The effect of adversity on the behavioral response to social exclusion in patients with borderline personality disorder and persistent depressive disorder

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Barbara Bianca Barton

aus

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Referent: Prof. Dr. Thomas Ehring

Korreferent: Prof. Dr. Frank Padberg

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Abstract

The human species is in need of social contact to survive. Thus, forming and maintaining interpersonal relationships and avoiding social exclusion is essential. Especially mental health disorders, including borderline personality disorder (BPD) and persistent depressive disorder (PDD), are associated with interpersonal dysfunction. Further, interpersonal dysfunction may be related to previous negative interpersonal events like childhood maltreatment (CM). Both, patients with BPD and PDD report high levels of CM. However, it is unclear whether specific subtypes of CM e.g., emotional, physical, or sexual maltreatment, or specific developmental periods in which CM occurs are more associated with interpersonal problems than others. Moreover, little is known about possible mediators affecting the relationship of CM on interpersonal functioning. Possible mediators are rejection sensitivity (RS) and resilience. People high in RS anticipate and fear rejection in social situations, and also perceive rejection more quickly and show both emotional and behavioral overreactions to rejection, eventually leading to actual rejection. Furthermore, previous negative interpersonal experiences are also associated with higher RS and it is associated with a variety of mental disorders, including BPD and depressive disorders. Resilience describes the ability to adapt in the face of negative life events e.g., interpersonal threats. If resilience can be developed, it might mitigate the negative effects of new threats like social exclusion. One of the most valid ways to experimentally induce social exclusion is the Cyberball paradigm. In this virtual ball passing game, the participant is being excluded by receiving less ball tosses from one of the alleged coplayers. Previous studies using the Cyberball paradigm have mostly focused on the effect on emotions, needs and behavior after social exclusion. A few studies have focused on the behavioral response during Cyberball in healthy subjects and found an immediate increase in ball tosses towards the excluding player. However, research on the immediate behavior in clinical samples is missing. This dissertation aims to gain more knowledge on the association between CM in general but especially concerning specific subtypes and the timing of negative interpersonal events and the behavioral response during social exclusion induced by Cyberball. Further, the aim was to test possible mediating effects of RS and resilience explaining the relationship between CM or negative life events and the behavioral response during Cyberball. Finally, this dissertation aimed to fill the research gap in resilience in patients with BPD and PDD.

Abstract

In *study I*, a cross-diagnostic sample including BPD patients (n = 36), PDD patients (n = 34) and age and gender matched healthy controls (HC) (n = 70) played an experimental (partial social exclusion) and control (inclusion only) condition of Cyberball in randomized order. Additionally, emotions, ratings of co-players, and tension were rated before and after the game, and need threat and behavioral intentions were rated after the game only. S*tudy I* found an increase in passing preference (PP) towards the excluder immediately after partial social exclusion started in HC, which was interpreted as prosocial behavior. PDD patients showed a significantly less increase in PP towards the excluder, while patients with BPD did neither significantly differ from HC nor from PDD patients. Interestingly, while negative emotions were significantly higher before Cyberball in both patient groups compared to HC, the change in emotions from before to after the game was similar. In *study II*, the same sample filled out the Childhood Trauma Questionnaire (CTQ) and the Rejection Sensitivity Questionnaire (RSQ). The CTQ total score and the subscale of emotional neglect were significantly correlated with less prosocial behavior in the whole sample and CM was associated with more RS. Surprisingly, RS was not associated with PP. In *study III* the effect of timing of negative and positive life events on PP was investigated using the Traumatic Antecedents Questionnaire (TAQ). Resilience measured with the Connor Davidson Resilience Scale (CD-RISC) was tested as a possible mediator. In the patient sample, negative events during youth and adulthood were significantly associated with less PP towards the excluder, while in HC positive events during youth were associated with more prosocial behavior. Interestingly, in the patient sample neither positive nor negative events were associated with resilience and resilience was associated with less PP. Neither RS nor resilience could be identified as mediators in the tested models of *study II* and *III*.

This thesis aimed at improving our understanding of differences in behavior between those with BPD and PPD compared to HC in order to better understand why individuals with BPD and PDD often report interpersonal problems using real time data. The less prosocial behavior as an immediate response to social exclusion compared to HC shown by patients underlies that differences might be subtle, yet might have a huge impact on the relationship. Further, this thesis shows how detrimental long-term effects of CM are, becoming visible in an experimental design of social exclusion. Yet, the relationship of CM and the behavioral response to social exclusion is probably very complex, making it difficult to elucidate single mediators like RS and resilience. This challenges future research concerning whether behavior can be predicted by expectations of one's own behavior. Further limitations are discussed,

clinical implications outlined and future research ideas aiming at elucidating interpersonal behavioral differences between patients with BPD and PDD compared to HC are suggested.

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Chapter 1
General Introduction

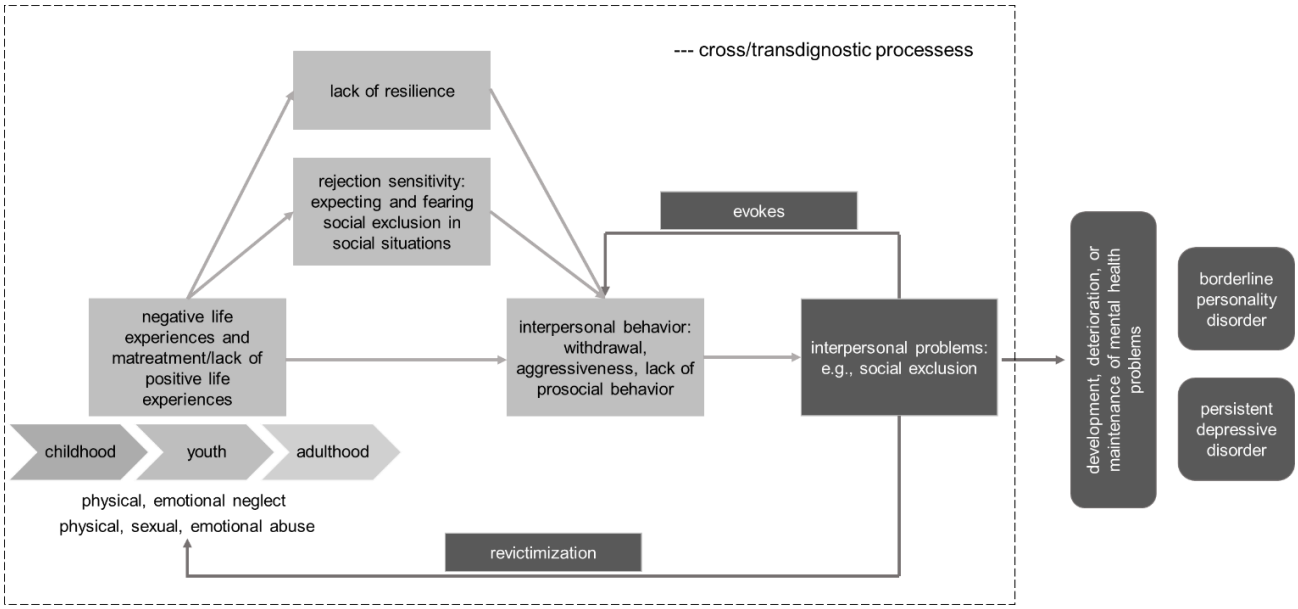
Interpersonal Dysfunction and mental disorders

Social deficits are very common in mental disorders (Cotter et al., 2018) and are often one of the first symptoms occurring before the full symptom onset (Porcelli et al., 2019). The resulting dysfunctional interpersonal behavior of each disorder may vary from social avoidance, withdrawal, inappropriate aggressive to inappropriate friendly behavior (Porcelli et al., 2019). This can start a vicious circle as dysfunctional interpersonal behavior might lead to interpersonal problems e.g., social exclusion and less or unsatisfying social interactions, negatively influencing mental health which might evoke or strengthen dysfunctional interpersonal behavior (Porcelli et al., 2019; Reinhard et al., 2020). Interpersonal stress is one of the most common forms of stress and predictive for psychological distress and physical symptoms (Almeida, 2005) and is particularly distressing compared to other stressors e.g., overload at work (Bolger et al., 1989). However, research on interpersonal dysfunction as a cross- or transdiagnostic domain is still limited (Porcelli et al., 2019). As a first step, it is necessary to improve knowledge on the etiology of interpersonal dysfunction by establishing and investigating a theoretical framework as suggested in Figure 1.1. A risk factor for interpersonal dysfunction is childhood maltreatment (CM) (Alink et al., 2012; Copeland et al., 2018). Further, the risk of developing interpersonal dysfunction might vary concerning the type of maltreatment and the timing which might not be limited to childhood but needs to be investigated over the life span. Dysfunctional interpersonal behavior might provoke interpersonal problems e.g., like being socially excluded. An inadequate behavioral response to social exclusion e.g., aggressive or withdrawal behavior, might evoke more dysfunctional interpersonal behavior leading to a vicious circle. These interpersonal problems might lead to the development, deterioration, or maintenance of mental health problems and the development of mental disorders like borderline personality disorder (BPD) or persistent depressive disorder (PDD). Further interpersonal problems might enhance chances to be revictimized, e.g., being socially excluded might make it easier for others to dominate and abuse. Moreover, the relationship between CM and dysfunctional interpersonal behavior might be mediated by rejection sensitivity (RS), the way we fear or expect rejection in social context, as well as by the degree of resilience necessary to successfully cope with a demanding

interpersonal situation. Elucidating the effect of CM on interpersonal behavior and the role of RS and resilience helps to support the theoretical framework suggested here, which in the future can lay grounds for therapeutic approaches by targeting the variables of this model and prove the importance of trans- and cross-diagnostic approaches to improve mental health (Dalgleish et al., 2020). Finally, explaining interindividual differences is necessary to better understand the differences in social behavior and social learning between those with mental disorders and healthy individuals (Flechsenhar et al., 2022).

Figure 1.1

Theoretical framework to explain interpersonal problems by cross/transdiagnostic processes



Note. Negative life experiences during childhood, youth or adulthood of different subtypes affect interpersonal behavior. There is also the possibility of an indirect pathway through rejection sensitivity and a lack of resilience. Eventually interpersonal behavior like withdrawal, aggressiveness, or a lack of prosocial behavior leads to interpersonal problems that might lead to revicitimization or evokes more dysfunctional interpersonal behavior. Further interpersonal problems can lead to development, deterioration, or maintenance of mental health problems e.g., different syndromes like borderline personality disorder or persistent depressive disorder.

Childhood Maltreatment

Definition and Prevalence

The World Health Organization (2019) defines CM as "the abuse and neglect that occurs to children under 18 years of age. It includes all types of physical and/or emotional ill-treatment, sexual abuse, neglect, negligence, and commercial or other exploitation, which results in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power." Often other terms and also definitions like childhood adversity, early life stress, early adversity and trauma (EAT) as well as adverse childhood experiences (ACE) are used to describe CM in the literature (e.g. McLaughlin, 2016). The seminal ACE study established the detrimental lifelong effects of CM in the literature (Felitti et al., 1998). Unfortunately, CM is quite common (McLaughlin, 2016). According to a study by Struck, Krug, et al. (2020) 15 % of adults without a mental disorder self-reported experiencing some type of moderate to severe CM and prevalence amongst patients with different mental disorders vary even between 56 and 75 %.

Subtypes of Childhood Maltreatment

Different subtypes of CM can be distinguished. The Childhood Trauma Questionnaire (CTQ, Bernstein et al., 1994) is one of the most established self-report questionnaires to assess CM and includes five subtypes of CM: emotional abuse, emotional neglect, physical abuse, physical neglect, sexual abuse. Mostly one subtype of CM is accompanied by other subtypes of CM and cumulative CM is associated with higher and a more complex psychopathology (Cloitre et al., 2009; Mills et al., 2013; Putnam et al., 2013). There is also a debate as to whether there are synergy effects within the different forms of neglect and abuse and whether each type of CM has different effects (Briggs et al., 2021; Putnam et al., 2020), thus looking at CM types individually is of high importance (Lacey & Minnis, 2020). While most research has focused on sexual and physical abuse, emotional maltreatment has been neglected so far, even though it is one of the most prevalent forms and seems to be a key risk factor for mood disorders (Gama et al., 2021; Saleptsi et al., 2004; Taillieu et al., 2016). Research on the effect of the different CM subtypes on interpersonal functioning are lacking.

Timing of Childhood Maltreatment

Another rather neglected topic in research is the impact of timing of CM. As there are sensitive periods in human development, it can be assumed that CM happening during those periods results in especially detrimental effects on brain function that translates into behavior

(Knudsen, 2004). There is evidence suggesting that specific types of CM at specific ages might increase specific psychopathology (Lippard & Nemeroff, 2020). For example, CM during early childhood was associated with higher symptom severity of depression and PTSD in large cross-sectional studies (Dunn et al., 2013) and interpersonal violence during middle childhood led to more difficulties in emotion regulation and higher symptom severity compared to other periods (Dunn et al., 2017; Dunn et al., 2018). Another study found interpersonal trauma before the age of 14 to be associated with more emotion regulation difficulties compared to those with interpersonal trauma after 14 years of age, however this difference diminished after controlling for PTSD symptom severity (Ehring & Quack, 2010). Deprivation during the first two years of life seems to have a significant impact on the development of stress response systems (McLaughlin et al., 2015), however children placed into homes before the age of two more often were able to build secure attachments compared to those placed after the age of two (Smyke et al., 2010). In a psychiatric sample of patients with alcohol related disorders, schizophrenic disorders, affective and personality disorders, especially adversity during late childhood and adolescence were reported compared to early childhood (Saleptsi et al., 2004). Khan et al. (2015) identified age at 14 as vulnerable period to develop MDD when being rejected, and age at 5 in males and age at 18 in females as a vulnerable period to develop suicidal ideation when experiencing sexual abuse. Effects of CM are not only visible in behavior but also in changes in the brain, as one study found that sexual abuse in females during different periods of childhood led to different abnormalities in the hippocampal volume, corpus callosum and the frontal cortex (Andersen et al., 2008). To date there is no clear answer whether specific time periods are more sensitive than others for CM nor how this impacts interpersonal functioning. Further it is also unclear how negative interpersonal experiences during youth and particularly adulthood impact interpersonal dysfunction.

Childhood Maltreatment: a transdiagnostic risk factor

What makes CM so devastating and the effects so detrimental is that, while other forms of adversity like a car accident or low socioeconomic status can be dealt with the help and support of the caretaker allowing the child to feel safe, when the caretakers themselves are causing the harm, the child is left alone in its misery (Teicher & Samson, 2013). The aftermath of CM is diverse. CM is associated with the development of psychiatric disorders in general (Chandan et al., 2019; Clark et al., 2010; Hogg et al., 2022; Norman et al., 2012) and higher symptom severity (Lippard & Nemeroff, 2020), higher threat detection (Teicher et al., 2016),

higher risk for suicidality (Lippard & Nemeroff, 2020) and suicide related behavior (Castellví et al., 2017). Moreover, CM is associated with e.g., obesity, diabetes, heart or respiratory diseases (Hughes et al., 2017), with biological abnormalities e.g., alterations in stress related systems such as the hypothalamic-pituitary-adrenal axis and corticotropin-releasing factor, epigenetic modifications and inflammatory processes as well as with altered neural structure and functioning, e.g. smaller hippocampal volumes or altered amygdala activity (Lippard & Nemeroff, 2020). Furthermore, CM also negatively affects therapeutic response after pharmacotherapy and psychotherapy in patients with major depression (Harkness et al., 2012; Williams et al., 2016), however, a more previous meta-analysis suggests no significant influence of CM on therapy success concerning major depression (Childhood Trauma Meta-Analysis Study Group, 2022).

Moreover, CM is associated with dysfunctional personality traits (Borroni et al., 2019) and seems predictive for detached behavior like social isolation or avoidance of closeness (Back et al., 2020). The lack of complex and varied stimulus-response contingencies or the presence of consistent rules, routines, and structures that come along with CM might both hinder children's ability to learn and develop cognitive and behavioral self-regulatory skills (McLaughlin, 2016). In situations of stress these vulnerabilities might enhance dysfunctional emotion regulation that could lead to a dysfunctional behavior (McLaughlin, 2016). Because of the deprivation from adequate social stimuli, individuals with CM might be hindered in learning functional social behavior leading to unhealthy relationships eventually ending in revictimization (Widom et al., 2014).

Teicher et al. (2021) suggests that CM needs to be recognized as an “etiological agent that can produce ecophenotypic variants psychiatric disorders” and that this should be recognized in the DSM. According to Teicher et al. (2021) CM distinguishes patients with CM from those without CM, and CM leads to ecophenotypes that diagnostically still fit in the categories, yet have some distinctions (Teicher & Samson, 2013) as described above e.g., higher severity. However, the potential etiological pathways of mental disorders are not part of the criteria, except e.g., post-traumatic stress disorder or adjustment disorder where a previous traumatic event is obligatory (Kaess, 2020). Because of its effects across diagnoses, CM can be accounted for as a transdiagnostic risk factor (Hoppen & Chalder, 2018; Kessler et al., 2010). The idea behind a transdiagnostic approach is to improve the existing categories used to describe disorders, that is to compare ICD/DSM diagnoses with each other and test whether these categories or other factors can better predict symptoms (Fusar-Poli et al., 2019).

While research in the field of cognitive behavioral processes is mainly dominated by a disorder-specific approach in order to understand the etiology and maintenance of a specific therapeutic strategy, it is notable that those cognitive behavioral processes have similarities across disorders (Harvey et al., 2004; Mansell et al., 2009). Further, the role of comorbidities and overlapping symptoms between mental disorders are often neglected in research (Cludius et al., 2020) and questions whether existing diagnosis can capture symptoms completely (Dalgleish et al., 2020). Transdiagnostic research originally derives from CBT and the treatment of eating disorders (Fairburn et al., 2003) and is based on the idea that psychiatric disorders share etiology and maintenance factors as well as cognitive, affective and behavioral characteristics. According to Harvey et al. (2004), a process can be considered transdiagnostic if it is relevant for different diagnoses, different in healthy controls (HC), contributes to the development and/or maintenance of the disorders, and can be targeted for prevention or treatment. Thus, transdiagnostic approaches describe an underlying level, eventually leading to different syndromes.

There are several attempts of transdiagnostic conceptualizations like the p factor (Caspi et al., 2014), the Research Domain Criteria (RDoC) initiative (Cuthbert, 2014), clinical staging models (Scott et al., 2013) or the Hierarchical Taxonomy of Psychopathology (HiTOP) (Kotov et al., 2017). The transdiagnostic approach has been supported by studies showing that the same treatment can be beneficial for several disorders, e.g., CBT is efficacious for eating disorders, anxiety and depression (Cuijpers et al., 2013; Hofmann & Smits, 2008; Linardon et al., 2017). With the DSM-5 Model for Personality disorders (American Psychiatric Association, 2015), the importance to better understand the underlying mechanisms causing personality disorders, e.g. interpersonal functioning, has been pointed out (Bertsch & Herpertz, 2018b). The transdiagnostic model of childhood adversity (McLaughlin, 2016) suggests that experiences of threat and deprivation negatively impact different neuropsychological aspects, e.g., threat might lead to an altered response to stress while deprivation might especially impact control of inhibition yet leading to all kind of different psychopathologies.

Borderline Personality Disorder

Definition and Prevalence

According to the DSM-5 for the diagnosis of BPD, the general criteria for a personality disorder and any five of the following nine symptoms have to be fulfilled: desperate efforts to avoid actual or suspected abandonment, patterns of unstable and intense interpersonal relationships, unstable self-image, impulsivity, repeated suicidal acts, suicidal ideation, self-detracting behavior, affective instability, chronic emptiness, inappropriate and intense anger and problems controlling anger, transient paranoid ideation or severe dissociative symptoms (American Psychiatric Association, 2015). The symptomatology can, therefore, be very heterogenous. The lifetime prevalence rate of BPD is about 2.7 % to 5.9 % (Grant et al., 2008; Tomko et al., 2014; Trull et al., 2010) and equally prevalent among women and men (Grant et al., 2008). BPD is very present in outpatient and especially inpatient settings with about 12 % respectively 22 % (Ellison et al., 2018).

Borderline Personality Disorder and Childhood Maltreatment

With the majority of patients with BPD reporting experiences of abuse, neglect and rejection while growing up (Afifi et al., 2011; Brakemeier et al., 2018), CM is a highly debated risk factor in the development of BPD (Ibrahim et al., 2018). In a meta-analysis, 71.1% of patients with BPD reported having experienced some form of adversity with physical neglect as the most prevalent subtype (48.9 %) followed by emotional abuse (42.5 %), physical abuse (36.4 %), sexual abuse (32.1 %), and emotional neglect (25.3 %) (Porter et al., 2020). The risk ratio of reporting CM is four to five times higher for patients with BPD compared to non-clinical controls, with emotional abuse and neglect being especially elevated in BPD patients and also significantly higher compared to other psychiatric groups (Kleindienst et al., 2021; Porter et al., 2020). Yet, it is very important to note, that not all patients with BPD report CM, which could be interpreted that there are different trauma and non-traumatic pathways leading to BPD (Kaess, 2020; Kleindienst et al., 2021); however it could also mean that CM has to be defined more broadly e.g., in one study family functioning was investigated next to CM and problems in family functioning were prevalent in 97.7 % (Infurna et al., 2016).

The biosocial theory by Linehan (1993) is one of the most thoroughly developed etiological models of BPD (Crowell et al., 2009) which helps explain how experiences in childhood can lead to BPD symptomatology. According to Linehan (1993) the main characteristics of BPD are deficits in emotion regulation, an emotional hypersensitivity, the

inability to regulate emotions, and a slow return to the emotional baseline. According to her theory these symptoms develop because of an interaction of biological vulnerabilities and an invalidating environment in which one grows up in. Caregivers who create invalidating environments neglect negative and emotional events, downplay difficulties finding solutions facing problems, only focusing on e.g., positivity, and fail to help their children name the emotion and how to regulate it. Moreover, an environment in which emotional or physical neglect or abuse or sexual abuse is happening, is also extremely invalidating. Linehan's (1993) model allows to understand the development of BPD in both, individuals with CM and those without but other forms of experienced invalidation. Further, not only abuse and neglect in the early development seem to affect the course of BPD. For example, sexual abuse during adulthood is associated with more severity and poorer prognosis of BPD (de Aquino Ferreira et al., 2018).

Borderline Personality Disorder and Interpersonal Problems

BPD is a severe mental disorder devastatingly impacting the patients themselves, their psychosocial functioning, and their interpersonal relationships (Jeung & Herpertz, 2014; Stoffers-Winterling et al., 2021). Interpersonal problems are a core feature of BPD described as instable social relationships, anxious preoccupation with real or imagined abandonment and an interpersonal hypersensitivity as described by the new alternative model of the DSM-5 (American Psychiatric Association, 2015). Interpersonal dysfunction in BPD patients is associated with an interplay of poor social cognition, e.g. hypersensitivity towards threat, misunderstandings in communicating, problems with social repair and trust, high personal stress and self-other diffusion, impulsivity, problems in emotion recognition, a negativity bias concerning emotions, and problems with affect regulation (Bateman et al., 2018; Dyck et al., 2009; Haliczer et al., 2021; Herpertz et al., 2014; King-Casas et al., 2008; Seitz et al., 2021; Unoka et al., 2009). Further, BPD is associated with greater relationship conflict, failure to maintain long-lasting relationships, decreased perceived social support, closeness, and trust, less integration in social networks, smaller network sizes, and high levels of loneliness (Beeney et al., 2018; Liebke et al., 2018; Nenov-Matt et al., 2020). Additionally, in patients with BPD, CM and especially emotional abuse are associated with less perceived social support (Grave et al., 2021) and CM is associated with hypersensitivity to potential threat (Nicol et al., 2013). Further interpersonal stressors lead to more negative affect in BPD patients compared to depressed patients and a community sample (Hepp et al., 2017; Hepp, Lane, et al., 2018). A less pronounced mirroring of the counterpart's emotions while at the

same time showing an intense emotional reaction could enhance social misunderstandings in BPD patients (Steinbrenner et al., 2022). Further, BPD patients mirror happiness to a lesser extent, which makes one less likable (Steinbrenner et al., 2022). In fact, without knowledge about the diagnoses, BPD patients are rated less likeable, less cooperative, more negative, less trustworthy, and less similar to oneself (Hepp et al., 2021; Hepp, Störkel, et al., 2018). Moreover, studies showed that BPD patients show more aggressive (McCloskey et al., 2009) but also submissive and quarrelsome behavior (Russell et al., 2007) and evaluate others more aggressive and negative (Barnow et al., 2009) as well as less trustworthy (Fertuck et al., 2013) and approachable (Nicol et al., 2013).

