory dysfunction in the maintenance of depressive and trauma-related disorders [19, 78], false memory might also contribute to the maintenance of BPD-related dysfunction. Furthermore, because the focus of the treatment of BPD relies heavily on patients' reports of experiences they have had in the past (e.g. schema therapy, transference-focused therapy), it is important to expand this line of research in clinical and treatment settings.

Abbreviations

BPD: Borderline Personality Disorder; DRM: Deese-Roediger-McDermott paradigm; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, 4th edition; AMPD: Alternative Model of Personality Disorders; PTSD: Posttraumatic Stress Disorder; MSI-BPD: McLean Screening Instrument for Borderline Personality Disorder; SCID-II: Structured Clinical Interview for DSM-IV axis II disorders; BPD-IS: Borderline Personality Disorder Impairment Scale; PID-5-SF: Personality Inventory for DSM-5 Short Form; BDI: Beck Depression Inventory; DES: Dissociative Experiences Scale; TLEQ: Traumatic Life Events Questionnaire; FTT: Fuzzy-Trace Theory.

Declarations

Acknowledgments

Not applicable.

Authors' contributions

All authors contributed to the study concept and design. S.F. Sajjadi performed the data collection. J. Gross supervised the data acquisition. S.F. Sajjadi performed the analysis, interpretation and drafted the paper under the supervision of H. Hayne, M. Sellbom, and J. Gross. All authors read and approved the final version of the paper.

Availability of data and materials

Because sharing the data would violate confidentiality and participants did not consent for their data to be publicly available, we are unable to share the data.

Ethics approval and consent to participate

The research was reviewed and approved by the University of Otago's Human Ethics Committee (Health), which is accredited by the New Zealand Health Research Council and whose guidelines are consistent with those of the American Psychological Association. All participants provided written, informed consent

Consent for publication

Not applicable

Competing interests

The authors have no competing interests to declare.

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Tables

Table 1 Zero-order correlations between false memory and traditional/AMPD indices of BPD, and individual difference measures

		Mean (*SD*)	False Recognition Rates				
			BPD	Trauma	Negative	Positive	Overall
Traditional BPD	SCID-II	4.14 (*3.28*)	.008	.10	.06	.14*	.11
	MSI-BPD	3.21 (*2.47*)	-.002	.08	.08	.13*	.10
AMPD-Criterion A	Identity impairment	1.24 (*0.66*)	.13*	.13*	.09	.08	.15**
	Self-direction	0.90 (*0.96*)	-.06	-.06	-.12*	.08	-.05
	Empathy	0.51 (*0.43*)	.04	.03	.06	.01	.05
	Intimacy	0.66 (*0.59*)	.07	.06	.05	.08	.09
AMPD-Criterion B	Anxiousness	1.31 (*0.85*)	.10	.08	.10	.09	.13*
	Emotional Liability	0.86 (*0.77*)	.02	.08	.06	.10	.10
	Separation Insecurity	1.16 (*0.80*)	.01	.07	.03	.02	.05
	Impulsivity	0.77 (*0.71*)	.10	.05	.03	.07	.09
	Hostility	0.66 (*0.63*)	.05	.02	.05	.05	.06
	Depressivity	0.35 (*0.57*)	.03	.02	.09	.03	.06
	Risk Taking	0.60 (*0.65*)	.06	.01	-.03	-.009	.01
Individual differences measures	Dissociation	17.45 (*11.82*)	.12*	.13*	.05	.12*	.15**
	Trauma	16.56 (*14.52*)	.03	.08	.16**	.11*	.14*
	Depression	8.80 (*8.18*)	.08	.07	.08	.02	.09

Note. Overall false memory is mean across all 4 word lists; BPD, trauma-related, negative, and positive.

**Correlations significant at the *p* < .01 level (2-tailed); *Correlation is significant at the *p* < .05 level (2-tailed).