Longitudinal studies report persisting impairments in social functioning in BPD patients despite a remission in general BPD symptoms (Alvarez-Tomás et al., 2017; Barnicot & Crawford, 2019; Choi-Kain et al., 2010; Gunderson et al., 2011; Zanarini et al., 2012; Zeitler et al., 2020). Contrary, positive interpersonal relationships predicted remission of BPD over a four-year follow-up (Skodol et al., 2007). A study even found interpersonal stressors to negatively influence BPD patients' daily physical health and that this relationship was stronger in BPD compared to a depressed control group (Hepp et al., 2020). A better understanding of mechanisms leading to and maintaining interpersonal dysfunction in BPD is highly important to identify starting points for preventive and psychotherapeutic strategies (Porter et al., 2020).

Persistent Depressive Disorder

Definition and Prevalence

PDD, according to the DSM-5 (American Psychiatric Association, 2015), is defined by depressive symptoms for most of the days during the last two years with no period longer than two months without symptoms of depression; additionally to the depressed mood, symptoms of at least two or more concerning appetite, sleep, low energy, low-self-esteem, poor concentration or difficulties in decision making, feelings of hopelessness need to be fulfilled. Further the diagnosis of PDD summarizes different forms of chronic courses of depression. It is possible to code a PDD with pure dysthymic syndrome, with persistent major depressive episode, with intermittent major depressive episodes with current episode, or with intermittent major depressive episodes without current episode. The ICD-10 (World Health Organization, 2016) does not allow to code a chronic course, and dysthymia and unipolar depression cannot

be diagnosed at the same time. With the ICD-11 it will be possible to diagnose a chronic course of depression and a double diagnosis of unipolar depression and dysthymia if dysthymia has been prevalent in the first preceding two years (Cerbo, 2021).

The lifetime prevalence of PDD is about 2.7 to 5.7 % (Angst et al., 2009; Blanco et al., 2010; Satyanarayana et al., 2009). Major Depression has a lifetime prevalence of about 16 - 20 % (Angst et al., 2009; Jacobi et al., 2004; Kessler et al., 2005) and about 20 - 36.5 % of patients with depression develop a chronic course (Nübel et al., 2020; Spijker et al., 2002). Patients with PDD need long-term care and are one of the most prevalent mental disorders with 22 to 36 % in the outpatient treatment (Klein & Santiago, 2003). In analogue to major depression, the prevalence of PDD is twice as high in females compared to males (Blanco et al., 2010).

Persistent Depressive Disorder and Childhood Maltreatment

With about 60 to 76 % of patients with PDD reporting to have experienced at least moderate or severe CM (Brakemeier et al., 2018; Negele et al., 2015; Struck, Krug, et al., 2020), CM might play an important role in the development and maintenance of PDD (Wiersma et al., 2009). Results of meta-analyses also suggest that CM, and especially emotional abuse and neglect, elevates the risk of a chronic course of depression (Nanni et al., 2012; Nelson et al., 2017). When compared to HC, patients with PDD score higher regarding emotional and physical abuse and neglect and sexual abuse and when compared to patients with episodic depression higher regarding CM in general and especially concerning physical and emotional abuse (Struck, Krug, et al., 2020). Yet, a systematic review concluded that studies on differences concerning CM subtypes between PDD and episodic depression are too heterogenous to draw legitim conclusions (Köhler et al., 2019).

According to McCullough's (2000) theory PDD, is predominantly an interpersonal disorder: interpersonal trauma leads to social isolation impairing social learning and eventually leading to interpersonal difficulties. As a result of inadequate social stimulation, patients are stuck in a prelogical, preoperational, and unsocial thinking style as described by Piaget (1926). Thus, they assume that their environment will always react in the same way and that they will always feel the same way. The two core symptoms are fear avoidance and perception decoupling. Fear avoidance describes the behavior in PDD patients of avoiding situations that resemble their traumatic interpersonal experiences leading to an interpersonal distance. Perception decoupling means that patients with PDD belief that nothing will ever

change in the future, therefore, their own behavior is not influenced by the positive or negative feedback of others. A study with PDD patients found a significant link between CM and interpersonal problems (Struck, Krug, et al., 2020).

Persistent Depressive Disorder and Interpersonal Problems

Anhedonia, one of the core symptoms of depression, is the loss of interest or pleasure in activities that used to bring joy (Cruwys et al., 2014). This often manifests in social withdrawal, e.g. not meeting friends leading to feeling less socially connected (Cruwys et al., 2014). Social isolation has been identified as a risk factor for depression (McKenzie et al., 2013) and increases the risk of relapse while group membership has been proven to be a protective factor in the development of depressive symptoms (Cruwys et al., 2014). Another study found the quality of relationships, but not social isolation to be predictive of depression (Teo et al., 2013). In sum, depression is often especially manifested in interpersonal relationships and associated with lower social functioning (Hirschfeld et al., 2000).

PDD needs to be distinguished from major depression, as it is associated with more mental and medical comorbid disorders, higher disability and health service use, higher probability to relapse, increased likelihood of suicidal ideation and attempts, higher symptom severity a poorer social adjustment, early onset, and CM (Blanco et al., 2010; Klein et al., 2006; Klein et al., 2020; Ley et al., 2011; Nübel et al., 2020; Rhebergen et al., 2010; Satyanarayana et al., 2009; Seemüller et al., 2022; Sondermann et al., 2020; Wiersma et al., 2009). Patients with PDD have more interpersonal fears (Klein et al., 2020) and are perceived more submissive and hostile compared to HC and patients with episodic depression (Bird et al., 2018; Constantino et al., 2008). Low levels of social integration and support as well as negative social interaction have been identified as risk factors for PDD (Hölzel et al., 2011). Further, they feel less socially connected and less compassionate to others compared to HC which might decrease the motivation to sustain social relationships resulting in a negative spiral maintaining PDD (Frick et al., 2021). Patients with PDD also have smaller social network sizes, higher impairment in social skills, feel less satisfied with social support, experience higher levels of distress in difficult social situations compared to HC and patients with non-chronic depression (Domes, Spenthof, et al., 2016; Nenov-Matt et al., 2020; Visentini et al., 2018). Low social support and negative social interaction have even been identified as risk factors for a chronic course of depression (Hölzel et al., 2011). Further, during depression, theory of mind abilities are decreased what can attenuate psychosocial functioning (Bora & Berk, 2016). Interestingly, a recent study found that PDD patients are

only less successful to be empathetic compared to HC when put under stress (Guhn et al., 2022). In a study by Rhebergen et al. (2010), patients with PDD had lower social functioning even after three years of recovery of depressive symptoms compared to patients with major depression.

Social Exclusion

In the literature, the terms “social exclusion” (deprived of social contact), “rejection” (being rejected with a reason) and “ostracism” (being ostracized without reason) are often considered as different types of being excluded, however the terms are often used interchangeably in the literature (Williams, 2007). In this thesis the term “social exclusion” will dominantly be used as it is considered to be a broadly term describing that someone is forced to be alone and deprived of social contact (Blackhart et al., 2009).

Social exclusion happens on a daily basis, mostly by strangers or acquaintances of equal status and is experienced as negative, especially when the attribution of social exclusion is internal, that is found in oneself (Nezlek et al., 2012). In fact, recalling social pain is more painful than recalling physical pain (Chen et al., 2008) and being socially excluded is even painful when one does not like the excluding party (Gonsalkorale & Williams, 2007), if being socially excluded has a monetary advantage (van Beest & Williams, 2006), or prevents one from an infectious disease (Ren et al., 2022). Further, social isolation is a known risk factor for depressive disorders (Chou et al., 2011). Different theories exist that explain why social exclusion has such detrimental effects on humans and suggest possible behavioral reactions to deal with it. Social exclusion is hurtful as it threatens our fundamental need to belong (Baumeister & Leary, 1995), threatens our self-esteem (Sociometer Model of Self-Esteem, Leary et al., 1995), and deprives us from the normative state of being in relationships (Social Basline Theory, Coan & Sbarra, 2015). In order to secure inclusion and regain belongingness and self-esteem, as well as to refill our social resources that the brain is dependent on similar to bioenergetic resources, these theories argue that one behaves in a prosocial way. The term prosocial behavior describes a behavior intended to reinforce interpersonal relationships (Williams, 2007). According to the multimotive theory, three motives motivate behavior after social exclusion: wish to reconnect with others or the excluder, urge to defend ourselves, or the need to withdrawal if further exclusion is feared (Smart Richman & Leary, 2009). Moreover, the temporal-need-threat model suggests three stages to cope with social exclusion

(Williams, 2009; Williams & Nida, 2022). During the first stage, there is a reflexive pain response evoking negative affect and threat to the four fundamental needs: control, self-esteem, belongingness, and meaningful existence. During the second or reflective stage one evaluates the situation and chooses a corresponding behavioral response dependent on the need threat. Threat of the need to belong and self-esteem might enhance prosocial behavior, while threat of control enhances aggressive behavior (Williams, 2007, 2009). Constant exposure to social exclusion exhausts the resources to fulfill threatened needs leading to the third stage of resignation, in which depression, alienation and helplessness are prominent and enhance withdrawal behavior (Williams, 2009).

A meta-analyses could confirm that social exclusion leads to negative affect, increases arousal, and threatens belongingness, control and self-esteem, but not meaningful existence (Gerber & Wheeler, 2009). Further, the reaction was dependent on the situation, with either trying to gain control when possible by aggressive behavior or prosocial behavior when control couldn't be reestablished (Gerber & Wheeler, 2009). Contrary, a review by Blackhart et al. (2009) found that social exclusion does not lead to negative feelings, but eliminates positive feelings leading to a more neutral emotional state and that rejection did not have an effect on self-esteem but it increased when being accepted. The prosocial or affiliative behavior e.g., showing more interpersonal interest, donating more money to other people, or increased mimicking in a new social interaction, reported in studies is mostly measured after being socially excluded and is directed towards those not excluding the participant (e.g., Cuadrado et al., 2021; Lakin et al., 2008; Maner et al., 2007) while less prosocial or antisocial behavior e.g., negative evaluations or punishment of listening to aversive sounds, is mostly directed towards the previous excluding player (e.g., Buckley et al., 2004; Cuadrado et al., 2021; Twenge et al., 2001).

Cyberball

One of the best evaluated ways to experimentally induce social exclusion is the Cyberball paradigm (Hartgerink et al., 2015; Williams, 2007). In its original version it was a ball tossing game in a real-life setting (Williams & Sommer, 1997). Three participants wait in front of the experimenter's room for an experiment, two of those three participants are confederates. After one of the confederates starts ball tossing and all have received the ball a few times, the confederates start excluding the participant. In analogue to the ball tossing game in a real-life setting, Williams et al. (2000) developed a virtual ball tossing format. Participants are told to focus on the visualization of the game, that they are playing with other players over

the internet and that ball tossing counts are irrelevant. After being included for a couple of throws in the exclusion condition participants are not receiving the ball anymore. In the inclusion condition the confederates or co-players continue fair ball-tossing.

Cyberball has been used in samples including patients with BPD and to a lesser extent patients with PDD (Reinhard et al., 2020). Results of a meta-analysis show that BPD patients compared to HC rated perceived ball tosses significantly less when being in-and excluded (Cavicchioli & Maffei, 2020), however other studies found no difference (De Panfilis et al., 2015; Domsalla et al., 2014; Euler et al., 2018; Gerra et al., 2021; Jobst et al., 2014; Reinhard et al., 2022; Savage & Lenzenweger, 2018; Seidl et al., 2020; Weinbrecht et al., 2018) or even an overestimation in BPD patients (Wrege et al., 2019). A meta-analysis showed that BPD patients felt more excluded compared to HC (Hanegraaf et al., 2021). Irrespective of being included or excluded, BPD felt more ignored (Jobst et al., 2014; Renneberg et al., 2012) and their needs more threatened (Brown et al., 2017; Euler et al., 2018; Gutz et al., 2015; Wrege et al., 2019) after Cyberball compared to HC; however there is also one study sowing higher need threat in BPD patients compared to HC only after inclusion but not exclusion (Gerra et al., 2021). Independent of the situation or before and after the game compared to HC, BPD patients experienced significantly less positive emotions (De Panfilis et al., 2015; Reinhard et al., 2022; Staebler, Renneberg, et al., 2011) and more negative emotions (De Panfilis et al., 2015; Lawrence et al., 2011; Reinhard et al., 2022; Renneberg et al., 2012; Staebler, Renneberg, et al., 2011; Wiesenfeller et al., 2020). BPD patients reported an increase of inner tension irrespective of the condition (Domsalla et al., 2014), only after exclusion (Dixon-Gordon et al., 2013; Ernst et al., 2018), or no change of inner tension at all (Jobst et al., 2014). Compared to HC, BPD judged the players as more hostile and showed less intention to approach pleasant activities but more to escape or to perform aggressive and self-harming behavior after being excluded (Gutz et al., 2016). Moreover, the Cyberball-induced ostracism is associated with hormonal changes (Jobst et al., 2014), activation in brain regions (Beeney et al., 2014; Domsalla et al., 2014; Malejko et al., 2018; Weinbrecht et al., 2018; Wrege et al., 2019) and pain processing (Bungert, Koppe, et al., 2015) which differ between BPD and HC.

To this date three studies investigating the effects of Cyberball in patients with PDD in comparison to HC are available resulting in no significant difference between both groups concerning estimation of ball tosses and the extent of feeling ignored after the game (Bauriedl-Schmidt et al., 2017; Jobst et al., 2015; Seidl et al., 2020). Two of the studies found no difference between PDD patients and HC concerning feeling excluded (Bauriedl-Schmidt et

al., 2017; Jobst et al., 2015), while one found significant higher feelings of exclusion in PDD patients (Seidl et al., 2020). PDD patients had significant more negative emotions before and after the game compared to HC, however, Cyberball only led to significant decrease in negative emotions in HC but not in PDD patients (Jobst et al., 2015). In one study need threat in total and concerning meaningful existence (Seidl et al., 2020) and in another study self-esteem (Bauriedl-Schmidt et al., 2017) were significantly higher after exclusion in PDD patients compared to HC. More passive intentions like smoking or sleeping were reported in PDD patients compared to HC after the game (Bauriedl-Schmidt et al., 2017). The only Cyberball study in which patients with BPD and PDD patients were compared, showed higher need threat in total, and concerning belongingness, self-esteem, and control as well as less feeling of cohesiveness in BPD compared to PDD patients (Seidl et al., 2020).

In the current literature the focus has been drawn on emotions and needs as well as behavior after being socially excluded in Cyberball. However, measuring behavior after Cyberball might already be an intend to cope with the pain and is not a direct response to the social exclusion but already within the reflective period (Williams, 2007). Therefore, focusing on the behavioral reflexive or immediate response to social exclusion is necessary especially to better understand the behavior of those who struggle with interpersonal relationships like patients with BPD or PDD. Two Cyberball studies in HC, support the hypotheses of prosocial behavior during social exclusion, however towards the excluder. Xu et al. (2017) found that this behavior of turning towards the excluder did not differ between groups with oxytocin applied nasally compared to placebo. In our research group we also could show, that HC significantly increase their ball tosses towards the excluder up to two minutes after being socially excluded and that the behavior differed significantly between the control and experimental condition (Dewald-Kaufmann et al., 2021).

Excursus: Experimental Approaches to Induce Social Exclusion

Next to Cyberball, there are other approaches to experimentally induce social exclusion. It is beyond the scope of this excursus to name every available experiment, but rather to summarize different types of social exclusion experiments and discussing them. The various experiments can be briefly divided into two kinds: those that induce social exclusion in vivo and those that induce social exclusion in sensu (Blackhart et al., 2009; Gerber & Wheeler, 2009).

In vivo experiments induce social exclusion within the experiment by having the participant socially excluded in real time. The Cyberball paradigm (Williams et al., 2000) or its predecessor the simple ball tossing game (Williams & Sommer, 1997) are in vivo social exclusion experiments, for example. Another example are chat room paradigms in which social exclusion is induced by confederates sharing a special interest or experience and addressing the chats directly to another while leaving the participant out of the conversation (Gardner et al., 2000) or not choosing the participant to be included in a planned conversation (Silk et al., 2014). In another experiment the participant does not receive "likes" on a social media platform presenting personal information about him or herself (Wolf et al., 2015). Furthermore, another in vivo approach to induce social exclusion is to be excluded from confederates while playing cards (Ruocco et al., 2010). A newer approach is to use virtual reality to create social interactions and manipulate social exclusion (Hesse et al., 2017; Prendergast & Schubert, 2020). The latter experiments have in common that the instructions do not include information on social exclusion, rather the participant is experiencing social exclusion in real time themselves (Gerber & Wheeler, 2009). However, there are also in vivo experiments in which participants are receiving feedback about being excluded. In so called feedback paradigms participants are usually told that others evaluated them or something they did negatively (Twenge et al., 2001) or chose not to interact with them based on information about the participant that has been previously given to them (e.g., Nezlek et al., 1997) or simply based on a picture (Davey et al., 2010; Lau et al., 2012). For example, in the Island Gateway paradigm participants are instructed to play a game and to choose confederates based on pictures to join the participant to a lonely island, while receiving the same information regarding him/herself (Kujawa et al., 2014). Another example is the Mannheim Virtual Group Interaction Paradigm in which the participant gets acquainted with avatars supposedly representing other participants and then receives feedback whether one is liked or not (Liebke et al., 2018). While the above-described experiments have a cover story to make the participant believe the exclusion is real, other paradigms just ask the participant to imagine that it is real (e.g., Hsu et al., 2013). In the train ride experiment (Zadro et al., 2005) several participants are in the experiment seated in rows of chairs and told to imagine to sit in a crowded train while at the same time given different instructions e.g., where to sit, to exclude or to insult someone with different context stories like someone did not invite you to a birthday party. Thus, in this experiment the participant is given a specific role to play, not having the chance to naturally react to the exclusion. Last but not least, there are coalition experiments in which participants are asked to form a coalition with one or more confederates (Wissink et

al., 2022). While those experiments are not primarily constructed to induce social exclusion, it can be discussed whether not being part of the coalition induces social exclusion or whether the fear of being excluded motivates a behavior to form coalitions that are not beneficial for the participant (Wissink et al., 2022)

Experiments inducing social exclusion in sensu either ask to identify with someone else who is/has experienced social exclusion or to imagine social exclusion happening to oneself. Examples are experiments in which one is listening to or reading scenarios about social exclusion and instructed to vibrantly imagine those (Herpertz et al., 2017; Hitlan et al., 2006), or watching movie scenes in which someone is rejected and trying to identify with the protagonist (Tuschen-Caffier & Vögele, 1999). Moreover, other studies instruct the participant to imagine to be alone in future life (Twenge et al., 2001) or remembering a previous rejection like a breakup from a romantic partner (Cacioppo et al., 2013).

In vivo induction mostly allows a real time and immediate reaction towards the excluder as the social exclusion is happening at the moment. Although, so far, the immediate behavioral response has rarely been the main focus in the literature. However, in those experiments in which social exclusion is not named but only experienced, e.g., less ball tosses as in Cyberball, it is not given that social exclusion gets detected. In sensu induction experiments are probably more obvious on this regard as the instruction is to imagine social exclusion. Further, especially when participants are asked to remember an episode of self-experienced social exclusion, external validity can be considered high (Godwin et al., 2014). Different experimental approaches might lead to a different kind of experienced social exclusion possibly provoking different behavior (Gerber & Wheeler, 2009). According to a meta-analysis, when different experiments are compared, in vivo experiments like Cyberball especially increase arousal, while in sensu experiments with instructions to remember social exclusion do not decrease self-esteem, and those like the future alone paradigm seem not to decrease mood (Gerber & Wheeler, 2009). The authors of this meta-analysis come to the conclusion that in vivo induction experiments should be preferred as they affect mood, self-esteem, and arousal. Another meta-analysis also found differences between in vivo and in sensu induction experiments: being socially excluded in vivo by a group was experienced as more intense compared to imagining future social exclusion, however imagining social exclusion in general had the highest effect (Blackhart et al., 2009). Moreover, within each experiment there are many different details that could influence internal states and behavioral reactions e.g., duration, degree of exclusion, number of excluders, if we like the excluder or

not, if they belong to the same group as we do or not, excluding from the beginning or after an inclusive period, etc. (Blackhart et al., 2009; Gerber & Wheeler, 2009; Hartgerink et al., 2015). Even the position of the avatar might influence need threat, that is a position inferior to the co-players leading to more aggression than a superior position (Schoel et al., 2014). Concerning Cyberball, it is rather unclear as to what extent some specifies, e.g., number of players, effect the consequences of the induction of social exclusion (Hartgerink et al., 2015). Therefore, it is important to acknowledge that results of different experiments inducing social exclusion cannot be compared without comparing the details of those experiments. Thus, after finding a result the first goal should be to replicate it with the exact same experiment, secondly it should be repeated with the same experiment but changes in the manipulation, third other experiments using other forms of induction of social exclusion should be used to replicate the results.

The question arises as to what improvements could be made concerning experimental induced social exclusion. One goal probably would be to make in vivo inductions more realistic e.g., by using virtual reality. Here, social exclusion can quite realistically be induced, while manipulations can be controlled optimally e.g., the confederate's reaction, as compared with real life human to human interactions (Hesse et al., 2017; Kassner et al., 2012; Kothgassner et al., 2021; Prendergast & Schubert, 2020). For example, Kothgassner et al. (2021) used the Cyberball paradigm and implemented it into virtual reality. In real life, social exclusion might rather happen gradually. For example, a depressed patient who receives less and less invitations as they continuously cancel appointments. However, keeping a cover story alive for a long time seems very unethical. Of course, when we consider social exclusion as something very distressing and painful even induction of short exclusion with immediate debriefing can be debated. However, while depressive symptoms seem to be associated with a less pronounced recovery from social exclusion, recovery from Cyberball is achieved quickly (Büttner et al., 2021; Hartgerink et al., 2015). It remains difficult to induce social exclusion in an ecological valid way while staying in the boundaries of ethical guidelines. However, as social exclusion seems to be such a distressing event, the available experiments seem to be able to induce social exclusion in an effective enough way (Gerber & Wheeler, 2009).

Mediators

CM probably does not solely directly cause psychopathology (McLaughlin, 2016). It can rather be speculated that these relationships are mediated by certain factors including learning and shaping information processes (McLaughlin, 2016). So far research, on mediators in the context of CM has mostly focused on explaining the relationship with CM and psychopathology e.g. depressive symptoms (Hoppen & Chalder, 2018). For example, a systematic review identified transdiagnostic psychosocial mediators explaining the relationship between exposure to CM and affective disorders e.g., emotional dysregulation, resilience, attachment anxiety, maladaptive personality traits, re-traumatization, lack of social support, and biological moderators (Hoppen & Chalder, 2018).

Identifying the mediators explaining the relationship between CM and interpersonal dysfunction that are changeable is important to increase knowledge on the pathways as suggested in Figure 1.1 and to elucidate potential targets to prevent dysfunctional behavior and to help changing it once it has already developed (McLaughlin, 2016). Here, rejection sensitivity (RS) and resilience will be discussed as two possible mediators.