**Table 2** Path standardized coefficients, p-values, and 95% confidence intervals for the mediation models

Models 1-4: The mediating effect of dissociation and trauma in the relation between BPD and false memory.	ß	p	95% Bootstrap CI
Model 1: BPD to BPD-related false memory			
Path a_1: BPD à DES	0.50	< .001*	
Path a_2: BPD à Trauma	0.36	< .001*	
Path b_1: DESà BPD-related false memory	0.15	.02*	
Path b_2: Trauma à BPD-related false memory	0.01	.76	
Total effects (c)	0.008	.88	
Direct effects (c)	-0.07	.27	
Indirect effects:			
· BPDàDESàBPD-related false memory	0.077	-	0.007, 0.151[†]
· BPDàTraumaà BPD-related false memory	0.007	-	-0.036, 0.053
Model 2: BPD to trauma-related false memory			
Path b_1: DESà trauma-related false memory	0.10	.12	
Path b_2: Trauma à trauma-related false memory	0.04	.49	
Total effects (c)	0.10	.07	
Direct effects (c)	0.03	.61	
Indirect effects:			
· BPDàDESàtrauma-related false memory	0.05	-	-0.015, 0.125
· BPDàTraumaà trauma-related false memory	0.03	-	-0.026, 0.068
Model 3: BPD to negative false memory			
Path b_1: DESà negative false memory	0.01	.81	
Path b_2: Trauma à negative false memory	0.16	.01*	
Total effects (c)	0.06	.29	
Direct effects (c)	-.005	.93	
Indirect effects:			
· BPDàDESà negative false memory	0.007	-	-0.064, 0.078
· BPDàTraumaà negative false memory	0.05	-	0.013, 0.110[†]

Models 1-4: The mediating effect of dissociation and trauma in the relation between BPD and false memory.	Standardized coefficients	p-value	95% Bootstrap CI confidence interval
Model 4: BPD to positive false memory			
Path b_1: DESà positive false memory	0.06	.36	
Path b_2: Trauma à positive false memory	0.06	.26	
Total effects (c)	0.14	.01*	
Direct effects (c')	0.08	.22	
Indirect effects:			
· BPDàDESà positive false memory	0.03	-	-0.028, 0.094
· BPDàTraumaà positive false memory	0.02	-	-0.018, 0.082

Note. *statistically significant at the Bonferroni-corrected value of $p < .008$; †statistically-significant indirect effect.
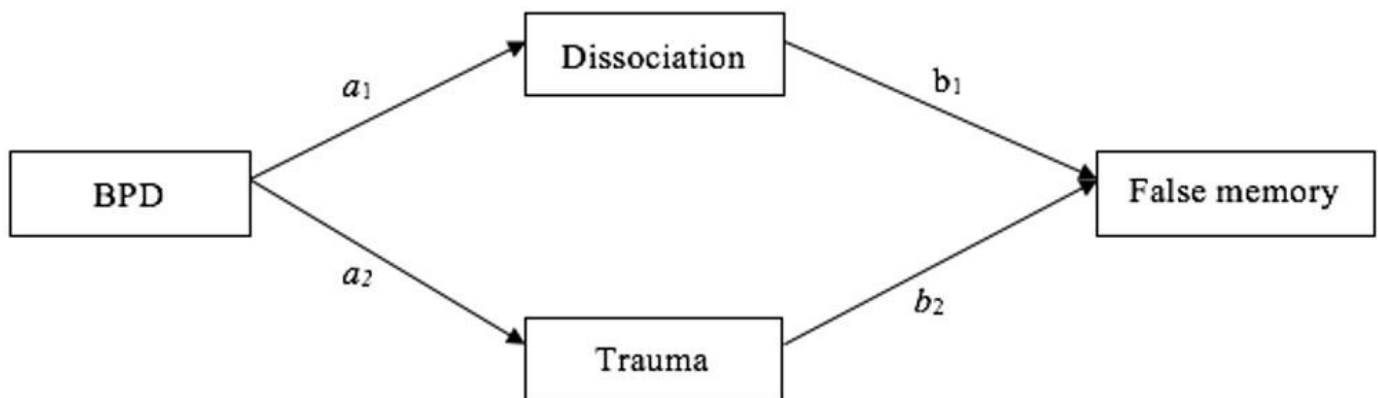
Paths a_1 and a_2 were the same in all of the models. DES is the measure of dissociation.