Rejection Sensitivity

While social exclusion or rejection is hurtful and not desirable, there seem to be individual differences concerning the extent somebody experiences and/or avoids it. One psychosocial construct that might account for these variances is RS (Downey & Feldman, 1996). The term describes a cognitive and affective disposition how to respond to social rejection. Individuals high in RS perceive social exclusion faster, have a lower threshold as what is perceived as threatening as well as a higher expectancy of social exclusion, and might overreact emotionally as well as behaviourally (Downey & Feldman, 1996). As Downey and Feldman (1996) summarize in their paper on RS, many theories have postulated that negative previous interpersonal relationships might enhance RS. According to Bowlby's (1980) attachment theory children develop mental intra-and interpersonal models that shape their future relationships based on the experience how well caretakers fulfil their children's needs, which could be confirmed in a study by Feldman and Downey (1994). When children learn from their parents that asking for support results in rejection, they will overgeneralize this experience and will be anxious to express their needs in the future, which impacts interpersonal behaviour and relationships leading to aggressive or avoidant behavior eventually ending in unhappy relationships (Bowlby, 1980; Downey & Feldman, 1996).

Studies in healthy adults and community samples could show that high RS was associated with more avoidant behavior after a negative interaction (Meehan et al., 2018), with a negative problem solving style and with interpreting problems as threats (Kraines & Wells, 2017). Furthermore, a meta-analytic review including mostly community samples and two studies with a clinical sample found associations between RS and aggressive behavior as well as with victimization (Gao et al., 2021).

RS is significantly associated with a variety of mental health problems, including BPD in clinical as well as in community samples (Cavicchioli & Maffei, 2020; Gao et al., 2017; Heekerens et al., 2022; Rosenbach & Renneberg, 2011; Sato et al., 2020) and depression (Gao et al., 2017). Gunderson and Lyons-Ruth (2008) argue that the interpersonal hypersensitivity in BPD patients leading to interpersonal dysfunction includes RS next to the fear of abandonment and the inability to be alone. The expectation of rejection seems to be an essential feature especially in the earlier stages of BPD (Cavicchioli & Maffei, 2020), however there are also results showing that age is not moderating the effect (Gao et al., 2017). Further, childhood rejection and emotional neglect and abuse is associated with RS in patients with BPD (Foxhall et al., 2019).

Depressive symptoms and RS are also associated with each other (Kraines & Wells, 2017). In individuals with depression, RS predicted more stressors like interpersonal conflicts leading to more long-term depressive symptoms (Liu et al., 2014). Further, in women with high RS when unable to prevent rejection in a valued relationship, depressive symptoms occurred (Ayduk et al., 2001). Choosing avoidance out of fear to be socially excluded might in fact result in social exclusion followed by loneliness and eventually depressive symptoms (Kraines & Wells, 2017). On the other hand, according to the social risk theory, depressed individuals fear to be seen as a social burden and thus expect social exclusion which is why they choose to avoid social contacts to protect themselves and others (Allen & Badcock, 2003). However, when the depressive symptoms diminish, the willingness to affiliate increases (Allen & Badcock, 2003). In a study from our research group including 60 inpatients with PDD taking part in a naturalistic psychotherapy study, RS was significantly positively correlated with depressive symptoms, assessed with an interview and self-report measure, as well with self-reported borderline symptoms (Konvalin et al., 2021).

Resilience

Even though resilience has been agreed to be very important in the research of CM, the definition of resilience remains blurry (Yoon et al., 2021). According to the American Psychiatric Association (2020), resilience describes the ability to adapt to adverse events like extreme stress caused by interpersonal problems, trauma or threats, and once resilience is built, it can lead to a positive personal development enabling individuals to adapt well when facing further stressors. Thus, studying resilience is important to understand human's behavior to stress. Key characteristics of resilience include adaptive coping, positive emotions, more hope, social support as well as social support seeking, and social connectedness (MacLeod et al., 2016). Resilience can in- and decrease over time depending on the protective and adaptive experiences that are faced and the environment that one is surrounded by (Kim-Cohen & Turkewitz, 2012; Masten, 2014). Adaptive experiences and interpersonal relationships improve the prognosis in some personality disorders (Skodol et al., 2007). However, as Meng et al. (2018) suggests, the protective effect of positive experiences might not be enough for a whole life, so investigating the effect of positive events through life is of high relevance. The effect of adaptive events might be dependent on the developmental phase, e.g. during adolescence we seek support from our peers and no longer only from our parents (Domhardt et al., 2015). Studies show long lasting effects of CM on resilience e.g., sexual abuse is associated with lower resilience even after 27 years (Lind et al., 2018). A population study could show that CM is a significant negative predictor for self-reported resilience (Campbell-Sills et al., 2009), while at the same time resilience has been reported to be protective against the negative impact of CM (Meng et al., 2018; Nasvytienė et al., 2012). In fact, CM is associated with higher psychopathology if resilience is low (Campbell-Sills et al., 2006). Williams (2009) states that long-term social exclusion might also negatively impact resilience. On the other hand, those who have experienced adversity seem to be able to achieve resilience if they can benefit from close relationships, have the ability to be in relationships, are able to feel secure and, do not define themselves by their CM (Burt & Paysnick, 2012). Further, individuals with higher resilience were found to have more pain-relieving chemicals activated in their brains after imagining social exclusion (Hsu et al., 2013). So, resilience might attenuate the impact of social exclusion (Waldeck et al., 2015). After being socially excluded in Cyberball, individuals low in resilience showed significantly less prosocial behavior e.g., donating after the game, compared to those with high resilience, however, those high in resilience showed prosocial behavior equally regardless of the condition (Shi et al., 2022). Though, Shi et al. (2022) argue that while they assessed prosocial behavior after the game in

the reflective stage, resilience might already be influencing processes during the reflexive stage that is during the game and that this should be further investigated.

According to Fonagy et al. (2017), BPD is caused by an inflexibility in social communication and adaption to negative interpersonal experiences, and thus describes BPD as the consequence of a lack of resilience. A study comparing BPD patients with a non-clinical sample found significantly lower resilience in BPD patients, resilience predicting quality of life before and after therapy in BPD patients and only little effectiveness of different forms of psychotherapy on quality of life in BPD patients (Guillén et al., 2021). Further, resilience next to self-esteem was found to mediate the relationship between childhood abuse and borderline features (Xie et al., 2021). Yet, studies on resilience and BPD are scarce.

No studies so far have reported specifically on resilience in patients with PDD. However, a systematic review and meta-analysis found higher resilience to be associated with less depressive symptoms in older adults in cross-sectional studies (Wermelinger Ávila et al., 2017). Further, resilience is associated with less depressive symptoms at baseline of routine inpatient treatment and positively impacts outcome (Marschollek & Bonnet, 2021). Additionally, resilience was found to mediate between childhood adversity and depressive symptoms (Vieira et al., 2020; Zheng et al., 2022).

Aim of the present thesis

This thesis aims to improve knowledge on interpersonal problems that maintain mental disorders like BPD and PDD and at identifying potential and changeable mediators that could eventually be targeted in psychotherapy (see Figure 1.1). Therefore, the major goal of this thesis is to investigate the behavioral response to being socially excluded during the experimental Cyberball paradigm and the comparison of the response between patients with BPD and PDD compared to HC. Moreover, this thesis addresses the question whether CM effects the behavioral response during Cyberball. In particular, it was of interest to analyze the effect of different types of maltreatment and abuse as well as the timing of negative and positive life events on the behavioral response while being socially excluded. In addition, the aim was to study RS and resilience in patients with BPD and PDD and to test the mediating effect of those constructs on the relationship between negative interpersonal experiences, e.g. CM, and the behavioral response to social exclusion. This thesis includes three studies.

In *study I*, 36 patients with BPD and 34 patients with PDD as well as 70 age and gender matched HC played two conditions of the Cyberball paradigm in randomized order: being socially included and being partially socially excluded. A novel variant of the Cyberball paradigm was used to investigate the behavioral response to social exclusion. In order to study the behavioral reaction in the novel variant of Cyberball partial exclusion was induced instead of total exclusion, which had mostly been used in previous Cyberball variants and does not allow to study the behavioral response. This cross-diagnostic study was the first to address how patients with BPD and PDD behaviorally react while being socially excluded compared to HC. Additionally, emotions, tension and assessment of co-players before and after the game, as well as need threat and behavioral intentions after the game were assessed. In *study II* and *study III,* the goal was to look at the relationship between previous negative interpersonal experiences, in *study III* also positive interpersonal experiences, and the behavioral response during social exclusion and to investigate potential mediators explaining this relationship. In *study II* the effect of CM and the subtypes emotional abuse, emotional neglect, physical abuse, physical neglect and sexual abuse on the behavioral response to social exclusion were investigated. Further, RS was tested as a mediator of this relationship. In *study III* the focus was drawn on timing of adversity. The effect of negative but also positive life events during childhood, youth and adulthood on the behavioral response during social exclusion was of focus. Additionally, the mediating effect of resilience was tested.

Chapter 2

Study I:

Altered immediate behavioral response to partial social exclusion: A cross-diagnostic study in patients with borderline personality disorder and persistent depressive disorder

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Abstract

Borderline personality disorder (BPD) and persistent depressive disorder (PDD) are related to interpersonal dysfunction which might become particularly apparent in situations of social exclusion (SE). While emotional responses to SE have been widely explored, behavioral data in clinical samples are lacking. In this cross-diagnostic study, we applied a variant of the Cyberball paradigm to investigate the dynamic behavioral response to partial SE in BPD and PDD. BPD patients (n = 36), PDD patients (n = 34) and age and gender matched healthy controls (HC) (total n = 70) played experimental (i.e. partial SE Cyberball) and control (i.e. inclusion only) conditions in randomized order. While all groups tended to increase ball tosses towards the excluder in response to SE, this behavioral turn was significantly lower in PDD (p = .03, d = -.30) and trendwise in BPD patients (p = .06, d = -.28). Thus, an altered immediate response to partial SE was observed in BPD and PDD, in addition to the emotional reactions previously reported. This study supports the hypothesis of a behavioral coping with SE in BPD and PDD that might be problematic in the long run and provides an experimental paradigm for future research on interpersonal dysfunction.

Introduction

Interpersonal dysfunction is one of the most challenging aspects in the treatment of borderline personality disorder (BPD) and persistent depressive disorder (PDD). BPD patients are characterized by multiple interpersonal difficulties including hallmark symptoms like abandonment avoidance, impaired control of anger and aggression, and unstable relationships (American Psychiatric Association, 2013). Furthermore, additional symptoms associated with interpersonal difficulties have been reported in the literature like deficits in social cognition, sensitivity to threat, hostility, submissiveness, separation insecurity, intimacy avoidance and problems in mentalizing (Beeney et al., 2018; Bertsch et al., 2019; De Meulemeester et al., 2017; Euler et al., 2021; Fitzpatrick et al., 2021; Mulay et al., 2019; Russell et al., 2007). Further, BPD patients show less effort to repair broken relationships (King-Casas et al., 2008). The interpersonal difficulties in PDD are less explored, but obvious in clinical settings e.g. interpersonal fears (Klein et al., 2020) and hostile-submissive behavior (Constantino et al., 2008).

Interpersonal dysfunction of BPD and PDD may become particularly apparent in situations of social conflict, rejection or exclusion. According to the social risk hypothesis

(Allen & Badcock, 2003), avoidant and submissive behavior may serve as an adaptive strategy to cope with SE in situations of feeling unwanted. However, this risk-averse behavior comes at the cost of missing out on new social interactions and might – although intended to avoid SE – in fact provoke SE (Allen & Badcock, 2003) leading into a vicious circle of fearing, inadequately responding to, and, experiencing SE (Reinhard et al., 2020). A frequent used experimental approach to studying the effects of SE is the *Cyberball paradigm* (Williams et al., 2000). In this virtual ball-tossing game, the frequency of ball tosses from virtual co-players to the participant and each other is manipulated to induce SE. So far, Cyberball has mostly been used to study the effect of SE on emotions and needs assessed by questionnaires after the game in both healthy subjects (Gerber & Wheeler, 2009; Hartgerink et al., 2015) and clinical samples including BPD and PDD (Dubreucq & Franck, 2019; Reddy et al., 2019; Reinhard et al., 2020; Seidl et al., 2020). The important information of the behavioral reaction to SE during Cyberball has been widely neglected and only been investigated in a few studies. Recently, in our own research group, Dewald-Kaufmann et al. (2021) investigated the immediate behavioral response to partial SE of healthy subjects in a newly developed variant of the Cyberball paradigm with two alleged co-players. In order to observe a behavioral response, we changed the complete exclusion paradigm used by Williams et al. (2000) to a partial social exclusion where participants receive a reduced number of ball tosses. The main finding was that subjects showed an immediate increase in ball passes to the excluding player followed by a delayed return of participants' behavior to baseline. Similarly, Xu et al. (2017) investigated the effect of intranasal oxytocin compared to placebo on the behavioral response to partial social exclusion induced by a Cyberball variant with three alleged co-players and found that ball tosses were also more often directed towards the excluding player in both groups. These results point towards a reconnection tendency in healthy controls (HC) to the excluding player. This may be interpreted as a prosocial behavioral turn, corresponding to prior theories on behavioral reactions to SE (Ren et al., 2018). Comparable behavioral data on Cyberball are lacking for BPD and PDD patients.

In order to fill this research gap, we used the novel Cyberball variant (Dewald-Kaufmann et al., 2021) to investigate the immediate behavioral response to partial SE in patients with BPD and PDD in comparison to HC matched for age and gender. To ensure comparability with previous studies, the effect of Cyberball on emotions, needs, and rating of players was additionally assessed. In contrast to our findings in healthy subjects (Dewald-Kaufmann et al., 2021), we hypothesized that BPD and PDD would show an altered response to partial SE according to the social risk hypothesis (Allen & Badcock, 2003).

Material and Methods

Sampling and Procedure

One hundred and forty participants including 36 BPD patients, 34 PDD patients, and equivalent numbers of age and gender-matched HC ($HC_{BPD,}$ HC_{PDD}) were included in this study. Participants were recruited via flyers, online platforms and, patients additionally via the University Hospital in Munich. HC and outpatients received financial compensation of 30 Euros. Diagnoses of BPD and PDD were determined by an experienced clinical psychologist (BBB) using the Structural Clinical Interview Axis I (SCID-I) for axis I disorders (Wittchen et al., 1997) and the International Personality Disorder Examination (IPDE) for axis II disorders (Mombour et al., 1996) or the Structural Clinical Interview Axis II (SCID-II) for axis II disorders (Wittchen et al., 1997). PDD was diagnosed according to DSM-IV (a chronic MDD for more than two years, a dysthymic disorder with a superimposed MDD or a recurrent MDD, which has never fully remitted between episodes within the last two years) with the exception that dysthymia was allowed as patients were also categorized by PDD subtypes as described in the DSM-5 (American Psychiatric Association, 2013). Exclusion criteria were pregnancy, breastfeeding, acute suicidality, acute manic or psychotic episode, substance use disorder as a main diagnosis or sedative (benzodiazepines or hypnotics) drug intakes on a regular basis. Further, having taken sedative medication on demand at the day of Cyberball led to exclusion of the study, this was checked by questioning the patients before the experiment. Regular psychopharmacological medication (e.g. antidepressants) was allowed during the study. PDD patients had to fulfill less than three of the nine BPD criteria. For detailed information on in-and exclusion criteria for HC please to refer to Dewald-Kaufmann et al. (2021) as the HC included in the current study were drawn from this larger sample. See Table 2.1 for baseline characteristics and Table A1 in the supplemental materials for comorbidities and drugs.

Table 2.1

Baseline characteristics (N = 140)

	BPD (*n*=36)	PDD (*n*=34)	HC_{BPD} (*n*=36)	HC_{PDD} (*n*=34)	
					p-values
Male *n* (%)	17 (47.2)	19 (55.9)	17 (47.2)	19 (55.9)	.789[1]
Setting					.599[1]
Inpatients *n* (%)	29 (80.6)	29 (85.3)	---	---	
Outpatients *n* (%)	7 (19.4)	5 (14.7)	---	---	
Age (years) *M* (SD)	28.83 (9.22)	38.16 (12.34)	29.04 (9.07)	38.23 (12.22)	<.001** [2+a]
Years of education *M* (SD)	14.04 (2.45)	16.58 (3.78)	16.21 (2.66)	17.42 (3.05)	<.001** [2b]
BDI-II *M* (SD)	31.36 (10.71)	25.52 (11.26)	2.44 (2.90)	1.82 (2.73)	<.001** [2+c]
BSL-23 *M* (SD)	2.00 (0.87)	1.01 (0.65)	0.16 (0.24)	0.15 (0.17)	<.001** [2+d]

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder; HC_{BPD}: age and gender matched healthy controls to the BPD patients; HC_{PDD}: age and gender matched healthy controls to the PDD patients; BDI-II= Beck Depression Scale; BSL-23= Borderline Symptom List; p^1 values are results of chi-square statistics; p^2 values are results of analysis of variance statistic; $^+$ Levene's Test significant in one-way ANOVA: results of Welch Test and Games Howell Test are reported; **p<.001

Specific Note. [a] BPD vs. HC_{BPD}: p = 1.000, BPD vs. HC_{PDD}: p = .003, PDD vs. HC_{PDD}: p = 1.000; PDD vs. HC_{BPD}: p = .005, BPD vs. PDD: p = .004, HC_{BPD} vs. HC_{PDD}: p = .004 [b] BPD vs. HC_{BPD}: p = .016, BPD vs. HC_{PDD}: p < .001; PDD vs. HC_{PDD}: p = .661, PDD vs. HC_{BPD}: p = .956, BPD vs. PDD: p = .004, HC_{BPD} vs. HC_{PDD}: p = .339 [c] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .132, HC_{BPD} vs. HC_{PDD}: p = .794 [d] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p < .001, HC_{BPD} vs. HC_{PDD}: p = 1.000

Measures

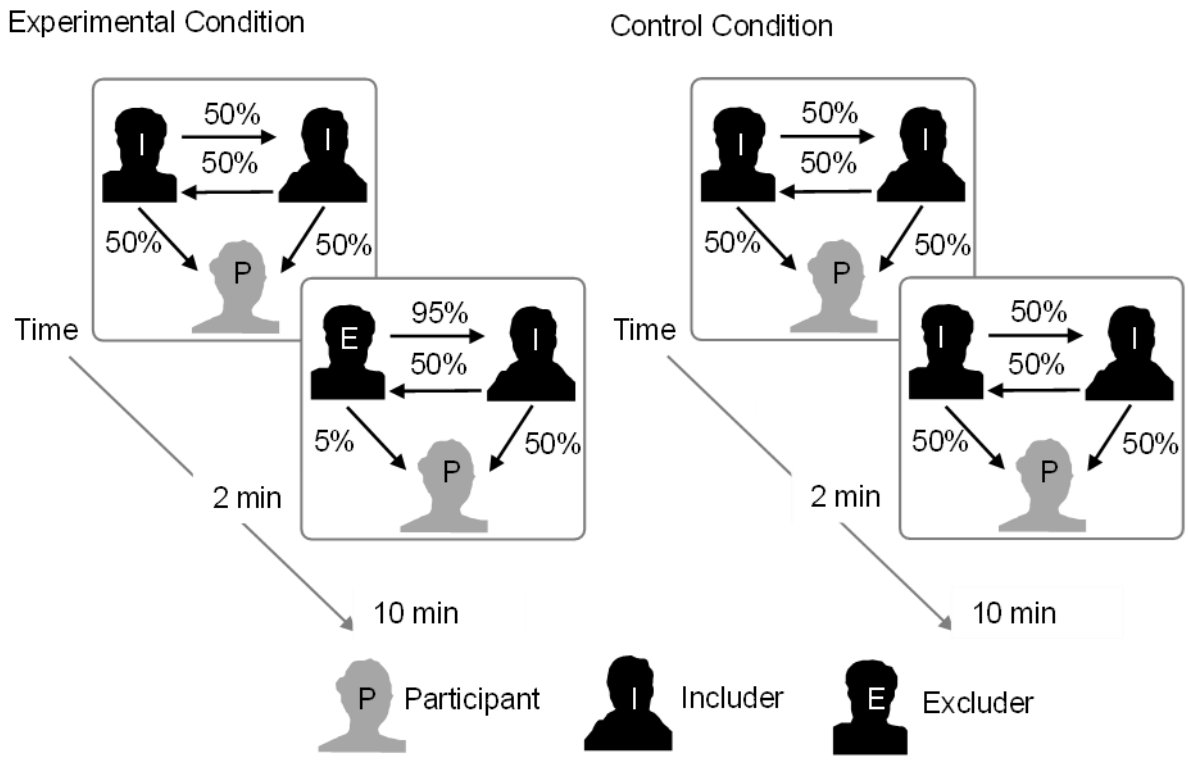
Cyberball Paradigm

Participants played a modified version of Cyberball (Williams et al., 2000) programmed by co-author TW, as described previously (Dewald-Kaufmann et al., 2021). HC analysed in this study were drawn from the sample (N=94) described in Dewald-Kaufmann et al. (2021).

In brief, participants were instructed to play a virtual ball game with two alleged co-players. Each participant played an experimental (partial exclusion) and a control condition (inclusion) in randomized order, both with an identical baseline period of inclusion only (Figure 2.1). Participants who tossed the ball exclusively to one player during baseline were excluded from data analysis to minimize inclusion of participants not taking the game seriously. Using this criterion, one BPD and one PDD patient and five HC were excluded. After that the remaining patients and HC were matched by age and gender.

Figure 2.1

Design of the Cyberball Paradigm



Note. The experiment has been described elsewhere (Dewald-Kaufmann et al., 2021). The experiment took place in a silent and dimmed room with the instructor (not blinded to condition) being present the whole time of the experiment sitting at a table across from the participant. Participants were told that they would take part in a virtual ball tossing game with participants from other German study centers and were informed that the game was not about testing their performance; asking questions was not allowed during the game. A photo of the participant was taken, which was visible during the game and deleted afterwards. Each participant played Cyberball in an experimental (2 min baseline: inclusion; 10 min: partial

exclusion) and a control condition (2 min baseline: inclusion; 10 min: inclusion) in randomized order. For each condition, two out of four pictures of same-gender coplayers, who had been rated in a pilot experiment as having average personality traits (Sympathy, Trustworthiness, Attractiviness, Dominance, Aggressiveness) (Roayaee et al., 2020), were used in a pseudo-randomized order. In the same pseudo-randomized manner, social behavior (inclusion/exclusion) and screen position (left/right) were assigned to the pictures. There was a 10 min break between conditions without specific instructions. At the end of the experiment, all participants were fully debriefed about the cover story.

Self-report Measures

Severity of depressive symptoms and BPD symptoms were measured with self-rating scales: BDI-II (Hautzinger et al., 2006) and the Borderline Symptom List (BSL-23, Bohus et al., 2009), respectively. To be comparable with classic Cyberball studies the Emotion Scale (Gross & Levenson, 1995), the Need Threat Scale (NTS, Grzyb, 2005; Zadro et al., 2004) and the Behavioral Intention List (Staebler, 2008) were also used. Moreover, participants were asked to rate their tension and their co-players on different characteristics before and after the game. Description of the Scales, results and a comparison with the current literature can be found in the supplemental materials (Tables A2-A10 and pp 167-187). The NTS, which was filled out after each Cyberball game, includes three items for manipulation check. The two items “I was excluded” and “I was ignored” were added up for ostracism intensity. The third item asks for estimation of perceived ball tosses, which was used for the manipulation check.

Statistics

Analyses were conducted using SPSS Statistics 26.0 and the statistical software package lme4 in R (Version 3.6.1). The significance threshold was fixed at $p < .05$. Mixed one-way analysis of variance (ANOVA) were calculated to assess group differences. Independent variables were group (BPD, PDD, HC_{BPD}, HC_{PDD}), condition (experimental condition, EC, control condition CC) and, if adequate, time (pre, post). Dependent variables were emotions, rating of players, needs, inner tension, and behavioral intentions. To test for differences between groups at baseline and regarding the change from before to after Cyberball (ES, ratings of players, inner tension) mixed ANOVAs were calculated. Significant effects of mixed ANOVAs were further analyzed by post-hoc tests (Tukey or Games Howell in case of a significant Levene’s test). Partial eta squared (η_p^2) was used as a measure of effect-size,

small effect: η_p^2=.01; medium effect: η_p^2=.06; large effect: η_p^2=.14 (Cohen, 1988). Pairwise *t* tests were applied to test for differences between pre-and post-measurements as well as between experimental and control condition within each group. For multiple comparisons adjustments, *FDR* correction according to Benjamini and Hochberg (1995) was applied within groups.

Playing behavior was operationalized by the Passing Preference (PP). In extension to Dewald-Kaufmann et al. (2021), we used a continuous instead of a minute-wise measure of PP allowing a more detailed and differentiated resolution of the PP. To this end for each turn, a gliding average with a window size of 7 trials and correction for a potential preference for one player during baseline was computed using the formula:

$$PPi = 1/ws \sum_{j=1}^{ws} P((i-1)*s+j) - 1/BL \sum_{k=1}^{BL} P(k)$$

with *PP*i = passing preference in window I; *P* = pass direction for the n-nth trial 1 = participant --> excluder; 0 = participant --> includer; ws = sliding window size in trials; s= shifting distance between two subsequent windows; j = j^{th} trial within current window; bl = number of trials in baseline period and; k = k^{th} trial within baseline period. Using this coding scheme, a positive PP indicated a preference for the excluder. In our analysis, a window size of 7 trials showed the most stable results and was thus used for all PP-calculations. The resulting PP-time series were finally smoothed slightly with a kernel of 3. With the number of played trials differing individually, we chose a cut-off of 10 trials in the baseline period and of 50 trials thereafter as most data were generated within these boundaries. These cut-offs were applied to both the experimental and the control condition. For comparison with the minute-wise approach used by Dewald-Kaufmann et al. (2021), please refer to Figure A2 in the supplemental material. Piece-wise linear mixed-models (LMM) were used to phase-specifically analyze playing behavior during the game. As described in Dewald-Kaufmann et al. (2021), we created three time bins to test changes in playing behavior over the course of the game: Period 1 (baseline), Period 2 (immediate), Period 3 (extinction). Period 1 was the baseline period, when the participant was equally included by both players, thus an inclusive period, and ended with the start of partial exclusion after two minutes. During Period 2, participants showed their immediate behavioral response towards the experimental manipulation of partial exclusion. The end was defined by the maximum of normative PP in HC as a total sample and in each HC group, HC: M = 0.23, SD = 0.37; HC_{BPD}: M = 0.21, SD = 0.40; HC_{PDD}: M = 0.25, SD = 0.34. Period 3 was defined as the phase of late response

extinction for the remaining time with the end-point defined as Trial 50 (see Figure 2.2). However due to partial exclusion in the experimental condition, the participant has less ball possessions compared to the control condition. Therefore, trial counts are not sufficiently comparable between conditions. We thus decided on a separate analysis of conditions with each period and group included as fixed factors. Significance of model factors was determined using Satterthwaite approximation to degrees of freedom, Model parameters were computed using restricted maximum-likelihood estimation (REML). To measure explained variance of the fitted model, Ω^2 was calculated (Xu, 2003). Effect sizes and their confidence intervals for differences in slopes per period and between groups were calculated as recommended by Feingold (2009, 2015).

Results

Manipulation Check

All groups identified SE correctly with estimations of ball tosses differing between conditions, all ps < .001; Condition x Group: F(3, 134) = 1.82, ηp2 = .04, p = .15. In all groups, ostracism intensity was higher in the experimental compared to the control condition, all ps < .001, condition: F(1, 132) = 147.59, ηp2 = .53, p < .001. Only in the experimental condition, did BPD patients estimate ball tosses lower and experience ostracism more intensely compared to HC_{BPD}, both ps < .024. (see Table A5 in the supplemental materials).

Ball Tossing Behavior

In the experimental condition the variance explained by the model was $\Omega^2 = 0.46$. The interaction of Group x Period 1, $F(3, 8054) = 1.38$, $p = .247$, was insignificant, while the interactions Group x Period 2, $F(3, 8051) = 2.84$, $p = .036$, and Group x Period 3, $F(3, 8052) = 19.62$, $p < .001$, were both significant. During Period 2, BPD patients had a lower PP towards the excluding player compared to HC_{BPD}; however, this difference was observed on a trend level only, t (8051.22) = 1.88, $p = .06$, $d = -0.28$. During Period 3 and compared to $HC_{BPD,}$ BPD patients had a significant lower PP towards the including player, $t(8051.40) = -4{,}62$, $p <. 001$, $d = 0.57$. PDD patients only differed significantly from HC_{PDD} during Period 2 with a lower PP towards the excluding player $t(8051.28) = 2.19$, $p =. 03$, $d = -0.30$. There were no significant differences in playing behavior between patient groups, while HC groups differed significantly during Period 3 with HC_{BPD} showing a sustained decrease in PP towards the excluding player that is a sustained increase towards the including player, $t(8052.46) = 6.92$,

$p <$ .001, d = -0.85 (see Table 2.2 and Figure 2.2). In the control condition the model explained $\Omega^2 = 0.27$ of the variance. All interactions reached significance, Group x Period 1: $F(3, 8054) = 5.21$, $p = .001$, Group x Period 2: $F(3, 8051) = 7.48$, $p < .001$, Group x Period 3: $F(3, 8052) = 2.64$, $p = .05$. BPD patients differed from HC_{BPD} during all periods, all ts (dfs <8175.79) < 4.23, ps < .01, ds > |0.32|, and from PDD patients during Period 2, $t(8168.36) = 2.87$, $p = .004$, d = .31. Additionally, during Period 3 playing behavior differed between HC groups, $t(8167.87) = 2.37$, $p = .02$, d = -.31. (see Table A11 and Figure A1-A2 in the supplemental materials).

Table 2.2

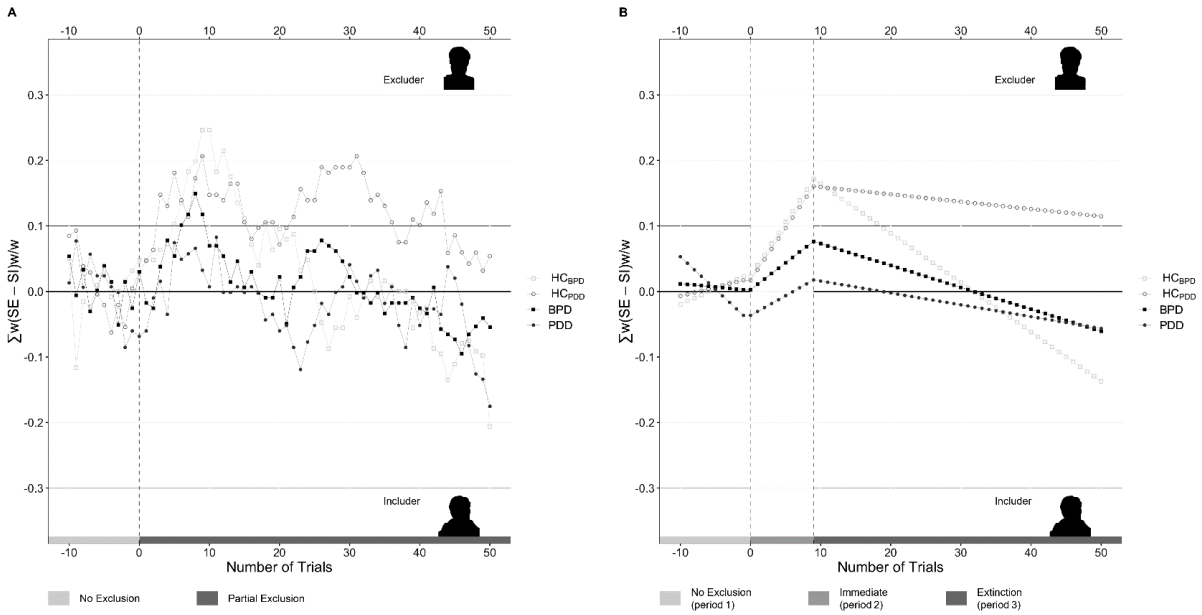
Results of piecewise Linear Mixed Models (LMM) – Group Comparisons within the Experimental Condition

Period	Time interval (trials)	Contrast Group 1 vs. Group 2	Slope Group 1	Slope Group 2	*t*	*df*	*p*	*d* [95% CI]
1: no exclusion	[-10,0]	BPD vs. HC_{BPD}	-0.001	0.005	0.73	8054.73	.46	-0.30 [-1.11, 0.50]
1: no exclusion	[-10,0]	PDD vs. HC_{PDD}	-0.010	0.003	1.62	8053.85	.10	-0.48 [-1.05, 0.10]
1: no exclusion	[-10,0]	BPD vs. PDD	-0.001	-0.010	-1.16	8053.90	.25	-0.38 [-1.04, 0.27]
1: no exclusion	[-10,0]	HC_{BPD} vs. HC_{PDD}	0.005	0.003	-0.27	8054.67	.79	0.09 [-.59, 0.77]
2: immediate	[1,9]	BPD vs. HC_{BPD}	0.008	0.017	1.88	8051.22	.06	-0.28 [-.58, 0.01]
2: immediate	[1,9]	PDD vs. HC_{PDD}	0.006	0.016	2.19	8051.28	.03*	-0.30 [-.57, -0.03]
2: immediate	[1,9]	BPD vs. PDD	0.008	0.006	-0.49	8051.22	.63	-0.07 [-.36, 0.21]
2: immediate	[1,9]	HC_{BPD} vs. HC_{PDD}	0.017	0.016	-0.13	8051.27	.90	0.02 [-.26, 0.30]
3: extinction	[10,50]	BPD vs. HC_{BPD}	-0.003	-0.008	-4.62	8051.40	<.001**	0.57 [.33, 0.81]
3: extinction	[10,50]	PDD vs. HC_{PDD}	-0.002	-0.001	0.72	8052.80	.47	-0.08 [-.29, 0.14]
3: extinction	[10,50]	BPD vs. PDD	-0.003	-0.002	1.66	8051.80	.10	0.19 [-0.04, 0.41]
3: extinction	[10,50]	HC_{BPD} vs. HC_{PDD}	-0.008	-0.001	6.92	8052.46	<.001**	-0.85 [-1.09,-0.61]

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; CI = confidence interval; Effect size *d* and confidence intervals were calculated as recommended by Feingold (2009, 2015); *$p < .05$. **$p<.001$

Figure 2.2

Passing Preference during the Experimental Condition in the Cyberball Paradigm (N=140)



Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} =age and gender matched healthy controls to the PDD patients; A: mean Passing Preference of each group; B: data fitted to each period using piece-wise Linear Mixed Models

Discussion

To our knowledge, this is the first study investigating the immediate dynamic behavioral response to partial SE in BPD and PDD using a cross-diagnostic approach. In a recently developed variant of the Cyberball paradigm, we observed an altered immediate behavioral response to partial SE during the first minutes of SE in BPD and PDD patients compared to HC characterized by an attenuated increase of ball tosses towards the excluding player. While this difference was significant in PDD patients compared to HC_{PDD}, BPD patients differed only trendwise compared to HC_{BPD}. These findings confirm our expectation for HC and replicate findings from Dewald-Kaufmann et al. (2021) and Xu et al. (2017), and are partly in line with our hypothesis on patients' behavior.

The reduced immediate response to partial SE in BPD and PDD patients fits well with their common avoidant or submissive interpersonal behavioral patterns and could be interpreted as a risk-averse approach that converges with the social risk hypothesis of depressed mood (Allen & Badcock, 2003). Still, BPD patients tried to reconnect with the excluder in this study, which is in line with studies showing that BPD patients are not non-cooperative per se (Thielmann et al., 2014). Interestingly, while HC_{BPD} showed an adaptive rather dominant behavior characterized by increased ball tosses towards the includer in the later SE period, BPD patients did increase ball tosses significantly less. Thus, BPD patients' behavior support findings of being less dominant in interpersonal situations (Barnow et al., 2009; Russell et al., 2007). The behavior of PDD patients is in line with previous findings on interpersonal difficulties (Constantino et al., 2008; Klein et al., 2020) and McCullough's (2000) hypothesis of fear avoidance and perception decoupling. Due to childhood maltreatment patients with PDD fear social contacts and, therefore, try to avoid situations that resemble the traumatic experiences leading to an interpersonal distance. Perception decoupling, also resulting from childhood maltreatment, is the belief that nothing will ever change in the future and, therefore positive or negative feedback of others is not influencing one's own behavioral reaction and vice versa (McCullough, 2000). Further, the less pronounced prosocial behavior could also be associated with difficulties in perspective taking which is a further characterization of PDD (Domes, Spenthof, et al., 2016) and was found to reduce prosocial behavior (Will et al., 2015). Further, studies have shown a significant decrease in oxytocin in BPD and PDD patients compared to healthy subjects (Jobst et al., 2014; Jobst et al., 2015) after being excluded in Cyberball. As oxytocin is positively associated

with prosocial behavior (Marsh et al., 2021), the decrease in oxytocin found in patients might display the neurobiological underpinnings of less prosocial behavior.

In the experimental condition, both HC groups differed significantly in their PP after their initial response, with HC_{BPD} showing a more sustained decrease in PP towards the excluder that is a more sustained increase towards the includer. To test whether the significant differences in age, experienced ostracism intensity, overall need threat and need threat for self-esteem in the experimental condition between HC groups covary with this difference, we performed post-hoc correlation analysis with the PP in both conditions, yielding no significant associations (see Tables A12-A13 in the supplemental materials). As research shows that similar age of participants and virtual co-players is associated with feeling close in Cyberball (Hühnel et al., 2018), the age difference to the alleged co-players with ages ranging from 20 to 30 might explain the higher ostracism intensity in $HC_{PDD.}$ However, the difference in PP found between HC groups was unexpected. The sustained turning towards the including player in the HC_{BPD} group during Period 3 compared to HC_{PDD} might also explain the differences found in comparison with the BPD group during Period 3. From a further perspective, the initial response to partial SE of turning towards the excluding player might reflect a reflex, however, after this quick and unintentional response other factors like personality traits or cognitive aspects might define further behavior. This finding suggests that the behavioral response to Cyberball needs to be further explored in larger HC samples to better understand differences in playing behavior in general.

The somewhat surprising behavior of BPD patients and the differences found between HC groups during Period 3 in the control condition are rather unexpected, as order of condition and of pictures were randomized.

The manipulation check was successful in each group, indicating that all groups can correctly identify being ex- and included (Bauriedl-Schmidt et al., 2017; Domsalla et al., 2014; Jobst et al., 2014; Jobst et al., 2015; Renneberg et al., 2012; Savage & Lenzenweger, 2018; Seidl et al., 2020). In accordance with Gutz et al. (2015), BPD patients reported higher ostracism intensity compared to HC_{BPD}, however in this study only in the experimental condition. As in Renneberg et al. (2012) but in contrast to others (e.g., Jobst et al., 2014), BPD patients rated the number of received ball tosses significantly lower when being excluded compared to HC_{BPD}. The high BDI scores in BPD patients are in accordance with findings that depressed BPD patients rate their depressive symptoms more intense compared to similar depressed controls (Stanley & Wilson, 2006).

Limitations

We regard this study as a pilot for investigating the behavioral response to partial SE in clinical samples and are aware of several limitations: First, even though the experiment was well chosen to observe behavioral reaction to SE, other explanations for the observed behavior cannot be fully ruled out. Second, the sample size is relatively small. Third, the two patient and the two HC groups were not age matched and, therefore, comparisons within these entities might have been confounded by this variable. Fourth, age differences between participants and the virtual co-players might also have affected their playing behavior and should be further investigated. Fifth, as many patients received psychopharmacological medication, we cannot rule out influence on behavioral and self-assessment measures. Sixth, we cannot fully rule out whether a delay in noticing the SE might have led to different PP in the patient group as we only asked about estimated ball tosses after and not continuously during the game. Finally, about half of the BPD patients also suffered from depressive disorders and a few PDD patients reported BPD symptoms, thus this overlap in symptomatology possibly affects the comparison to PDD patients. Yet, focusing on BPD patients without depressive symptomatology would not be representative with about 87% suffering from comorbid depressive disorder (Zanarini et al., 2019). Future research should consider these limitations and aim at a larger sample size with age and gender matched participants through all groups and comparable age differences with the alleged co-players only including patients without pharmacotherapy.

Clinical and research implications

From a clinical perspective, our experimental approach to measure behavioral response to SE, could be a first step towards quantifying interpersonal difficulties and eventually also investigating improvements in interpersonal behavior after therapy. Future research should focus on the association of playing behavior and rejection sensitivity, previous experience with SE, childhood maltreatment, loneliness and cognitions during the game including expectations on rejection and connecting with the co-players after the game. Objective measures of distress (e.g. heart rate) should be included in future studies to gain deeper insight into the physiological underpinnings of the behavioral response. Investigating how the immediate reaction to SE is evaluated by others would be highly relevant as dysfunctional behavioral coping with SE might lead to further exclusion (Reinhard et al., 2020). Finally, future research needs to replicate our findings in larger samples.

Conclusion

This cross-diagnostic study investigated the response of BPD and PDD patients to partial SE using Cyberball compared to HC. Our results support the notion of a reduced capacity for social reconnecting in patients with interpersonal dysfunction. These findings contribute to a better understanding of the psychopathology of BPD and PDD. Aiming at individualized therapy, future research needs to imbed the behavioral response to SE within a larger framework reaching from childhood maltreatment to other individual factors of current psychopathology including rejection sensitivity and loneliness. A comparison of playing behavior before and after therapy could represent a first step toward a behavioral measure of interpersonal behavior.

Chapter 3

Study II:

Association between the behavioral response during social exclusion and recalled childhood maltreatment

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Abstract

Social exclusion is a critical event for mental health. Patients with interpersonal dysfunction, e.g., with borderline personality disorder (BPD) or persistent depressive disorder (PDD), are particularly vulnerable, often based on their experiences of early adversity in life. The etiological pathways from childhood maltreatment (CM) to current behavior during social exclusion are still underexplored. This cross-diagnostic study investigated the relationship between self-reported CM and behavioral reaction to social exclusion in an experimental paradigm (Cyberball). Data from 140 subjects including patients with BPD and PDD as well as healthy controls were analyzed. The effect of CM (Childhood Trauma Questionnaire, CTQ) on behavior to social exclusion during Cyberball (ball tossing behavior) was analyzed including rejection sensitivity (RS) as a mediator. In the whole sample, the CTQ score (B = -.004, $p < .05$) as well as the emotional neglect subscore (B = -.016, $p < .01$) were associated with a reduced ball tossing behavior towards the excluder. There were no significant indirect effects involving RS. These current findings support the relationship between CM and an altered interpersonal response in critical interpersonal situations. Larger cohorts with multidimensional data in social domains are warranted to further investigate the link between CM and current interpersonal dysfunction.

Introduction

Mental disorders with interpersonal problems, e.g., patients with borderline personality disorder (BPD) and persistent depressive disorder (PDD) are associated with a high prevalence of childhood maltreatment (CM) as well as repeated experiences of rejection (Brakemeier et al., 2018; Humphreys et al., 2020; Nelson et al., 2017; Nenov-Matt et al., 2020). While BPD is a personality disorder and PDD is not, both patient groups struggle particularly with stressful interpersonal situations such as conflicts, rejection or social exclusion (American Psychiatric Association, 2013; Struck, Gärtner, et al., 2020). Further, long-term studies show that both patient groups are characterized by deficits in social functioning, which remain stable over time (Gunderson et al., 2011; Rhebergen et al., 2010). CM has been found to be associated with lower social functioning later in life (Simon et al., 2009) as well as reduced prosocial behavior in children and adolescents (Alink et al., 2012; Yu et al., 2020). However, the pathways from CM to interpersonal dysfunction are not completely understood (Teicher, 2020). Two constructs that are particularly related to the

experience of social exclusion are 1) rejection sensitivity (RS) and 2) the behavioral response to social rejection or exclusion.

RS is defined as a cognitive-affective disposition to expect, readily perceive and emotionally or behaviorally overreact to social rejection (Downey & Feldman, 1996). Within the Cognitive-Affective Processing System framework (CAPS, Mischel & Shoda, 1995) RS results from the dynamic interplay of expectations and affects that are activated by specific psychological features within interpersonal situations provoking behavioral reactions (Ayduk et al., 2000). According to the conceptual model of RS by Levy et al. (2001), RS increases by experiences of interpersonal rejection and leads to anxious or angry expectations of rejection that are activated when facing a trigger, e.g., a dispute with a friend. Individuals high in RS are vigilant to rejection and once rejection is perceived, cognitive reactions (e.g., self-blame) and affective reactions (e.g., anger) can occur (Levy et al., 2001). These immediate responses can even cause long term changes of thinking, e.g., rumination (Pearson et al., 2011). Finally, the cognitive-affective states influence the reactions on a behavioral level, (e.g., withdrawal or aggression). Unfortunately, these behavioral reactions in high RS individuals are likely to enhance experiences of rejection resulting in a vicious circle of rejection (Levy et al., 2001) and can lead to dysfunctional relationships (Ayduk et al., 1999; Ayduk et al., 2003; Purdie & Downey, 2000; Romero-Canyas et al., 2010). This postulated sequence has been empirically supported in earlier research (Feldman & Downey, 1994; Normansell & Wisco, 2017; Rokita et al., 2018; Rosenbach & Renneberg, 2014). Patients with BPD and PDD were found to be highly rejection sensitive (Bungert, Liebke, et al., 2015; Cavicchioli & Maffei, 2020; Foxhall et al., 2019; Gao et al., 2017; Nenov-Matt et al., 2020). Moreover, studies have shown that CM is associated with and can enhance the development of RS (Feldman & Downey, 1994; Luterek et al., 2004), that is experiences of being rejected, neglected or abused during childhood eventually lead to the fear and expectation of further rejection through lifetime. For example, RS has been found to mediate the effect of CM on adult attachment behavior in a community sample by Feldman and Downey (1994). Despite the fact that RS might play a pivotal role in the maintenance of mental disorders through the vicious circle of fearing rejection and being rejected (Nenov-Matt et al., 2020; Reinhard et al., 2020) it has not been sufficiently studied in research on psychopathology (Hsu & Jarcho, 2021).

The second construct investigated here is the behavioral reaction to social exclusion. According to the theoretical model by Levy et al. (2001), patients with BPD and PDD might often find themselves confronted with situations in which they are rejected or excluded, which

may be caused by high RS. People's actual behavioral response to social exclusion may provide a deeper understanding of patients' interpersonal difficulties. In our own study we investigated the behavioral response to social exclusion in patients with BPD and PDD compared to healthy controls (HC) using a modified version of the Cyberball paradigm (Barton et al., 2021). In this modified version, participants are led to believe to play a ball tossing game on the computer with two alleged co-players located at another German university, one of them turns into the excluding player and starts to partially exclude the participant. In line with previous studies, HC increased ball tosses, that is the passing preference (PP), immediately to the excluding co-player, which was interpreted as trying to reconnect and behave prosocial (Dewald-Kaufmann et al., 2021; Xu et al., 2017). Both patient groups showed an attenuated approach compared to age and gender matched HC (Barton et al., 2021). We interpreted this finding of immediate increases of PP towards the excluder as a reflex that seems altered in BPD and PDD patients. Thus, we concluded that differences in this immediate behavioral turn might be essential to understand the interpersonal difficulties BPD and PDD patients report. As interpersonal difficulties seem to be very resistant over time (Gunderson et al., 2011; Rhebergen et al., 2010), and often remain stable after successful remission of core symptoms in BPD (Zeitler et al., 2020), making behavior visible that might enhance interpersonal difficulties is highly relevant.

Taken together, CM is associated with interpersonal difficulties. According to theoretical models, repeated experiences of rejection enhance RS, which promotes behavior that is likely to lead to actual rejection, completing a vicious circle. Studies on this topic are rather limited and have mainly relied on self-report data to assess interpersonal behavior. To the best of our knowledge, no study has investigated the relationship between CM and the observable behavioral response to partial social exclusion during Cyberball in a cross-diagnostic sample consisting of patients with BPD, PDD and age and gender matched HC. We hypothesized that CM is associated with a reduction of prosocial or social repair behavior, i.e., tossing the ball less frequently to the excluder (Primary Hypothesis), and higher RS, rejection anxiety and expectancy (Secondary Hypothesis 1). Moreover, we tested whether RS serves as a mediator between CM and the behavioral reaction to social exclusion (Secondary Hypothesis 2).