Figures
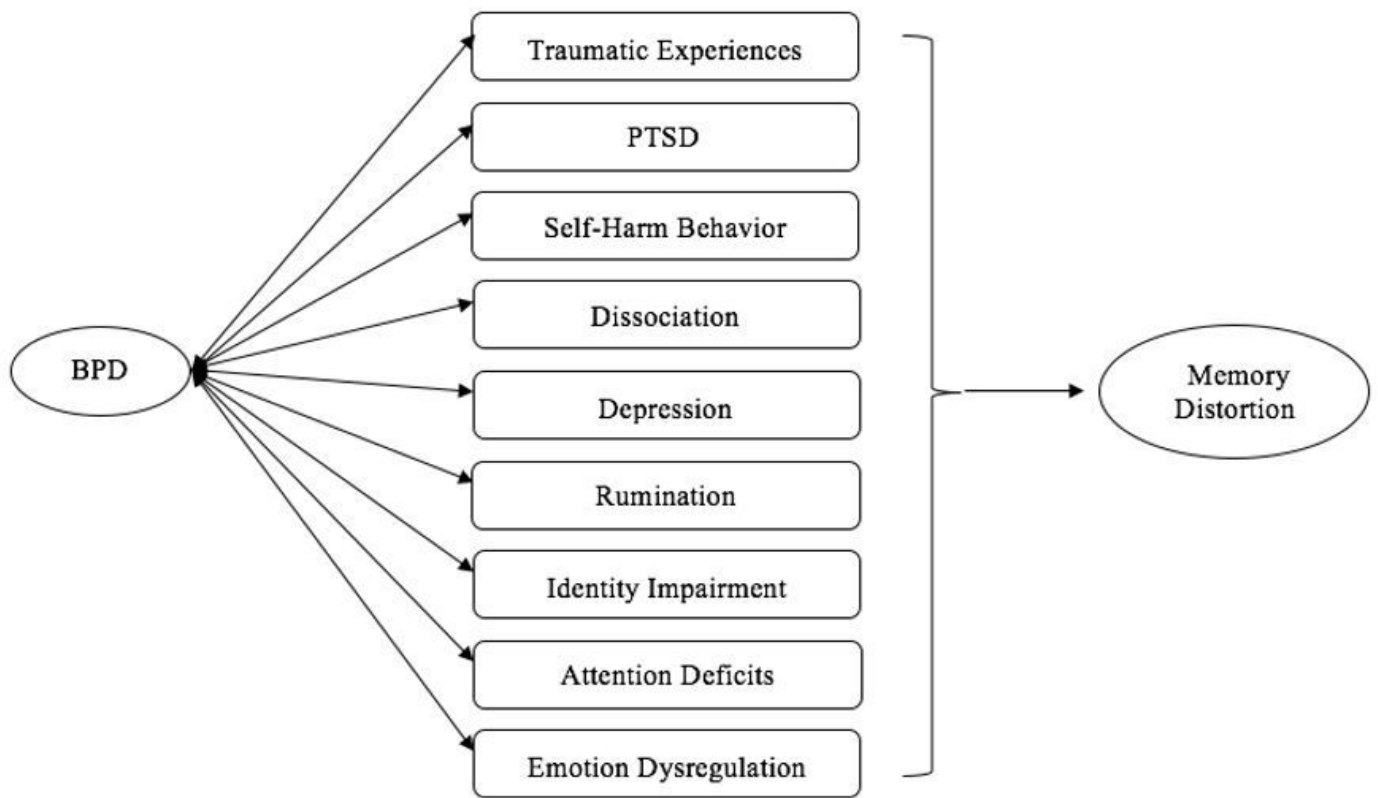
Figure 1

A diagrammatic outline of the characteristics of BPD that might lead individuals with BPD to have heightened vulnerability to memory distortion.

Figure 2

Hypothesized mediation model of BPD and false memory.

Supplementary Files

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