Patients and Methods

Participants and Procedure

The study was approved by the local ethics committee (Faculty of Medicine, Ludwig-Maximilians University, Munich, Germany; registration number: 281-11) and was registered retrospectively as part of its parent study (Faculty of Medicine, Ludwig-Maximilians University, Munich, Germany; registration number: 713-15) at the German Clinical Trials Register (DRKS-ID: DRKS00019821). All methods were carried out in accordance with the ethical guidelines of the German Psychological Society, a German adaption of the ethical guidelines ("Ethical Principles of Psychologists and Code of Conduct") provided by the American Psychological Association, and with the Good Clinical Practice guidelines. Written informed consent for participation in this study was given by all participants. A detailed description of participants and procedures is given elsewhere (Barton et al., 2021; Nenov-Matt et al., 2020). In brief, patients with BPD and PDD were recruited via the psychiatric clinic of the LMU University and HC were recruited via flyers. The SCID I and II interviews (Wittchen et al., 1997) were conducted by an experienced clinical psychologist (BBB) to confirm diagnoses of BPD or PDD (according to DSM-5 criteria); PDD patients and HC were allowed to fulfill no more than three of the nine BPD criteria. HC were excluded if they fulfilled criteria of any mental disorder, had received psychotherapy or psychopharmacological treatment within the previous 10 years and scored higher than 12 on the Beck Depression Inventory (Hautzinger et al., 2006). Inpatients did not receive any compensation, while outpatients and HC received 30 Euros. In total 34 PDD patients (55.9 % male) and 36 BPD patients (47.2% male) as well as 70 age and gender matched HC were included in this study. PDD patients, M_{age} = 38.23, *SD* = 12.22, were significantly older compared to BPD patients, M_{age} = 28.83, *SD* = 9.22, $t(61) = -3.57$, $p = .001$, $d = 0.42$, and consequently HC (HC_{PDD} vs. HC_{BPD}) groups differed in the same respect, $t(61) = 3.57$, $p = .001$, $d = 0.42$. The pooled patient and HC groups did not significantly differ in age, *M*age patients= 33.37, *SD* = 11.75 vs. M_{age} HC = 33.50, *SD* = 11.60, $t(122) = .074$, $p = .941$, $d = 0.01$.

All participants played and completed the adapted variant of the Cyberball Paradigm (Williams et al., 2000). For a more precise description of the experiment please see Barton et al. (2021). In brief, the game starts with two minutes of being included by both alleged same gender co-players, that is the participant receives an equal amount of ball tosses from both co-players. After this inclusive baseline period, one of the co-players starts excluding the participant and only tosses 5% of his/her ball tosses towards the participant, while the other

co-player still passes 50% of his/her ball-tosses. This period of being partially socially excluded lasts for ten minutes. In previously published studies (Barton et al., 2021; Dewald-Kaufmann et al., 2021), we defined three periods: the inclusive baseline period, the immediate response and the extinction period. The immediate response period starts after the 2-minute-long inclusive baseline period and the end was defined by the maximum of PP in HC. In this current study we used data previously published (Barton et al., 2021), but we were only interested in the PP during the immediate response period in the experimental condition, therefore, only this parameter from the Cyberball Paradigm was included in this current analysis.

Childhood Trauma Questionnaire

Each participant filled out the German short version of the Childhood Trauma Questionnaire (CTQ) consisting of 28 items with a 5-point Likert scale (Bernstein & Fink, 1998; Bernstein et al., 2003; Wingenfeld et al., 2010). The CTQ consists of five subscales: emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect. In addition, we report the scores on the Minimization-Denial (MD) subscale of the CTQ to assess response biases (MacDonald et al., 2016). The psychometrics of the German version of the CTQ are satisfying with a good construct validity and Cronbach's α = .80 - .89, only physical neglect had a Cronbach's α = 0.55 (Klinitzke et al., 2012).

Rejection Sensitivity

The German version of the Rejection Sensitivity Questionnaire for adults (RSQ, Downey & Feldman, 1996; Staebler, Helbing, et al., 2011) consists of 20 items. Each item describes a scenario with a request towards a significant other and one has to rate the level of anxiety and the expectation to be rejected on a 6-point Likert scale. Both internal consistency, Cronbach's α = .84, and test-retest reliability, r = .78 -.83, were high in the validation study of the English version (Downey & Feldman, 1996). In this sample, Cronbach's α was acceptable for the whole sample with Cronbach's α = .64 and α = .95 for the subscale rejection anxiety and α = .94 for the subscale rejection expectancy.

Statistics

Analyses were conducted using SPSS Statistics (Version 25) with the significance threshold fixed at $p < .05$ and the PROCESS macro for SPSS (Version 4.0) (Hayes, 2018).

For the precise description of the analysis for the PP, please refer to Barton et al. (2021). In short, the PP was calculated with positive scores indicating favorizing the excluding player. To assess group differences, whole patient samples vs. HC, BPD vs. HC_{BPD}, PDD vs. HC_{PDD}, on the self-report measures one-way analysis of variance (ANOVA) with planned contrasts were calculated. If the Levene's test was significant, the Welch ANOVA test was reported. Effect sizes were calculated according to Cohen (1988) with $r = \sqrt{\frac{t^2}{t^2+df}}$ and |0.1| being a small, |0.3| a medium and |0.5| a large effect. Due to multiple testing *FDR* correction was applied according to Benjamini and Hochberg (1995).

Pearson correlation with bias-corrected and accelerated bootstrap confidence intervals, *BCa* 95% *CI*, with 1000 bootstrap samples were used to investigate associations between the CTQ, RSQ and PP.

As age differed significantly between the two patient groups as well as between the two HC groups, Pearson correlations with bias-corrected and accelerated bootstrap confidence intervals, *BCa* 95% *CI*, with 1000 bootstraps were used to test for associations between age and CTQ as well as RSQ and PP, resulting in no significant results, all *p*s > .084. However, the correlation between age and the RSQ total score and especially the subscale for rejection anxiety was marginally significant, p =.054 [-.304; -.013] (see supplemental materials Table B1).

To test the mediating effect of rejection anxiety and expectancy, parallel multiple mediator models were calculated using the PROCESS macro, and model 4 (Hayes, 2018) including age as a covariate. We decided to estimate several models with the subscales of the CTQ as the independent variable since the subscales in this study were highly correlated and, therefore, would have canceled each other out in one model (Hayes, 2018, p. 143). As recommended by Hayes and Rockwood (2017) we used confidence intervals computed from 10000 bootstrap iterations with 95% to control for significance of the indirect effect. Before conducting the analysis, linearity and homoscedasticity assumptions were checked using the multiple regression standardized predicted and residual values and each model was controlled by visual inspection of LOESS smoothing. Normality of estimation error assumption was checked using the multiple regression standardized residuals (Kane & Ashbaugh, 2017). The independence of error terms was given, Durbin-Watson d = 2.18 - 2.24 (Field, 2016). Assumptions were met, except for the subscales of physical and sexual abuse, here homoscedasticity was not given. Additionally, there was indication of reduced variance: in

the whole sample 78 % reported no physical abuse and 78 % no sexual abuse. In comparison, 51 % reported no emotional abuse, 38 % no emotional neglect and 58 % no physical neglect. In a second step conditional process analyses (Hayes & Rockwood, 2020) were calculated using the PROCESS macro and model 59 (Hayes, 2018). In this hypothetical moderated mediation model including two parallel mediating pathways that link CM and behavioral response to social exclusion through rejection anxiety and rejection expectancy, we tested if diagnosis moderated the effects while controlling for age (see supplemental materials Figure B1).

Results

Group characteristics

Statistical information for comparisons between groups, including means of the CTQ, RSQ, and PP during Cyberball, is summarized in Table 3.1. Patients scored significantly higher on all CTQ and both RSQ scales compared to the HC sample. Patients with BPD scored significantly higher on the RSQ and CTQ total and subscale scores compared to the HC_{BPD} sample. In patients with PDD, the CTQ total score and the subscales emotional neglect and abuse and physical neglect as well as the RSQ with both subscales were significantly higher compared to HC_{PDD}. When comparing BPD and PDD, BPD patients reported significantly higher CTQ total scores and on the subscales for physical abuse and neglect as well as significantly higher scores on the RSQ and both subscales than PDD patients. Patient and HC groups did not differ significantly concerning PP. Average scores of the MD subscale also differed between groups (please see Table 3.1).

Table 3.1

Sample characteristics (CTQ and RSQ scores as well as passing preference [PP] during social exclusion) and statistical information on comparisons between groups: patients (BPD/PDD) and healthy controls (HC_{BPD}, HC_{PDD})

								Planned Contrasts				
	Patients	HC	BPD	PDD	HC_{BPD}	HC_{PDD}	one-way ANOVA	Patient vs. HC	BPD vs. HC_{BPD}	PDD vs. HC_{PDD}	PDD vs. BPD	HC_{BPD} vs. HC_{PDD}
CTQ_{total}	54.10 (17.58)	32.21 (8.26)	58.15 (19.50)	49.82 (14.36)	31.42 (6.22)	33.05 (10.02)	$F(3.70) = 32.69$, **$p < .001$, $p_{FDR} < .001$**	$t(93) = -9.57$, **$p < .001$**, $r = 0.70$	$t(42) = -7.83$, **$p < .001$**, $r = 0.77$	$t(59) = -5.59$, **$p < .001$**, $r = 0.59$	$t(64) = 2.04$, **$p = .045$**, $r = 0.25$	$t(55) = 2.01$, $p = .419$, $r = 0.11$
CTQ_{EA}	13.99 (5.19)	6.90 (2.96)	14.68 (4.86)	13.26 (5.50)	6.78 (2.42)	7.03 (3.49)	$F(3.71) = 35.36$, **$p < .001$, $p_{FDR} < .001$**	$t(104) = -9.84$, **$p < .001$**, $r = 0.69$	$t(52) = -8.73$, **$p < .001$**, $r = 0.77$	$t(56) = -5.59$, **$p < .001$**, $r = 0.60$	$t(66) = 1.14$, $p = .259$, $r = 0.14$	$t(58) = 0.35$, $p = .728$, $r = 0.05$
CTQ_{PA}	7.82 (4.30)	5.54 (1.63)	8.88 (5.31)	6.71 (2.52)	5.39 (1.23)	5.71 (2.04)	$F(3.68) = 6.88$, **$p < .001$, $p_{FDR} < .001$**	$t(67) = -4.23$, **$p < .001$**, $r = 0.46$	$t(38) = -3.85$, **$p < .001$**, $r = 0.53$	$t(63) = -1.8$, $p = .077$, $r = 0.22$	$t(51) = 2.2$, **$p = .032$**, $r = 0.30$	$t(51) = 0.8$, $p = .428$, $r = 0.11$
CTQ_{SA}	7.31 (4.73)	5.36 (1.24)	7.99 (5.19)	6.59 (4.16)	5.17 (0.74)	5.56 (1.60)	$F(3.75) = 4.82$ **$p = .004$, $p_{FDR} = .004$**	$t(76) = -3.32$, **$p = .001$**, $r = 0.36$	$t(36) = -3.24$, **$p = .003$**, $r = 0.47$	$t(43) = -1.35$, $p = .185$, $r = 0.20$	$t(66) = 1.25$, $p = .214$, $r = 0.15$	$t(46) = 1.31$, $p = .198$, $r = 0.19$
CTQ_{EN}	15.99 (4.92)	8.00 (3.03)	16.53 (4.88)	15.41 (4.97)	7.72 (3.03)	8.30 (3.06)	$F(3.74) = 44.30$, **$p < .001$, $p_{FDR} < .001$**	$t(113) = -11.5$, **$p < .001$**, $r = .73$	$t(59) = -9.21$, **$p < .001$**, $r = 0.77$	$t(55) = -7.11$, **$p < .001$**, $r = 0.69$	$t(68) = 0.95$, $p = .344$, $r = 0.11$	$t(68) = 0.8$, $p = .429$, $r = 0.10$
CTQ_{PN}	8.99 (3.31)	6.41 (2.12)	10.06 (3.66)	7.85 (2.46)	6.36 (1.62)	6.46 (2.56)	$F(3.72) = 11.89$, **$p < .001$, $p_{FDR} < .001$**	$t(108) = -5.64$, **$p < .001$**, $r = 0.48$	$t(48) = -5.55$, **$p < .001$**, $r = 0.62$	$t(66) = -2.29$, **$p = .025$**, $r = 0.27$	$t(62) = 2.98$, **$p = .004$**, $r = 0.35$	$t(55) = 0.18$, $p = .855$, $r = 0.02$
CTQ_{MD}	0.29 (0.80)	1.31 (1.86)	0.14 (0.47)	0.44 (1.03)	1.62 (2.01)	0.98 (1.65)	$F(3.65) = 8.56$. **$p < .001$, $p_{FDR} < .001$**	$t(91) = 4.22$, **$p < .001$**, $r = 0.41$	$t(39) = 4.31$, **$p < .001$**, $r = 0.57$	$t(56) = 1.62$, $p = .111$, $r = 0.21$	$t(46) = -1.57$, $p = .124$, $r = 0.23$	$t(67) = -1.46$, $p = .149$, $r = 0.18$
RSQ	14.73 (5.31)	6.07 (2.90)	16.56 (5.74)	12.80 (4.07)	5.90 (2.97)	6.26 (2.87)	$F(3.74) = 51.45$, **$p < .001$, $p_{FDR} < .001$**	$t(103) = -12.53$, **$p < .001$**, $r = 0.78$	$t(52) = -9.91$, **$p < .001$**, $r = 0.81$	$t(59) = -7.66$, **$p < .001$**, $r = 0.70$	$t(63) = 3.18$, **$p = .002$**, $r = 0.37$	$t(68) = 0.52$, $p = .608$, $r = 0.06$
$RSQ_{Expectancy}$	3.34 (0.74)	2.07 (0.55)	3.52 (0.80)	3.14 (0.62)	2.01 (0.56)	2.12 (0.54)	$F(3.136) = 48.21$, **$p < .001$, $p_{FDR} < .001$**	$t(136) = -11.69$, **$p < .001$**, $r = 0.71$	$t(136) = -9.96$, **$p < .001$**, $r = 0.65$	$t(136) = -6.62$, **$p < .001$**, $r = 0.49$	$t(136) = 2.44$, **$p = .016$**, $r = 0.06$	$t(136) = 0.67$, $p = .505$, $r = 0.07$
$RSQ_{Anxiety}$	4.09 (0.82)	2.56 (0.88)	4.40 (0.78)	3.77 (0.74)	2.58 (0.96)	2.58 (0.81)	$F(3.136) = 42.52$, **$p < .001$, $p_{FDR} < .001$**	$t(136) = -10.78$, **$p < .001$**, $r = 0.68$	$t(136) = -9.34$, **$p < .001$**, $r = 0.63$	$t(136) = -5.96$, **$p < .001$**, $r = 0.46$	$t(136) = 3.14$, **$p = .002$**, $r = 0.26$	$t(136) = 0.02$, $p = .987$, $r = 0.01$
PP	0.04 (0.27)	0.12 (0.25)	0.06 (0.25)	0.01 (0.29)	0.11 (0.23)	0.12 (0.28)	$F(3.136) = 1.30$, $p = .279$, $p_{FDR} = .279$	$t(136) = 1.8$, $p = .074$, $r = 0.15$	$t(136) = 0.81$, $p = .422$, $r = 0.07$	$t(136) = 1.73$, $p = .086$, $r = 0.15$	$t(136) = 0.83$, $p = .411$, $r = 0.07$	$t(136) = 0.14$, $p = .892$, $r = 0.01$

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, MD: Minimization-Denial, HC: healthy controls, BPD: borderline personality disorder, PDD: persistent depressive disorder, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), FDR: False Discovery Rate, $\alpha = .05$, significant results are indicated in bold face

Childhood Maltreatment, Rejection Sensitivity and Passing Preference

Analyzing the whole sample, CM in general as well as the subscales for emotional neglect and emotional abuse, were significantly negatively correlated with PP (see results shown in Table 3.2). The subscale for physical abuse was marginally significantly negatively correlated with PP. The CTQ total score as well as all CTQ subscales were significantly positively correlated with the RSQ total score and both RSQ subscales. There was no significant association between PP and the RSQ. In patients with BPD, PP was negatively correlated with emotional neglect, and in patients with PDD, significant negative correlations between PP and the CTQ total score as well as physical and sexual abuse subscales were observed. In the patient sample, PP was significantly negatively correlated with emotional neglect only, while there were no significant correlations between PP and CTQ total or subscale scores in the HC sample (see supplemental materials Tables B2-B5).

Mediation Analyses

We conducted mediation analyses to test the effect of CM on PP through rejection expectancy and rejection anxiety in the whole sample. The direct effect of the CTQ total score and CTQ_{EN} score on PP was significant (Primary Hypothesis). CM as a total score and all subscales were significantly associated with both anxiety and expectance to rejection (Secondary Hypothesis 1). However, there were no indirect effects in any of the models (see supplemental materials Table B6) (Secondary Hypothesis 2). When age was entered as a covariate into the models, only the direct effect of the CTQ_{EN} score on PP remained significant (see supplemental materials Figure B1 and B7). Younger age was associated with higher rejection expectancy when the independent variable was the CTQ total score or emotional neglect, and with more rejection anxiety in all calculated models (see Table B7 in the supplemental materials). To test the effect of diagnosis, we included this variable in the model as a moderator. The moderated mediation indices were insignificant in all models, suggesting that diagnosis did not moderate the effects between the variables. When age was entered as a covariate, the results were comparable (see supplemental materials Tables B7 and B9).

Table 3.2

Correlations between CTQ and RSQ scores as well as passing preference [PP] during social exclusion (N=140)

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
PP	-	**-.190** [-.332;-.034] *p* = .025	**-.167** [-.314;-.001] *p* = .049	-.165 [-.353;-.004] *p* = .052	-.142 [-.362;.063] *p* = .094	**-.228** [-.379;-.056] *p* = .007	-.011 [-.173;.150] *p* = .900	-.069 [-.225;.098] *p* = .418	-.090 [-.254;.081] *p* = .291	-.085 [-.244;.073] *p* = .317
CTQ_{total}		-	**.902** [.871;.932] *p* <.001	**.792** [.687;.859] *p* <.001	**.671** [.501;782] *p* <.001	**.874** [.819;.914] *p* <.001	**.804** [.727;.863] *p* <.001	**.684** [.593;.773] *p* <.001	**.688** [.593;.775] *p* <.001	**.556** [.443;.655] *p* <.001
CTQ_{EA}			-	**.598** [.476;.700] *p* <.001	**.447** [.266;.594] *p* <.001	**.815** [.757;865] *p* <.001	**.654** [.546;.748] *p* <.001	**.661** [.556;.756] *p* <.001	**.658** [.552;.749] *p* <.001	**.549** [.422;.663] *p* <.001
CTQ_{PA}				-	**.548** [.232;.767] *p* <.001	**.562** [.435;.659] *p* <.001	**.653** [.517;.767] *p* <.001	**.397** [.224;.564] *p* <.001	**.391** [.230;.536] *p* <.001	**.326** [.174;.452] *p* <.001
CTQ_{SA}					-	**.395** [.220;.529] *p* <.001	**.521** [.262;.725] *p* <.001	**.389** [.218;.551] *p* <.001	**.367** [.211;.511] *p* <.001	**.308** [.157;.443] *p* <.001
CTQ_{EN}						-	**.583** [.471;.674] *p* <.001	**.691** [.597;.767] *p* <.001	**.719** [.634;.788] *p* <.001	**.573** [.432;.696] *p* <.001
CTQ_{PN}							-	**.542** [.403;.657] *p* <.001	**.547** [.411;.661] *p* <.001	**.405** [.248;.526] *p* <.001
RSQ_T								-	**.941** [.915;.959] *p* <.001	**.891** [.850;.921] *p* <.001
RSQ_E									-	**.749** [.657;.816] *p* <.001

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), significant results are indicated in bold face

Discussion

In this study, we investigated the effect of early adversity, i.e., self-reported CM; on the behavioral response, i.e., PP, to partial social exclusion during Cyberball. We hypothesized that CM would be associated with a reduction of prosocial behavior as measured by ball tosses to the excluder vs. includer (Primary Hypothesis). To our knowledge, we show for the first time, that CM, especially emotional neglect, was associated with lower behavioral indicators of a prosocial reaction in a cross-diagnostic sample. Further, all forms of CM, i.e., CTQ_{total} as well as CTQ subscale scores were associated with higher RS (Secondary Hypothesis 1). In contrast, we could not support our assumption that RS mediates the effect of CM on PP during Cyberball, and diagnosis did not moderate the effects in the respective models (Secondary Hypothesis 2).

Our results confirm previous findings, that CM is a risk factor for interpersonal dysfunction (Huh et al., 2014; Rokita et al., 2018). Especially emotional neglect appears to impact on the behavioral response to social exclusion, i.e., leading to reduced prosocial or social repair behavior during partial exclusion in the modified Cyberball paradigm. Emotional neglect derives from parental behavior resulting in being less responsive to the needs of a child (Schimmenti & Bifulco, 2015), which can be considered as a form of rejection. The role of emotional neglect in the spectrum of CM and trauma has been underrepresented in the scientific literature with most studies focusing on sexual or physical abuse (Gilbert et al., 2009; Xiao et al., 2021), yet emotional neglect has been found to be at least as detrimental compared to other forms of CM (Chamberland et al., 2012), e.g. being more predictive of the development of interpersonal difficulties (Müller et al., 2019; Raby et al., 2015; Wildschut et al., 2020). As van der Kolk et al. (1991) emphasized, emotional neglect is, therefore, one of the most harmful forms of CM as the child may be precluded from emotional warmth and support, which is relevant for dealing with other traumatic events including the experience of abusive behavior. Emotional abuse and neglect probably induce or enhance negative cognitive beliefs about self-esteem (Spertus et al., 2003). According to the multi-motive model by Smart Richman and Leary (2009), the latter may predict the behavioral response to rejection. Further, because of emotional neglect, interpersonal functional strategies such as reaching out to others or behaving in a prosocial manner may have been less well learned.

In line with previous studies, we found that CM is associated with RS (Jin et al., 2018; Luterek et al., 2004). That is, the experience of being abused or neglected has an effect on the expectancy of and anxiety for rejection later in life. While all CTQ subscales significantly

positively correlated with both subscales of the RSQ, the highest correlations were with emotional neglect and abuse. In accordance, van Harmelen et al. (2010) found that those two subtypes have the strongest association with self-depressive and self-anxious thinking compared to other forms of CM. As already established, emotional maltreatment can be considered as a form of rejection with being called names or being overseen, therefore, it is understandable that especially those forms of maltreatment lead to higher expectancy and fear of further social rejection.

The results of our study are in contrast to the results of the study by Casini et al. (2021). Here, the expectation of rejection was directly negatively associated with prosocial behavioral tendencies and anxiety about rejection was directly associated with withdrawal tendencies assessed via a questionnaire. In the current study, however, RS was not associated with the behavioral response. One explanation of these contradicting findings could be the limited methodological comparability, as Casini et al. (2021) used self-report questionnaires for measuring behavioral tendencies, while we used actual behavioral data. These results suggest, that what we feel or think might not necessarily translate into actual behavior. Further, neither rejection anxiety nor expectancy were mediators between CM and the behavioral response during Cyberball in this study. Moreover, in the study by Casini et al. (2021) the effect of RS on prosocial behavior assessed via self-reporting was mediated by different emotion regulation strategies. Thus, one could argue that RS as assessed with the RSQ measures a more or less stable trait, while PP measures a dynamic behavior that might be associated with a mixture of more transient affective but also cognitive aspects in response to social exclusion (e.g., the attempt to restore social homeostasis by means of prosocial behavior). A possible, even very likely component of this mixture might also be former biographical events, which would explain the association between PP and CTQ.

Importantly, the non-significant index of moderated mediation suggests, that the effect of CM on RS and of emotional neglect on prosocial behavior during Cyberball is not moderated by diagnosis. When age was entered as covariate in the models, younger age was associated with more RS, especially rejection anxiety. This result is in line with previous studies. For example, Norona et al. (2018) found that RS decreases from ages 16 to 23 in a mostly female Israeli cohort. Results from another sample with healthy individuals found that those who scored high in RS had more problems regulating emotional responses to aversive social stimuli and that this effect was more pronounced with younger age (Silvers et al., 2012).

As age was still a significant covariate, when diagnosis was added as moderator, the effect of age cannot be explained by higher RSQ scores in the younger BPD group.

In addition, BPD patients showed significantly higher CM and RS scores compared to PDD patients. RS indeed seems to be especially high in BPD (Staebler et al., 2011). In another Cyberball study by Gutz et al. (2016), BPD patients attributed social exclusion more internally and also attributed hostile intentions more to the excluder compared to healthy subjects, which indicates that BPD patients might expect rejection due to negative believes about themselves and others. In line with the results of Brakemeier et al. (2018), BPD patients showed significantly higher overall CM scores compared to PDD patients. Interestingly, findings from Goodman et al. (2014) suggest that while both, emotional neglect and abuse as well as RS predict BPD symptoms, the strength of the relationship between RS and BPD symptoms is dependent on the severity of emotional abuse and neglect. These results suggest that while emotional neglect and abuse as well as RS, are related to BPD symptoms and are associated with each other, there also seem to be independent pathways underlying the complexity of the interplay of different variables resulting in the same psychopathology. Further, in line with previous studies (Church et al., 2017; MacDonald et al., 2016), the MD subscale was significantly lower in patients compared to the HC and in BPD patients compared to HC_{BPD}.

To the best of the authors' knowledge, no study to date has looked at the pathways from CM to behavioral measures, e.g., PP, during Cyberball and a hypothetical mediation by RS. Thus, the experimental design measuring the immediate behavioral response to social exclusion is an important strength of this study. However, this study does not come without limitations. First, we only used self-report measures in order to assess CM and RS. According to a recent meta-analysis, the agreement between prospective and retrospective assessment of CM was rather low (Baldwin et al., 2019). Thus, adults retrospectively reporting CM may have different risk pathways compared to prospective cohorts of children experiencing CM. Moreover, individuals scoring high in retrospective CM assessment are probably those with particular risk for developing psychopathology (Newbury et al., 2018). A second limitation is, that our analysis was based on cross-sectional data only. For mediation analyses, longitudinal or prospective data are clearly preferred (Walters, 2018), however, retrospective data like the CTQ have the capacity to bring events into order (Walters, 2018). Third, the lack of significant associations between other CTQ subscales (i.e., sexual abuse, physical abuse, emotional abuse and physical neglect) and PP may also be explained by a smaller variance of scores in those subscales compared to the emotional neglect subscale. Therefore, larger

samples with higher variance of scores on all CTQ subscales are needed in order to finally confirm our current results. Also, the heteroscedasticity found in the models including the sexual and physical abuse subscales should lead to careful interpretation of the results. Further, the MD subscale was relatively high in the HC_{BPD} sample, suggesting possible under-reporting of CM in this sample. Fourth, as the CTQ physical neglect subscale has not shown good internal consistency in a validation study, the respective results should be interpreted with caution (Klinitzke et al., 2012). Fifth, the high Cronbach's α for the RSQ subscales in this study raise some concern (Streiner, 2003). Sixth, as behavior is context specific, the results of this study may not be generalizable to other situations of social rejection and exclusion beyond Cyberball. Finally, the interpretation of our data is limited by its moderate sample size which particularly impedes further analyses of study subsamples.

Future research should take these limitations into account and investigate larger cross-diagnostic samples including patients from additional clinical groups, e.g., non-chronic forms of uni- or bipolar depression, anxiety and post-traumatic stress disorders, as well as a wider spectrum of personality disorders. It also would be of interest to assess subjective beliefs and convictions of how one has behaviorally reacted to social exclusion in comparison with the actual behavior. Furthermore, our findings with Cyberball need to be compared to those from future studies using other social exclusion paradigms (e.g., Liebke et al., 2018; Ruocco et al., 2010) in order to investigate the generalizability of our findings. Finally, according to Zhao et al. (2010) the direct-only non-mediation effects found in this study, indicate that there may be omitted mediators possibly explaining the relationship between CM and the behavioral response during Cyberball. As Smart Richman and Leary (2009) pointed out in their multi-motive model, the contextual system in which rejection occurs is very complex and prediction of behavior depends on different internal and external variables. Future studies should take this complexity into account by e.g., focusing on very recent events of rejection and also on the state of current resilience.

In conclusion, we showed, that previous experiences of CM, especially emotional neglect during childhood, were associated with a reduction of prosocial behavior in an experimental paradigm (i.e. Cyberball). Interestingly, this effect was not mediated by RS. The results of this study underline the detrimental role of CM during development, that manifests in reactions to social exclusion cross-diagnostically later in life. In addition, our findings propose an experimental approach for further exploring this pathway. Ideally, longitudinal studies in larger cross-diagnostic cohorts with multidimensional data in social domains are

warranted, to further investigate the link between interpersonal adversity early in life and current interpersonal dysfunction.

Chapter 4

Study III:

Association of the immediate behavioral response to experimental social exclusion with adverse and adaptive experiences during childhood, youth, and adulthood: A cross-diagnostic study in vulnerable groups

Abstract

Childhood adversity has been linked to higher psychopathology e.g., interpersonal difficulties and even to a less prosocial behavior when being socially excluded in vulnerable groups. However, little is known about vulnerability across periods of age and the role of adverse experiences versus protective factors. In this study, we therefore investigated the association of the behavioral response to experimental social exclusion with adverse versus adaptive experiences as well as resilience across clinical groups with persistent depressive disorder (PDD) and borderline personality disorder (BPD) i.e., groups reporting a high prevalence of childhood adversity, as well as healthy controls (HC) (N = 140). Adverse and adaptive experiences were assessed with the Traumatic Antecedents Questionnaire (TAQ) for different periods of age from childhood to adulthood, and resilience was measured with the Connor Davidson Resilience Scale (CD-RISC-10). A modified version of the Cyberball paradigm was used to assess the direct behavioral response to partial social exclusion. In patients, adverse events during both youth (B = -.12, p = .016) and adulthood (B = -.14, p = .013) were negatively associated with prosocial behavior, while in the HC sample, adaptive experiences during adolescence were positively associated with prosocial behavior (B =.25, p = .041). Resilience did not mediate these effects. The study is the first to investigate the relationship of the immediate behavioral response to social exclusion and self-reported adverse vs adaptive experiences during different periods of age as well as resilience. Our findings support the notion that critical events during youth may be particularly relevant for current interpersonal dysfunction.

Introduction

Experiences of early adversity and trauma (EAT), e.g. child abuse and neglect, can have detrimental impact on mental health including dysfunctional interpersonal behavior (Alink et al., 2012; Copeland et al., 2018; Kessler et al., 2010; Wilson & Scarpa, 2015). Further, EAT, as measured by the Childhood Trauma Questionnaire, was associated with less prosocial behavior as a reaction to being socially excluded in a previous study using the Cyberball paradigm (Barton et al., 2023). The modified version of the Cyberball paradigm used (Dewald-Kaufmann et al., 2021) induces social exclusion by partially excluding the participant by one of two co-players in a virtual ball-tossing game. However, the CTQ does not allow specific conclusions regarding a critical age and the impact of adaptive events, as it asks about childhood maltreatment until the age of 18. Thus, a uniform conceptualization of

EAT may be misleading, as EAT are not only diverse in type and severity, but may have occurred at different developmental stages from child- to adulthood (e.g. Kessler et al., 2010). Although EAT has been extensively studied during childhood, less is known about the impact of adversity explicitly during youth and adulthood (Patton et al., 2016), yet its effect on psychological health may be detrimental as well (Xu et al., 2013). Studies directly investigating the timing of adverse life events and their effects on psychopathology are scarce and results from these studies are mixed. For example, EAT at an early age may be particularly toxic as the development of the brain and social skills is interrupted (Fox et al., 2010), which reduces the capacity to use the environment as a source of resilience (Luyten et al., 2020). When adversity occurs during the transition to school-age, prosocial behavior might be negatively affected in a particular way (Jaffee & Maikovich-Fong, 2011). However, adolescents and adults who have fully developed cognitive skills compared to children can identify the adversity's detrimental effect, so the impact might even be worse (Harpur et al., 2015).

EAT increases the risk for the development of various psychiatric disorders and is associated with an early onset, a more severe clinical course, as well as less treatment response to psycho -and pharmacotherapy (Lippard & Nemeroff, 2020). For example, patients with borderline personality disorder (BPD) and persistent depressive disorder (PDD) both report a high prevalence of EAT measured with the Childhood Trauma Questionnaire (CTQ, Bernstein et al., 2003) assessing adverse events up to the age of 18 (Struck, Krug, et al., 2020). While patients with BPD also report increased experiences of, e.g. violence during youth and adulthood (Sharp et al., 2020; Vanwoerden et al., 2019), there is a lack of data on prevalence of adverse events during adolescents and adulthood in patients with PDD. Further, both patient groups are characterized by interpersonal difficulties (Bird et al., 2018; Zanarini et al., 2010). Patients with BPD have difficulties maintaining relationships due to their emotional instability, anger outbursts, fear of abandonment and their changes in perceiving their significant others (American Psychiatric Association, 2015). Patients with PDD have been found to show hostile-submissive behavior probably resulting in loneliness and a small social network (Bird et al., 2018; Nenov-Matt et al., 2020). In a previous study, we found deviant behavior to social exclusion induced by the Cyberball paradigm in patients with BPD and PDD compared to healthy controls (HC) (Barton et al., 2021). While HC immediately increased ball tosses towards the ball player excluding them, which was interpreted as

prosocial behavior, PDD patients showed no increase. BPD patients did not significantly differ from HC, nor from PDD regarding this immediate behavioral reaction (Barton et al., 2021).

Pathways explaining the relationship between adverse life events and interpersonal difficulties are not well understood. Resilience might be one possible pathway explaining the impact of adverse life events on today's interpersonal behavior. Resilience is the ability to adapt to adverse events like extreme stress caused by interpersonal problems, trauma or threats (American Psychiatric Association, 2020). Studies have shown that self-reported childhood adversity is associated with less resilience in adulthood (Campbell-Sills et al., 2009; McLafferty et al., 2021; Nishimi et al., 2020) and that higher amount of experienced family stress in the past might weaken the growth of resilience (Collazzoni et al., 2016). Nishimi et al. (2020) found no association between the developmental period in which childhood adversity occurred and resilience in adulthood. Furthermore, positive interpersonal experiences like parental care or peer relationships can enhance resilience in individuals with severe physical and sexual abuse (Collishaw et al., 2007). In fact, when predicting resilience, adaptive life events, e.g. support from friends, might even have more impact compared to adversity (Howell & Miller-Graff, 2014). Resilience is positively correlated with more intact social functioning (Wingo et al., 2017) and negatively correlated with emotional and behavioral problems (Meng et al., 2018). Studies in adolescents showed that childhood adversity led to more behavioral and emotional problems assessed via questionnaire (e.g. prosocial behavior) and that the relationship was mediated by resilience, that is childhood adversity leading to less resilience leading to more behavioral and emotional problems (Arslan, 2016; Lackova Rebicova et al., 2021). So far, resilience has been neglected in the research of BPD (e.g. Paris et al., 2014) and PDD. BPD is discussed as the consequence of a lack of resilience (Fonagy et al., 2017) and depression has been linked to lower resilience (Poole et al., 2017; Schulz et al., 2014). Yet, no study to date has explicitly reported resilience of patients with PDD.

The aim of this study was to analyze associations between adverse and adaptive life events during childhood, youth and adulthood, resilience and the immediate behavioral reaction to social exclusion during Cyberball in patients of two disorders typically related to EAT, i.e. BPD and PDD, compared to HC. In addition, we compared resilience of the clinical sample to HC, and tested the effect of resilience on the relationship between adverse and adaptive events during childhood, youth or adulthood and the behavioral response to social exclusion during Cyberball. Based on previous studies we hypothesized that: a) Adverse life

events are associated with reduced prosocial behavior, i.e. lower rates of ball tosses to the excluder, and resilience scores, whereas adaptive life events are related to higher rates of ball tosses and resilience scores; b) Resilience is significantly lower in patients with BPD and PDD compared to HC and c) Resilience mediates the effect of adverse and adaptive life events on the immediate behavioral response to social exclusion during Cyberball. Finally, d) we explored whether patterns in these associations differ between the clinical sample with an EAT history and HC.

Methods

Participants

A total of 140 participants, BPD: $n = 36$, 47.2% male, 80.6 % inpatients; PDD. $n = 34$, 55.9 % male, 85.3% inpatients; age- and gender-matched HC (HC_{BPD}: $n = 36$, HC_{PDD}: $n = 34$), were recruited via LMU University Hospital and using flyers. To assess BPD the SCID I and II interviews (Wittchen et al., 1997) were used. The DSM-5 criteria were used to assess PDD (American Psychiatric Association, 2015). Patients with PDD were excluded if they fulfilled more than three criteria of BPD. Psychotherapy or pharmacotherapy within the last 10 years, depressive symptoms (assessed with the Beck Depression Inventory, BDI, Hautzinger et al, 2006 ≥12), fulfilling any psychiatric disorder or pregnancy led to the exclusion of HC. Patients with BPD were significantly younger than patients with PDD (BPD: $M_{age} = 28.83$, $SD = 9.22$, vs. PDD: $M_{age} = 38.16$, $SD = 12.34$, $p \leq .001$); similarly, HC_{BPD} were younger than their HC_{PDD} counterparts (HC_{BPD}: Mage = 29.04, $SD = 9.07$, vs. HC_{PDD}: Mage = 38.23, $SD = 12.22$, $p \leq .001$). Patients with BPD and PDD did not differ concerning BDI scores (BPD: $M_{BDI} = 31.36$, $SD = 10.71$ vs. PDD: $M_{BDI} = 25.52$, $SD = 11.26$, $p = .132$), but patients with BPD reported significantly higher scores on the Borderline Symptom List 23 (BSL-23, Bohus et al., 2009) compared to patients with PDD (BPD: $M_{BSL} = 2.00$, $SD = 0.87$ vs. PDD: $M_{BSL} = 1.01$, $SD = 0.65$, $p < .001$); in addition both patient groups reported significant higher scores on both scales compared to their matched HC (all ps < .001). The most common comorbidities in patients with BPD were anxiety disorders (61.1%), post-traumatic stress disorder (PTSD, 41.7%) and any substance abuse during the previous year (44.4 %). In patients with PDD, these were, any cluster C personality disorder (44.1%), any anxiety disorder (35.3 %), and any substance abuse during the previous year (20.6 %). All participants in this study gave written informed consent before participating in the study, which was approved by the ethics committee of the Faculty of Medicine Ludwig-Maximilians-University

Munich, Germany (registration number: 281-11, registered retrospectively as part of its parent study, registration number: 713-15, at the German Clinical Trials Register DRKS-ID: DRKS00019821). The Good Clinical Practice guidelines as well as the ethical guidelines of the German Psychological Society, a German adaption of the ethical guidelines ("Ethical Principles of Psychologists and Code of Conduct") provided by the APA were followed. For a more detailed description of the participants please refer to Barton et al. (2021).

Traumatic Antecedent Questionnaire (TAQ)

The TAQ (Hofmann et al., 1999) is a 43 item self-report questionnaire assessing adverse and adaptive experiences during childhood (7-12 years), youth (13-18 years) and adulthood (>18 years), that also includes one additional question about how distressing it was to answer the questions. Originally, the TAQ also asks about early childhood (0-6 years), which we did not include in this study due to the fact that memories from this age period are considered less reliable (Fundudis, 1997). The TAQ measures 2 domains measuring adaptive experiences (competence, safety), as well as 9 domains evaluating adverse experiences (neglect, separations, family secrets, physical trauma, sexual trauma, witnessing trauma, other traumas, exposure to familial or personal alcohol or illicit drug use). Items are rated on a Likert scale ranging from 0 to 3 and the option „don't know", as well as some dichotomous (yes/no) items. The TAQ also includes inverted items. Using the evaluation scheme, "don't know" was noted by using asterisks (*) and then put to 0, ratings of 0,1 or "no" were put to 0, all ratings of 2 remained, all ratings of 3 or "yes" were put to 3. The mean of all non-zero scores is then calculated for each domain. Adverse domains as well as adaptive domains are summed up for each developmental phase and for the whole life span. Cronbach's alpha was reported as > .80 in a Korean validation study with 37 items (Kim et al., 2011).

Connor-Davidson Resilience Scale (CD-RISC-10)

The CD-RISC-10 (Campbell-Sills & Stein, 2007; Sarubin, Gutt, et al., 2015) is one of the most widely used unidimensional self-report questionnaires to assess self-perceived resilience (Windle et al., 2011) and recommended to assess trait resilience (Wollny & Jacobs, 2021). Here, resilience is defined as the ability to cope with stress, adapt to change, function under pressure, and to achieve goals in the face of obstacles. Patients can rate on a 5-point Likert scale from 0 (never true) to 4 (always true). The sum score can range between 0 to 40, with higher scores indicating higher resilience capacity. The psychometrics of the German version of the CD-RISC-10 are satisfying with a Cronbach's alpha of > .80 (Wollny & Jacobs, 2021).

Cyberball

The Cyberball paradigm is a virtual ball tossing game and has been shown to be a valid experimental approach to induce social exclusion (Hartgerink et al., 2015). In its original version by Williams et al. (2000) the participant is completely excluded by two co-players and is thus not receiving any ball tosses. In this study, we used a modified version by co-author T.W. using partial exclusion, as we were interested in how participants behaviorally react to social exclusion. The goal of this Cyberball version is to assess the participant's actual behavioral response, that is assessing the ball tossing behavior being labeled as passing-preference (PP). The participant is led to believe playing a ball tossing game with two other gender matched participants allegedly also taking part in the study at other university clinics. After having received the ball 50% of the time from each player for 2 minutes (baseline period), the participant is being partially excluded by one co-player becoming the excluder who only gives the participant 5 % of his/her ball tosses. For this study, only the immediate behavioral reaction, that is the PP of the first two minutes of partial exclusion, is of relevance as our previous studies have shown an immediate increase in PP towards the excluding player in HC during this period (Barton et al., 2021; Dewald-Kaufmann et al., 2021). Both PDD and BPD patients showed a different PP, that is a less pronounced increase of PP towards the excluder, which was significant compared to HC in PDD but not in BPD patients (Barton et al., 2021). In brief, increased ball tosses towards the excluding player where positive scores and to the including player negative scores. The calculation of PP is described in detail elsewhere (Barton et al., 2021).

Statistical Analyses

Analyses were conducted using SPSS Statistics (Version 28) with the significance threshold fixed at $p < .05$. Group differences were calculated using one-way analysis of variance (ANOVA) with planned contrasts (HC vs. patients, BPD vs. HC_{BPD}, PDD vs. HC_{PDD}, BPD vs. PDD, HC_{BPD} vs. HC_{PDD}). The Welch ANOVA test was used in case of a significant Levene's test. Effect sizes were calculated according to Cohen (1988) with |0.1| being a small, |0.3| a medium, and |0.5| a large effect. To control for multiple testing, we used the false discovery rate (FDR, Benjamini & Hochberg, 1995). To test for correlations between the TAQ, CD-RISC-10, PP and age, Pearson correlation with bias-corrected and accelerated bootstrap confidence intervals, BCa 95% CI, with 1000 bootstrap samples were used. We conducted conditional process analyses to test the mediating effect of resilience on the relationship between adaptive and adverse life events on PP and the moderating effect of

group (patient versus HC) using PROCESS macro and model 59 (Hayes, 2018). Models were calculated for each adverse and adaptive subscale and each developmental phase of the TAQ as well as for the total scores (see Table S1). Confidence intervals computed from 10000 bootstrap iterations with 95% CI to control for significance of the indirect effect were used (Hayes & Rockwood, 2017). Age was included as a covariate in the conditional process analyses as it might influence resilience (Bonanno & Diminich, 2013; Campbell-Sills et al., 2009). Assumptions of linearity, homoscedasticity and normality were checked (Kane & Ashbaugh, 2017). The independence of error terms was given, Durbin-Watson $d = 1.70 – 1.79$ (Field, 2016). The relationship between almost each TAQ subscale, except adverse events during childhood and adulthood, and the CD-RISC-10 raised some concern considering linearity and the independence of errors, Durbin-Watson $d = 0.79$ - 1.01. The proposed model is illustrated in Figure S1 in the supplemental materials.

Results

Sample characteristics

The patient sample reported significant higher scores for adverse events and lower scores for adaptive events on the TAQ during each developmental phase as well as lower CD-RISC-10 scores compared to HC (see Table 4.1). The same applied when patients with BPD were compared with HC_{BPD} and patients with PDD with HC_{PDD}. Patients with BPD reported significantly higher overall scores for adverse events and during childhood and youth compared to patients with PDD. Resilience was significantly higher in patients with PDD compared to patients with BPD. However, all of these differences between patient groups became insignificant after FDR correction. HC_{BPD} and HC_{PDD} did not differ on any of the self-report scales (see Table 4.1).

Table 4.1

Means, Standard Deviations, and One-Way ANOVA for Study Variables

								Planned Contrasts				
	P	HC	BPD	PDD	HC_{BPD}	HC_{PDD}	one-way ANOVA	Patient vs. HC	BPD vs. HC_{BPD}	PDD vs. HC_{PDD}	PDD vs. BPD	HC_{BPD} vs. HC_{PDD}
TAQ_N	4.36 (1.78)	2.02 (1.26)	4.85 (1.68)	3.81 (1.75)	1.79 (0.93)	2.27 (1.52)	$F(3,69)=34.73$, **$p<.001$, $p_{FDR}<.001$**	$t(108.88)=-8.80$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.64$	$t(52.62)=-9.44$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.79$	$t(59.53)=-3.76$ **$p<.001$**, **$p_{FDR}<.001$** $r=0.44$	$t(62.33)=2.44$, **$p=.017$**, $p_{FDR}=.062$ $r=0.30$	$t(52.06)=1.54$, $p=.129$, $p_{FDR}=.462$ $r=0.21$
TAQ_{NC}	1.32 (0.77)	0.53 (0.46)	1.50 (0.78)	1.11 (0.72)	0.50 (0.41)	0.55 (0.51)	$F(3,70)=19.06$, **$p<.001$, $p_{FDR}<.001$**	$t(104.39)=-7.24$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.58$	$t(51.26)=-6.73$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.68$	$t(53.26)=-3.60$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.44$	$t(63.83)=2.09$, **$p=.041$**, $p_{FDR}=.090$ $r=0.25$	$t(63.48)=0.43$, $p=.669$, $p_{FDR}=.867$ $r=0.05$
TAQ_{NY}	1.54 (0.67)	0.67 (0.48)	1.73 (0.60)	1.32 (0.70)	0.59 (0.35)	0.76 (0.59)	$F(3,69)=35.55$, **$p<.001$, $p_{FDR}<.001$**	$t(105)=-8.52$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.64$	$t(54.83)=-9.78$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.80$	$t(58.74)=-3.46$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.41$	$t(59.26)=2.56$, **$p=.013$**, $p_{FDR}=.062$ $r=0.32$	$t(51.35)=1.40$, $p=.168$, $p_{FDR}=.462$ $r=0.19$
TAQ_{NA}	1.50 (0.57)	0.81 (0.48)	1.61 (0.60)	1.38 (0.51)	0.70 (0.37)	0.92 (0.56)	$F(3,132)=22.75$, **$p<.001$, $p_{FDR}<.001$**	$t(132)=-7.71$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.56$	$t(132)=-7.47$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.55$	$t(132)=-3.53$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.29$	$t(132)=1.86$, $p=.065$, $p_{FDR}=.102$ $r=0.16$	$t(132)=1.84$, $p=.069$, $p_{FDR}=.380$ $r=0.16$
TAQ_P	6.09 (2.15)	8.47 (0.63)	5.62 (2.29)	6.62 (1.87)	8.54 (0.38)	8.39 (0.82)	$F(3,61)=27.67$, **$p<.001$, $p_{FDR}<.001$**	$t(74.97)=4.69$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.48$	$t(35.83)=2.93$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.44$	$t(40.56)=4.84$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.61$	$t(63.57)=-1.97$, $p=.054$, $p_{FDR}=.099$ $r=0.24$	$t(44.42)=-1.01$, $p=.317$, $p_{FDR}=.581$ $r=0.15$
TAQ_{PC}	1.99 (1.02)	2.83 (0.26)	1.85 (0.97)	2.16 (1.06)	2.84 (0.20)	2.82 (0.32)	$F(3,63)=15.16$, **$p < .001$, $p_{FDR}<.001$**	$t(69.21)=6.38$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.61$	$t(36.88)=3.37$, **$p=.002$**, **$p_{FDR}<.001$** $r=0.49$	$t(34.95)=3.37$, **$p=.002$**, **$p_{FDR}=.002$** $r=0.50$	$t(61.25)=-1.21$, $p=.230$, $p_{FDR}=.253$ $r=0.15$	$t(53.78)=-0.27$, $p=.792$, $p_{FDR}=.871$ $r=0.04$
TAQ_{PY}	2.00 (0.97)	2.79 (0.26)	1.81 (0.97)	2.23 (0.93)	2.81 (0.20)	2.76 (0.32)	$F(3,63)=15.24$, **$p<.001$, $p_{FDR}<.001$**	$t(73.12)= 6.34$, **$p <.001$**, **$p_{FDR}<.001$** $r=0.60$	$t(36.82)= 6.03$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.70$	$t(36.56)= 3.02$, **$p =.005$**, **$p_{FDR} = .006$** $r=0.45$	$t(63.52)= -1.79$, $p=.079$, $p_{FDR}=.109$ $r=0.22$	$t(52.89)=-0.84$, $p =.403$, $p_{FDR}=.633$ $r=0.15$
TAQ_{PA}	2.09 (0.81)	2.85 (2.27)	1.96 (0.94)	2.24 (0.61)	2.89 (0.14)	2.81 (0.36)	$F(3,60)=21.31$, **$p<.001$, $p_{FDR}<.001$**	$t(72.58)=7.36$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.65$	$t(35.56)=5.83$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.70$	$t(47.75)=4.50$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.55$	$t(59.10)=-1.48$, $p=.144$, $p_{FDR}=.176$ $r=0.19$	$t(42.71)=-1.21$, $p=.234$, $p_{FDR}=.515$ $r=0.18$
TAQ item 43	2.62 (1.12)	1.43 (0.75)	3.00 (1.14)	2.19 (0.95)	1.39 (0.64)	1.47 (0.86)	$F(3,132)=23.86$, **$p<.001$, $p_{FDR}<.001$**	$t(132)=-7.45$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.54$	$t(132)=3.58$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.54$	$t(132)=-3.19$, **$p=.002$**, **$p_{FDR} = .002$** $r=0.27$	$t(132)=-7.44$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.30$	$t(132)=0.37$, $p=.709$, $p_{FDR}=.087$ $r=0.03$
CD-RISC	16.17 (5.92)	29.60 (6.08)	14.75 (5.97)	17.71 (5.54)	30.86 (5.35)	28.26 (6.60)	$F(3,135)=63.04$, **$p<.001$, $p_{FDR}<.001$**	$t(136)=13.35$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.75$	$t(135)=11.62$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.71$	$t(135)=7.34$, **$p<.001$**, **$p_{FDR}<.001$** $r=0.53$	$t(135)=-2.09$, **$p=.038$,** $p_{FDR}=.090$ $r=0.18$	$t(135)=-1.85$, $p=.067$, $p_{FDR}=.380$ $r=0.16$
PP	0.04 (0.27)	0.12 (0.25)	0.06 (0.25)	0.01 (0.29)	0.11 (0.23)	0.12 (0.28)	$F(3,136)=1.30$, $p=.279$, $p_{FDR}=.279$	$t(136)=1.8$, $p=.074$, $p_{FDR}=.074$ $r=0.15$	$t(136)=0.81$, $p=.422$, $p_{FDR}=.422$ $r=0.07$	$t(136)=1.73$, $p=.086$, $p_{FDR}=.086$ $r=0.15$	$t(136)=0.83$, $p=.411$, $p_{FDR}=.411$ $r=0.07$	$t(136)=0.14$, $p=.892$, $p_{FDR}=.892$ $r=0.01$

Note. P = patients, HC = healthy controls, BPD = borderline personality disorder, PDD = persistent depressive disorder, TAQ = Traumatic Antecedents Questionnaire, TAQ_N = total score negative life events, TAQ_{NC} = adverse events during childhood, TAQ_{NY} = adverse events during youth, TAQ_{NA} = adverse events during adulthood, TAQ_P = total score adaptive life events, TAQ_{PC} = adaptive events during childhood, TAQ_{PY} = adaptive events during youth, TAQ_{PA} = adaptive events during adulthood, CD-RISC-10 = Connor Davidson Resilience Scale, PP = passing preference during social exclusion, higher PP scores indicate increased ball tosses towards the excluder (Barton et al., 2021; Dewald-Kaufmann et al., 2021), FDR = false discovery rate, $\alpha = .05$, significant results are indicated in bold face

Specific Note. The TAQ was filled out by 35 patients with BPD, 31 patients with PDD, by 36 HC_{BPD} and by 33 HC_{PDD}; the CD-RISC-10 was filled out by 36 patients with BPD, 33 patients with PDD, by 36 HC_{BPD} and by 34 HC_{PDD}

Relationship between passing preference (PP) and adverse/ adaptive experiences and resilience

In the patient sample, adverse events during youth and adulthood showed a significant inverse correlation with PP (see Table 4.2). Further, higher levels of resilience were negatively associated with PP. Additionally, a younger age was associated with higher PP and an older age with higher resilience. In the HC sample, there was a significant relationship between adaptive events during youth and a higher PP, and higher resilience scores were significantly associated with more adaptive events in total and during adulthood (see Table 4.3). Further, there were significant positive associations between older age and adverse events in general and during youth and adulthood. In the patient and HC sample, the events during childhood, youth and adulthood were positively correlated within adverse and adaptive event domains. The only exception was a missing association between adaptive events during childhood with adaptive events during adulthood in the patient sample. While in the patient sample, adverse events were negatively correlated with adaptive events (except a missing association between adaptive events during childhood and adverse events during adulthood and none associations with adaptive events during adulthood), this relationship was not found in the HC group (see Table 4.2 and Table 4.3).

Conditional Process Analysis

The conditional direct effects show that in patients, but not in HC, adverse events in total, B = -.04, p = .031, as well as during youth, B = -.12, p = .016, and adulthood, B = -.14, p = .013, predicted reduced PP. Contrary, in HC but not in patients, adaptive events during youth lead to more PP towards the excluder, B = .25, p = .041. Group as a predictor for resilience was significant when adverse events in total, B = -12.47, p < .001, during childhood, -13.19, p < .001, youth, -12.33, p < .001, and adulthood, B = -12.38, p < .001, were independent variables. Adaptive events in total, B = 4.65, p = .044, and during adulthood were associated with higher resilience scores, B = 13.55, p = .011. With adaptive events during adulthood as an independent variable, group moderated the effect of adaptive events on resilience, R^2 = .02, F (1,131) = 5.18, p = .024. Overall, in all models, resilience scores did not mediate the relationship between adverse and adaptive events and PP. Further, the index of moderated mediation was insignificant (please see Table S1 in the supplemental materials).

Table 4.2

Correlations between age and TAQ and CD-RISC-10 scores as well as passing preference [PP] during social exclusion in the patient sample

	PP	TAQ_N	TAQ_{NC}	TAQ_{NY}	TAQ_{NA}	TAQ_P	TAQ_{PC}	TAQ_{PY}	TAQ_{PA}	CD-RISC-10
P	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
age	**-.307** [-.546; -.056] *p* = .012	.009 [-.262; .297] *p* = .945	.008 [-.280; .324] *p* = .951	-.065 [-.335; .229] *p* = .602	.095 [-.112; .325] *p* = .450	-.078 [-.288; .137] *p* = .533	-.147 [-.382; .113] *p* = .239	-.015 [-.260; .204] *p* = .905	-.004 [-.200; .198] *p* = .972	**.256** [-.021; .508] *p* = .038
PP		-.214 [-.436; .057] *p* = .084	-.078 [-.324; .211] *p* = .535	**-.244** [-.471; .025] *p* = .048	**-.275** [-.486; -.024] *p* = .025	.003 [-.224; .230] *p* = .981	.067 [-.207; .327] *p* = .594	.101 [-.136; .344] *p* = .419	-.198 [-.391; .007] *p* = .111	**-.269** [-.479; -.044] *p* = .029
NTAQ			**.895** [.826; .938] *p* < .001	**.912** [.843; .955] *p* < .001	**.828** [.736; .897] *p* < .001	**-.421** [-.601; -.241] *p* < .001	**-.342** [-.587; -.109] *p* = .005	**-.403** [-.602; -.180] *p* < .001	-.205 [-.425; .024] *p* = .098	**-.**151 [-.404; .096] *p* = .226
TAQ_{NC}				**.727** [.543; .851] *p* < .001	**.587** [.398; .743] *p* < .001	**-.407** [-.577; -.243] *p* < .001	**-.397** [-.623; -.168] *p* < .001	**-.290** [-.502; -.061] *p* = .018	-.234 [-.430; -.052] *p* = .059	-.172 [-.426; .065] *p* = .167
TAQ_{NY}					**.678** [.514; .795] *p* < .001	**-.351** [-.525; -.155] *p* = .004	**-.259** [-.514; .007] *p* = .035	**-.381** [-.570; -.163] *p* = .002	-.150 [-.369; .081] *p* = .230	-.141 [-.399; .095] *p* = .257
TAQ_{NA}						**-.346** [-.553; -.135] *p* = .004	-.222 [-.454; .012] *p* = .074	**-.414** [-.602; -.196] *p* < .001	-.146 [-.401; .115] *p* = .242	-.070 [-.313; .161] *p* = .575
PTAQ							**.787** [.649; .874] *p* < .001	**.850** [.757; .907] *p* < .001	**.650** [.416; .789] *p* < .001	.233 [-.056; .465] *p* = .060
TAQ_{PC}								**.528** [.256; .734] *p* < .001	.202 [-.056; .450] *p* = .104	.203 [-.073; .459] *p* = .101
TAQ_{PY}									**.397** [.118; .606] *p* < .001	.175 [-.082; .377] *p* = .160
TAQ_{PA}										.155 [-.180; .415] p = .215

Note. PP = passing preference during social exclusion, higher PP scores indicate increased ball tosses towards the excluder (30, 50), TAQ = Traumatic Antecedents Questionnaire, TAQ_N = total score negative life events, TAQ_{NC} = adverse events during childhood, TAQ_{NY} = adverse events during youth, TAQ_{NA} = adverse events during adulthood, TAQ_P = total score adaptive life events, TAQ_{PC} = adaptive events during childhood, TAQ_{PY} =

adaptive events during youth, TAQ_{PA} = adaptive events during adulthood, CD-RISC-10 = Connor Davidson Resilience Scale, $\alpha = .05$, significant results are indicated in bold face

Specific Note. The TAQ was filled out by 35 patients with BPD, 31 patients with PDD, by 36 HC_{BPD} and by 33 HC_{PDD}; the CD-RISC-10 was filled out by 36 patients with BPD, 33 patients with PDD, by 36 HC_{BPD} and by 34 HC_{PDD}

Table 4.3

Correlations between age and TAQ and CD-RISC-10 scores as well as passing preference [PP] during social exclusion in the healthy control sample

	PP	NTAQ	TAQ_{NC}	TAQ_{NY}	TAQ_{NA}	PTAQ	TAQ_{PC}	TAQ_{PY}	TAQ_{PA}	CD-RISC-10
P	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
age	.183 [-.034; .380] *p* = .131	**.260** [-.041; .547] *p* = .031	.163 [-.105; .419] *p* = .180	**.245** [-.056; .535] *p* = .042	**.277** [-.021; .557] *p* = .021	.125 [-.041; .316] *p* = .307	.162 [-.023; .362] *p* = .183	.087 [-.109; .299] *p* = .476	.048 [-.158; .242] *p* = .693	-.011 [-.275; .260] *p* = .927
PP		.022 [-.247; .247] *p* = .855	.130 [-.166; .380] *p* = .288	-.045 [-.252; .163] *p* = .711	-.019 [-.259; .211] *p* = .879	.230 [-.014; .440] *p* = .057	.190 [-.017; .340] *p* = .118	**.250** [-.020; .459] *p* = .038	.107 [-.167; .302] *p* = .379	.015 [-.195; .255] *p* = .900
NTAQ			**.843** [.766; .899] *p* < .001	**.930** [.887; .957] *p* < .001	**.878** [.788; .932] *p* < .001	-.097 [-.324; .114] *p* = .427	.056 [-.142; .281] *p* = .647	-.207 [-.455; -.070] *p* = .088	-.007 [-.304; .120] *p* = .530	-.092 [-.408; .226] *p* = .454
TAQ_{NC}				**.698** [-.009; .073] *p* < .001	**.554** [-.011; .099] *p* < .001	-.103 [.002; .107] *p* = .399	-.025 [.007; .111] *p* = .836	-.143 [-.002; .117] *p* = .241	-.075 [-.340; .120] *p* = .541	-.188 [.154; -.408] *p* = .122
TAQ_{NY}					**.764** [.611; .862] *p* < .001	-.120 [-.362; .120] p = .326	.038 [-.147; .275] *p* = .755	-.234 [-.534; .128] *p* = .053	-.086 [-.277; .094] *p* = .481	-.050 [-.346; .274] *p* = .683
TAQ_{NA}						-.036 [-.309; .163] *p* = .722	.132 [-.071; .311] *p* = .279	-.170 [-.421; .128] *p* = .162	-.044 [-.321; .132] *p* = .722	-.011 [-.304; .307] *p* = .928
PTAQ							**.801** [.470; .912] *p* < .001	**.716** [.634; .915] p < .001	**.845** [.579; .939] *p* < .001	**.287** [-.019; .538] *p* = .017
TAQ_{PC}								**.307** [.042; .536] *p* = .010	**.593** [-.025; .821] *p* < .001	.179 [-.049; .389] *p* = .141
TAQ_{PY}									**.389** [.116; .667] *p* = .001	.151 [-.105; .410] *p* = .215
TAQ_{PA}										**.343** [.085; .639] *p* = .004

Note. PP = passing preference during social exclusion, higher PP scores indicate increased ball tosses towards the excluder (30, 50), TAQ = Traumatic Antecedents Questionnaire, TAQ_N = total score negative life events, TAQ_{NC} = adverse events during childhood, TAQ_{NY} = adverse events during youth, TAQ_{NA} = adverse events during adulthood, TAQ_P = total score adaptive life events, TAQ_{PC} = adaptive events during childhood, TAQ_{PY} =

adaptive events during youth, TAQ_{PA} = adaptive events during adulthood, CD-RISC-10 = Connor Davidson Resilience Scale, $\alpha = .05$, significant results are indicated in bold face

Specific Note. The TAQ was filled out by 35 patients with BPD, 31 patients with PDD, by 36 HC_{BPD} and by 33 HC_{PDD}; the CD-RISC-10 was filled out by 36 patients with BPD, 33 patients with PDD, by 36 HC_{BPD} and by 34 HC_{PDD}

Discussion

In this study, we report differential patterns between BPD and PDD patients with an EAT history vs. HC regarding an association between adverse and adaptive life events on the one hand, and an immediate prosocial reaction to social exclusion, i.e. ball tosses to the excluder during Cyberball, and resilience on the other hand. We also aimed to investigate resilience in patients with BPD and PDD.

In patients but not in the HC group, we found adverse events during youth and adulthood to be significantly negatively associated with the PP towards the excluding player during Cyberball. Further, the conditional process analysis showed significant direct effects indicating that adverse events in general and especially during youth and adulthood led to a reduced PP towards the excluder. Interestingly, in this study adverse events during the childhood period (ages 7-12) were not associated with PP during Cyberball. Previous studies have mostly focused on the detrimental impact of childhood adversity and found it to negatively impact psychological health including interpersonal functioning (Alink et al., 2012; Copeland et al., 2018). However, youth is also a highly vulnerable phase (Thornberry et al., 2010) and like adults, adolescents are fully aware of the harm experienced, which might be especially harmful. Further, studies suggest that different adverse events might have different effects during different developmental stages in life (Pechtel et al., 2014; Schalinski et al., 2016). Thus, while childhood adversity might have great impact on the development of psychiatric disorders in general, adverse events during youth and adulthood might especially affect interpersonal skills. Nevertheless, maltreatment in early school ages may also negatively impact social behavior and interaction (Jaffee & Maikovich-Fong, 2011). Our results suggest that adverse events during youth and adulthood should receive more attention when investigating risk factors for interpersonal dysfunction in adulthood. In the HC group, only adaptive experiences during youth were significantly associated with more prosocial reactions, i.e. ball tosses to the excluder during Cyberball. The conditional process analyses also showed a significant effect of adaptive events during youth on PP. Again, youth seems to be a very critical phase to shape our interpersonal behavior (Domhardt et al., 2015).

Surprisingly, neither adverse nor adaptive events were correlated with resilience in any sample, with the only exception of adaptive experiences in total and during adulthood being associated with higher resilience scores in the HC sample. While the latter finding is in accordance with previous literature (Collishaw et al., 2007), the lack of an association between adverse life events and resilience differs from previous results (Campbell-Sills et al., 2009;

McLafferty et al., 2021) including ours which were also based on both TAQ and CD-RISC, however, the latter in its 25 item version (Sarubin, Wolf, et al., 2015). In addition to the moderate sample size leading to a potentially large beta error, it needs to be emphasized that resilience is multifaceted and other possible factors e.g. socioeconomic status next to adverse and adaptive life experiences need to be considered in the development of resilience (Burt & Paysnick, 2012; Campbell-Sills et al., 2009).

A higher resilience score was significantly associated with reduced prosocial behavior in the clinical sample, while there was no significant relationship between resilience and PP in the HC sample. Our findings are in contrast to studies finding more resilience to be related with lower levels of emotional and behavioral problems including prosocial behavior (Arslan, 2016; Lackova Rebicova et al., 2021). The results in the HC sample are in accordance with Wright et al. (2005), who also did not find an association between resilience and interpersonal functioning. Finally, resilience did not mediate the effect of adverse or adaptive life events on the immediate behavioral response to social exclusion during Cyberball. A possible explanation for the missing associations with resilience and the missing mediating effect is that self-reported resilience does not necessarily translate into behavior. In a study with college students, those who reported high resilience actually showed no difference concerning stress reactions such as heartrate, when facing a social stressor compared to those who reported low resilience (Roth & Herzberg, 2017). Yet, the self-reported resilience might affect how we reappraise the stressful situation, which could protect us or hamper the emotional consequences after being socially excluded. Finally, as Bonanno (2021) suggests, when studying resilience, small effects should be expected as resilience and the behavioral consequences might be very dependent on how one evaluates the situation.

To our knowledge, there are no prior studies on resilience in PDD, but also data on BPD are limited. Resilience scores of PDD patients were comparable to BPD patients and significantly lower as in HC. Without FDR correction, resilience scores of PDD patients were significantly higher than those of BPD patients. This finding is in accordance with previous findings of reduced resilience in BPD (Fonagy et al., 2017; Paris et al., 2014) but also in line with studies showing resilience to be negatively correlated with depression (Poole et al., 2017).

In the patient and HC sample, adverse events during all developmental phases showed intercorrelations, which is in line with research showing that victimization is often followed by further victimization (Trickett et al., 2011). Further, adverse interpersonal experiences

might lead to interpersonal difficulties and attract dysfunctional relationships that may be abusive or violent. EAT might therefore translate into real-life behavior. Behavioral paradigms like Cyberball might help to better understand this translation. Another possible explanation could be that victimization brings back memories of earlier victimization, which could bias the self-report. Similarly, the positive association between adaptive events during different developmental phases could also be due to a reappraisal bias. However, this hypothesis may have therapeutic implications, that is promoting to identify adaptive events in life could encourage detecting or reappraising upcoming events as more adaptive and, therefore, strengthen resilience. Further, the missing link between adverse events during childhood and adaptive events during adulthood in the patient sample, emphasizes that despite EAT new positive experiences are possible.

Limitations

Strengths of this study include the use of actual behavioral data to investigate interpersonal behavior, and the recruitment of age- and gender-matched samples to test our hypotheses. However, this study does not come without limitations. First, using cross-sectional data in mediation analyses always needs to be interpreted with caution (Walters, 2018). Second, the majority of data relies on self-report measures, which can always be influenced by reporting bias (Sheikh et al., 2016). When assessing childhood adversity, one has to consider that retrospective data only tells us about adversity that is remembered and appraised as such (Scott et al., 2012). Thus, based on the results of our study we have to be careful to conclude that objective adversities have the same effect on interpersonal behavior. Third, the sample size is moderate, and further interpretation of negative findings may be hampered by a considerable beta error. Fourth, our social stressor used, social exclusion induced by Cyberball, is very specific, which hampers generalization to other interpersonal situations.

Future research

Larger sample sizes are needed to replicate our findings and further explore the role of resilience. It needs to be noted, that adapting after a stressful event is rather the norm than the exception (Bonanno, 2004), e.g. after childhood adversity and interpersonal trauma, only 10-25% do not achieve resilient functioning (Walsh et al., 2010). While in our study HC reported low adverse events, participants who despite multiple adverse events do not develop a psychiatric disorder should be included in future studies to better understand the role of

psychopathology on interpersonal behavior. Moreover, future studies should focus on adaptive experiences in patients with BPD and PDD as it has been neglected in research so far but might predict symptom severity and quality of life (Harpøth et al., 2021). Considering therapeutic approaches, knowing more about the impact of adaptive experiences and resilience is fruitful, as both can be actively worked on, e.g. improving resilient coping techniques. A recent study showed that the relationship between polyvictimization and cybervictimization was mediated by resilience, suggesting that promoting resilience in individuals with negative life events could help to decrease further victimization (Cénat et al., 2021). Further, our study demonstrates a high prevalence of EAT in patients with BPD but also PTSD as a comorbid disorder, thus therapeutic approaches should consider to incorporate trauma-focused therapies into an individualized treatment plan.

As resilience is multidimensional, even though having the same level of resilience some people might use resilience in one domain but not in another (Lutha & Cicchetti, 2000), that is participants with the same level of resilience might react differently in their behavioral reaction to being socially excluded during Cyberball. Thus, different experiments inducing social exclusion are needed, to further explore the mediating effect of resilience.

Conclusion

In this study, we could show that patients with EAT show distinct patterns of associations between adverse and adaptive life events, resilience and, their responses to social exclusion. Interestingly, in this study we found adverse events during youth and adulthood and not childhood to effect interpersonal behavior in response to social exclusion. In HC, only adaptive events during adulthood were positively associated with resilience, and only in the clinical sample was resilience negatively associated with prosocial behavior. We did not find a mediating effect of resilience on the relationship between adverse or adaptive life events on the immediate behavioral reaction to social exclusion during Cyberball. This study partially fills a research gap on resilience in patients with PDD and BPD and provides evidence for the unexplored pathways from adverse and adaptive events to interpersonal behavior. Finally, this study shows the high prevalence of EAT in patients with BPD and PDD compared to HC and adds important knowledge to current literature, where reports of adversity during different timepoints of life in samples including female and male patients with BPD and PDD are scarce. The pathways between adverse and adaptive life events and the behavioral reaction to social exclusion might be multiple and future research should further try to elucidate these

pathways as they may be prerequisite for developing mechanism-based interventions for clinical groups with EAT.

Chapter 5
General Discussion

The major aim of this thesis was to improve the knowledge on interpersonal problems in patients with BPD and PDD by investigating the behavioral response to one of the most difficult interpersonal situations, that is social exclusion. As suggested in the theoretical framework in Figure 1.1, this thesis investigated the effect of CM and more precisely different CM subtypes and adversity during different life phases on the behavioral response to social exclusion. Moreover, the mediating effect of RS and resilience on this relationship was tested. Identifying possible pathways linking CM and the behavioral response to social exclusion helps to better understand the development of interpersonal dysfunction and could perspectival reveal targets for prevention and therapy to improve interpersonal dysfunction (McLaughlin, 2016). While there are some studies with HC and patients with BPD and PDD investigating the effect of social exclusion on emotions, need threat and behavioral intentions, research investigating the effect on the immediate behavioral response to social exclusion was lacking. *Study I* aimed at filling this research gap by investigating the immediate dynamic behavioral response during social exclusion when playing Cyberball and comparing behavior between HC and patients with BPD and PDD. Further in *study II* the effect of CM subtypes and in *study III* the timing of adversity on the behavioral response during Cyberball were investigated. Moreover, the aim of this thesis was to identify potential mediators to explain the relationship between CM and the behavioral response during Cyberball. RS and resilience were, therefore, tested as mediators in *study II* and *III*. Both, RS and resilience, are strongly tied with psychopathology in general and especially with BPD and PDD and are changeable, thus identifying them as mediators could benefit the development of psychotherapeutic strategies in the long-term. Additionally, studies investigating RS in PDD patients are lacking as are those on resilience in both disorders. In the following chapter the results of all three studies will be summarized and discussed within the scope of existing research. Further, future research approaches, as well as limitations and strengths will be discussed and finally clinical implications will be suggested.

Summary of findings

In s*tudy I* patients with BPD and PDD and age and gender matched HC played a variant of the Cyberball paradigm that experimentally induces social exclusion. The main finding of this study was, that while HC showed an immediate increase in ball tosses as soon as partial exclusion started, patients with PDD significantly differed by showing no increase towards the excluder or includer. Patients with BPD did not significantly differ from their matched HC_{BPD} sample nor from patients with PDD. However, the difference between BPD and HC_{BPD} showed a trend towards significance and indicates a less attenuated increase of ball tosses towards the excluder in BPD patients. During the baseline period, which included the first two minutes, none of the groups showed significant differences concerning PP, however, during the extinction period HC_{BPD} significantly increased PP towards the includer and differed significantly from patients with BPD and HC_{PDD}. The manipulation of social exclusion was successful in each group indicated by significant fewer estimated received ball tosses in the exclusion compared to control condition. Patients with BPD felt significantly more excluded compared to HC_{BPD}, but did not differ from patients with PDD and PDD patients did not differ from HC_{PDD}. Interestingly, while patients with PDD and BPD reported more negative and less positive emotions before the game compared to HC, the amount of change in emotions was not significant. There were no significant differences between groups concerning the ratings of the includer and excluder and, again no significant differences concerning the amount of change from before to after the game. Independent of the condition, needs were significantly more threatened in BPD patients compared to HC_{BPD} and PDD patients had significantly more need threat for self-esteem compared to HC_{PDD}. Further, the playing behavior was not significantly correlated with the overall need fulfillment or the sense of exclusion.

The main finding in *study II* was that in the sample of patients with BPD and PDD and age and gender matched HC, overall CM and emotional abuse and neglect were significantly negatively correlated with PP during Cyberball, indicating less ball tosses towards the excluder. This result suggests that the more CM one has experienced the less prosocial one behaves towards the excluder during Cyberball. In patients with BPD emotional neglect was significantly correlated with less PP while in patients with PDD overall CM, sexual and physical abuse were significantly correlated with less PP. In the HC only sample, CM and PP were not significantly correlated. Surprisingly, RS in general and expectancy and anxiety of rejection were not correlated with PP in none of the samples. In the whole sample and the only

patient sample, CM and all subscales were significantly correlated with higher RS and expectancy and anxiety of rejection. The mediation analyses showed no mediating effect of expectancy and anxiety of rejection on the relationship between CM and PP. RS was significantly higher in BPD compared to HC_{BPD} and in PDD compared to HC_{PDD}. Further, RS was significantly higher in BPD compared to PDD patients. CM and all subscales were significantly higher in patients with BPD compared to HC_{BPD}, while patients with PDD had higher scores concerning overall CM, emotional and physical neglect, as well as emotional abuse compared to HC_{PDD}. Further, patients with BPD reported significantly more physical abuse and neglect compared to patients with PDD.

The results of *study III* showed a significant correlation between negative experiences during youth and adulthood with less PP, thus less prosocial behavior during Cyberball, in the patient sample including patients with BPD and PDD. In the HC sample, positive experiences during youth were associated with more PP, that is more prosocial behavior. Surprisingly, in the patient sample neither negative nor positive experiences were correlated with resilience. In the HC sample, positive experiences overall and during adulthood were significantly correlated with more resilience. Interestingly, resilience was significantly correlated with less PP only in the patient sample. Resilience did not mediate the effect of positive or negative life experiences on PP. Patients with BPD and respectively patients with PDD reported significant higher negative and significant lower positive experiences during childhood, youth and adulthood as well as less resilience compared to HC_{BPD} and respectively HC_{PDD}. Moreover, patients with BPD reported significantly more negative experiences overall and during childhood and youth as well as less resilience compared to patients with PDD, however after FDR correction these differences became insignificant.

The results in the context of previous research

The results of this thesis show that there seems to be an immediate behavioral response to self-experienced social exclusion which is altered in patients with PDD and BPD compared to HC. Further, as shown in *study II* and *study III*, previous negative interpersonal experiences like CM are associated with this immediate behavioral response. As no prospective data was used to asses CM and life experiences at different phases assumptions of causality have to be careful, yet the mediation models showed that CM and negative life experiences predicted less prosocial behavior. The results of *study I* also broaden the definition of the reflexive stage

described by Williams (2009). According to Williams (2009), social exclusion is followed by reflexive pain, that is negative emotions like sadness and anger, and needs are threatened. Further, a study also showed an immediate acceleration of heart rate as an average response while being socially excluded (Reiter-Scheidl et al., 2018). However, the results of *study I* suggest that there are not only reflexive emotional or physiological responses but also a reflexive behavior that immediately occurs when social exclusion is experienced. Patients with PDD differ significantly in this regard from HC, while BPD patients seem to show a less attenuated prosocial behavioral response that, however, was neither significantly different from HC nor from patients with PDD. Interestingly, HC showed an immediate change in behavior in contrast or in addition to the idea that one gradually understands the pattern of exclusion during Cyberball and adapts one's behavior accordingly (Pfundmair & Echterhoff, 2021). One question that cannot be answered by the methodology of the studies in this thesis is whether the difference found in social behavior is due to deficits of interpersonal skills, whether it is a self-protective strategy, or whether it is a social reflex that happens without elaborate cognitive processing. Only future studies using methods like thinking aloud during Cyberball could help to answer this question. Interestingly, *study I* could show that while most negative emotions were significantly higher in both patient samples compared to HC, the effect of Cyberball on emotions was similar in all groups. These results suggest that while the emotional impact was the same, the behavioral reaction that is the immediate behavioral regulation of the emotions seemed different. These findings suggest an emotion dysregulation already known in BPD patients (Dixon-Gordon et al., 2021) and add knowledge on emotion regulation in PDD patients. Restrictively, it must be said that the emotions were measured before and after Cyberball and do not offer information on the emotional reaction during the game. Another interpretation could be that there is an emotional threshold and once overturned, it leads to a form of numbing that does not motivate to change behavior. Further, Cyberball might have been experienced as a more severe form of social exclusion in patients compared to HC. Bernstein and Claypool (2012) found that the level of severity of social exclusion led to either pain or numbing, and the authors suggest that less severe exclusion leads to pain and motivates prosocial behavior, while more severe social exclusion leads to numbing motivating more antisocial behavior. Thus, as patients started on a higher negative emotional level, a threshold of numbing might have been reached more often compared to HC explaining the less prosocial behavior observed in patients. Maner et al. (2007) suggests prosocial behavior might be shown when there is a chance to have new contacts. Further,

Maner et al. (2010) found that people high in RS have an increase of progesterone, which is associated with the motivation to engage in social contacts, if they are given the chance to reconnect after social exclusion. In *study I*, connecting with the excluder might have been plausible if the participant believed that it could be achieved, which might have been more likely in HC compared to patients, possibly explaining the prosocial behavior in HC. Further, social exclusion increases mentalizing in children after Cyberball and increases prosocial behavior in a following task (White et al., 2016), so another reason why HC might have shown more prosocial behavior could be due to better mentalization abilities, which might be less functional in patients with BPD (De Meulemeester et al., 2017; Euler et al., 2021) and depression (Halstensen et al., 2021). Thus, HC might realize that reconnection could be a way to win the excluder back, while patients having problems with mentalizing end up with a different realization and behavioral consequence. Still, it is impressive that exclusion by strangers has such a big impact on emotions, needs and the immediate behavioral response. One of the reasons why being rejected by strangers in Cyberball has such an impact, is that being excluded now might be understood as a warning to be excluded in the future (Sjåstad et al., 2021), which needs to be prevented. HC and patients with BPD and PDD seem to have a different approach how to prevent this possible future rejection e.g., as suggested by the social risk hypothesis of depressed mood according to which depressed individuals avoid anticipated social exclusion by social withdrawal (Allen & Badcock, 2003). However, the lack of prosocial behavior in patients might end up in evoking future social exclusion fuelling up a vicious circle of revictimization as described in Figure 1.1.

The question arises why patients might have such a different approach to deal with social exclusion. The results of *study II* and *study III* show that previous negative interpersonal experiences are associated with less prosocial behavior. Especially emotional neglect was significantly associated with less PP in the whole sample and only BPD sample. As emotional neglect is associated with an internalizing trait (Back et al., 2020), the less prosocial behavior shown could reflect an internalizing behavior that does not allow us to show the impact others have on us openly by adapting our behavior. Further, it might be that those negative previous experiences make the individual more cautious to trust that people will stop socially excluding them. Thus, these results are in line with the theory by McCullough (2000) of perception decoupling: the believe that one thinks that one cannot influence the behavior of others by one's own behavior in people having experienced CM. Interestingly in *study II*, while emotional neglect was associated with less prosocial behavior in BPD patients, it was sexual

abuse und physical abuse in patients with PDD. However, it needs to be emphasized that only a few participants reported sexual and physical abuse decreasing variance and limiting the interpretation of these results. However, the results indicate that differentiating into subtypes when investigating the effect of CM on psychopathology is necessary. Emotional neglect might be especially relevant concerning social exclusion, as those experiences might have taught the individual to feel less important and overseen which they might also experience during social exclusion. Further, as shown in *study III* assessing the time when maltreatment occurred is also of relevance. While CM includes maltreatment happening until the age of 18 (World Health Organization, 2019), the term childhood suggests that especially childhood and not youth is the most relevant period. The results of *study III*, however, suggest that in the case of the behavioral response to social exclusion it is youth and even adulthood and not childhood that seem especially vulnerable periods. These results suggest that our social behavior might be especially formed during adolescence and keeps to be formed even during adulthood. At the same time adaptive events during youth were associated with more prosocial behavior in the HC sample. Thus, future research should especially address youth as a vulnerable period for the development of the social brain.

Surprisingly, RS did not correlate with PP. While it seems very plausible that the behavioral response to social exclusion is modulated by the cognitive expectation and fear of rejection as measured with the RSQ, the results of *study II* could not confirm this hypothesis. Apparently, PP measures a dynamic behavior that is a mixture of more transient affective and cognitive aspects that goes beyond the more stable trait of RS. A possible further element of this mixture might also be former interpersonal experiences like CM. The latter would explain the association between PP and the CTQ as well as the TAQ. The missing association between RS and PP and the limited association between resilience and PP suggests that it seems difficult to predict behavior by assessing cognitive and affective expectations. These results challenge the idea of classical cognitive behavioral therapy, which is based on the idea that our thoughts motivate our behavior. However, these results might suggest that to predict our automatic e.g., immediate behavior, previous experiences e.g., CM, are stronger predictors. Thus, working on interpersonal trauma in therapy needs to be emphasized. Especially using imagery rescripting (ImRs, Arntz & Weertman, 1999) or eye movement desensitisation and reprocessing (EMDR, Lee et al., 2006) could be beneficial. In ImRs the patient is instructed to imagine different outcomes to the actual traumatic experience with the intention to satisfy the underlying need threat, while in EMDR bilateral stimulation e.g., eye movements, is used

to reduce distress of the trauma. A recent randomised clinical trial found ImRs and EMDR equally effective in treating those suffering from PTSD caused by CM (Boterhoven de Haan et al., 2020).

Further it was surprising that neither positive nor negative life events were associated with resilience. The only association was found between positive experiences in general and positive experience during adulthood with resilience in HC. The CD-RISC assesses how one thinks one adapts to difficult situations, and it might be that CM can lead to both less and more resilience, thus cancelling each other out in a correlation, yet it was also not a mediator. Moreover, at least in patients, resilience actually was negatively correlated with less prosocial behavior. As more resilience was expected to be associated with more prosocial behavior, this result was very surprising. One possible explanation could be that some patients might have built resilience due to more negative life experiences and as a consequence of the experience of negative interpersonal relationships choose not to affiliate and be prosocial to protect themselves from further disappointment as suggested in previous theories (e.g., Allen & Badcock, 2003). However, this is very speculative and not supported by the results of *study III* as there were no associations between negative life experiences and resilience, and thus future research on this matter is warranted.

Future research

The studies reported here offer important starting points for future research.

Social context

While this thesis looked at the behavioral response to being socially excluded by strangers, it would be of interest how one behaves when being socially excluded by significant others, close friends or family members. While social exclusion by strangers or those who are not too close to us seems to happen more often, being rejected by a close friend or family member is experienced as more painful (Nezlek et al., 2012). Contrary, depending on how one evaluates the emotional bond and trusts in the relationship with a close friend or family member, being socially excluded by non-family members might be even more threatening as due to the missing intimacy the threat of losing someone might be higher (Bolger et al., 1989). According to the social identity theory people define themselves as part of a group and thrive agreement with this group (Haslam et al., 2009). Interestingly, after being socially excluded

in Cyberball, participants mimicked other participants who had not been in the Cyberball game more if they belonged to the same group, in this case gender (Lakin et al., 2008). Thus, being socially excluded by people belonging to the same group as oneself might evoke an even stronger desire to repair the relationship leading to an even more pronounced prosocial behavior as an immediate response to social exclusion. Moreover, identifying with multiple social groups has a positive impact on state resilience measured as faster recovery after physical stress and greater endurance of physical pain (Jones & Jetten, 2011). Thus, future studies should assess how much the other ball players matter to the participant and how much they feel like they belong to the same group as well as to assess whether the participants think about other group memberships during Cyberball as this could motivate their behavior (Cruwys et al., 2014).

Intensity of social exclusion

A study by Schaan et al. (2020) showed that when manipulating the intensity of social exclusion, only those in a medium intense condition tried to reaffiliate with others, that is behaved prosocially, while those in the severe intense or inclusion condition showed no reaffiliation behavior. Future research could, therefore, manipulate intensity in Cyberball and investigate effects on behavior.

Evaluating prosocial behavior

Another future research perspective is to have the immediate reaction evaluated by HC and patient groups. The turning towards the excluder during social exclusion in Cyberball was interpreted as prosocial behavior and aiming to reconnect (Barton et al., 2021; Dewald-Kaufmann et al., 2021). However, as the goal is to understand what kind of behavior leads to interpersonal difficulties, it seems relevant how this behavior is actually perceived and evaluated by others. Therefore, the following scenarios should be investigated in healthy participants and participants with BPD and PDD: (1) the participants could be instructed to watch a Cyberball game of partial exclusion in which the excluded player either mimics the playing behavior as seen in HC, increasing ball tosses towards the excluder, or mimics the patients' playing behavior, continuing on playing with both players equally, (2) the participant is playing Cyberball with the excluder and another participant being excluded and behaving prosocial, (3) the participant is told to be the excluder and to evaluate the prosocial behavior towards her/himself. This could better help to understand which kind of behavior is experienced as appropriate and helpful in patients and in HC. It can, of course, also be

questioned whether behaving prosocial is in fact the better choice. Why behave prosocial when the other person is clearly signaling rejection? Why neglecting the includer behaving fairly? Why risking to be disappointed if the excluder does not change the exclusionary behavior? A possible answer to these questions is the ingrained hope to be included by the excluder and maybe also demonstrating the includer how one behaves if there is an interpersonal conflict. Finally, answering these research questions would help to elucidate strategies that are helpful to repair social relationships leading into long-lasting and resilient relationships.

Two-person experimental approach

Moreover, as Schilbach (2016) suggests, in order to improve our knowledge on mental disorders a better understanding of social dynamics is necessary. Using a two-person experimental approach could account for the fact that patients might have a different norm compared to HC regarding as what they expect as appropriate (Schilbach, 2016). Thus, Cyberball could also be played by an HC and a patient at the same time and one computerized co-player who excludes one of them. Further, this methodological approach would appreciate that problems are not only within an individual but also between individuals (Crowell, 2016). Normalizing two-person experimental paradigms could also pave a way into clinical practice and increase the involvement of the social network e.g. spouse, children etc. to enable a full remission (Crowell, 2016). Also, the question arises as to whether HC and patients would show an altered behavior when playing with other HC respectively patients (Jeung et al., 2016). For example, in a trust game BPD patients' behavior enhanced a different behavior in HC as compared when HC played with HC (King-Casas et al., 2008). Further, studies have shown that HC evaluate BPD patients as more negative compared to HC without knowledge of the diagnose, while BPD patients evaluated HC and BPD patients more negative per se (Hepp et al., 2021). BPD patients are evaluated as less likeable solely based on their behavior in a short video as was found in a study by Hepp, Störkel, et al. (2018). This study suggests that there are certain immediate or unconscious behaviors that might lead to a more negative evaluation. One of those immediate behaviors making one less likeable could be the immediate response to social exclusion. Therefore, an interesting further approach would be to use machine learning methods to predict whether a participant belongs to a clinical or non-clinical sample based on the behavioral response to social exclusion. As behavior for phenotyping should be interaction based (Schilbach, 2019), the behavioral response during Cyberball would be appropriate.

A new version of Cyberball, called "Social Ball" (Meral et al., 2022), might enable researchers to easily manipulate all of the above suggestions i.e., manipulating intensity, creating groups, having patients play against HC, and thus could be used in future research.

Influence of attribution and expectations

Further, the influence of attribution of social exclusion experienced during Cyberball on PP should also be investigated in future studies. The attribution that social exclusion is due to being disliked has shown to increase sadness which increased prosocial behavior while the attribution of being excluded due to disrespect has shown to lead to anger and more antisocial behavior (Debono et al., 2020). Further, during the reflective stage, that is after playing Cyberball, unstable and external attributions were most healing e.g., being told that there were problems with the computer (Yaakobi, 2022). Interestingly, not given an explanation about the exclusion led to similar distress as when the attribution was internal and stable e.g., being told that social exclusion happened because of one's personality traits (Yaakobi, 2022). In future studies attribution should be assessed by asking participants why they think they are being excluded and investigate the effect of attribution on the behavioral response.

Next to attribution of social exclusion, expectations should also be considered as a relevant influence on the immediate behavior to social exclusion. The reaction to being socially excluded might differ whether we expect the social exclusion or not. Furthermore, it would be interesting to investigate how people think they will behave when being socially excluded in Cyberball in comparison to how they actually behave. The missing association between RS and prosocial behavior as shown in *study II* suggests that even if we have certain expectations or anxiety of being rejected, our behavior might not be easily predicted by it.

Investigating biological and neurobiological underpinnings

Another future research goal would be to better understand biological and neurobiological processes that are associated with the behavioral response to social exclusion. A study found that the average immediate reaction to being socially excluded is a slowing heart rate which can be interpreted as a form of inhibition, e.g. freezing or avoidance (Reiter-Scheidl et al., 2018). Interestingly, a less pronounced cardiac deceleration was associated with aggressive behavior in a preceding experiment. Future studies could include measures of heart rate while playing Cyberball to investigate its association with the immediate behavioral response. Further, the neuropeptide oxytocin is involved in social behavior (Marsh et al.,

2021). Emotional neglect is associated with lower plasma oxytocin levels which is associated with insecure attachment representations and increased social fear and avoidance (Müller et al., 2019). Oxytocin plasma levels in patients with BPD and PDD decreased after being socially excluded in Cyberball and thus showed a significantly different change of direction compared to HC (Jobst et al., 2014; Jobst et al., 2015). Further, we conducted a pilot study showing a correlation between playing behavior during Cyberball and oxytocin indicating that reduced ball tosses towards the excluder were associated with lower oxytocin levels in patients with BPD, while in HC there was no association (Reinhard et al., 2022). These results are in line with findings of oxytocin increasing prosocial behavior, e.g. generosity (Zak et al., 2007), and approach behavior especially towards strangers (Cohen & Shamay-Tsoory, 2018), however, it was also found to increase aggressive reactions when being threatened (Ne'eman et al., 2016). A meta-analytic review came to the conclusion that in healthy individuals, oxytocin increases the startle response to threat (Leppanen et al., 2018). Further, although not enough studies were found to conduct a meta-analysis, the authors of the study discuss the possibility that oxytocin affects approaching behavior when facing threat (Leppanen et al., 2018). In patients with BPD, oxytocin has been shown to positively influence threat processing and the response to stress (Bertsch & Herpertz, 2018a) and to normalize that is adjust it to HC's attentional bias as well as approach and avoidance behavior towards angry faces (Brüne et al., 2013; Schneider et al., 2020). In patients with PDD, intranasal oxytocin led to reduced attention towards angry and increased attention towards happy faces (Domes, Normann, et al., 2016). A study with healthy individuals showed no influence of nasal applied oxytocin on the playing behavior during Cyberball; the only effect of nasal applied oxytocin measured was liking and preferring the excluder one week later but only in the male sample (Xu et al., 2017). In another study healthy males were first excluded in a previous experiment and then played Cyberball (Pfundmair & Echterhoff, 2021). During the first quarter of Cyberball, the group with nasal oxytocin showed fewer ball tosses towards an approaching player, who had previously excluded them, however during the second and third quarter of the game they showed significantly more ball tosses towards that player (Pfundmair & Echterhoff, 2021). However, studies investigating the effect of applied oxytocin in clinical samples are lacking.

Assessing dysfunctional interpersonal behavior, interpersonal problems and, revictimization

As patients with BPD and PDD often show aggressive and submissive behavior (Bird et al., 2018; McCloskey et al., 2009; Russell et al., 2007) that maintains interpersonal dysfunction using diary studies or ecological momentary assessment (Shiffman et al., 2008) could help to quantify this behavior and make it more visible (Wolf et al., 2015). As behavior might be very dependent on daily fluctuations within individuals (daSilva et al., 2021; Wright et al., 2015), methods like ecological momentary assessment also allow us to capture a realistic picture of the behavior to social exclusion. In addition to face to face interactions these methods could also measure how often social exclusion is experienced over social media or using online conversations (text messaging, emails, etc.). Further, these methodologies could minimize recall bias and could help to better understand social exclusion in everyday life by quantifying occurrence, and measuring individual responses (Crowell, 2016). Thus, these methods would help to assess actual dysfunctional interpersonal behavior and the ensuing interpersonal problems and would even allow to assess revicitimization. This information would help answer the question what kind of interpersonal behavior leads to interpsersonal problems such as social exclusion as proposed in theoretical framework as described in Figure 1.1. Ecological momentary assessment could also increase knowledge on RS and resilience in everyday life, by assessing expectation and anxiety concerning rejection and coping strategies in everyday life. It would also be of interest to see if positive encounters have a beneficial effect that might even increase resilience (Crowell, 2016). Future research using ecological momentary assessment could also address how often social exclusion is used towards others, e.g., giving someone the silent treatment (Buss et al., 1987).

Effect of psychotherapy on the behavioral response

In future studies it should be tested whether playing behavior changes after successful therapy and how long this possible effect endures. Further, as RS and resilience could not be identified as mediators other changeable mediators should be targeted. Possible other mediators could be the reconsolidation and reprocessing of experienced CM (Gama et al., 2021) and self-esteem, as the Sociometer Model of Self-esteem (Leary et al., 1995) suggests that social exclusion threatens our self-esteem, so a higher self-esteem might lead to more prosocial behavior. A possible change in playing behavior after psychotherapy should be investigated by considering improvements in these possible mediators.

Previous studies suggest that specific training on mechanisms necessary for interpersonal behavior can be successful, e.g., emotion recognition can be improved by training it (Berggren et al., 2018; Ichinose et al., 2018). Therefore, another future goal would be to directly work on the playing behavior itself e.g., by practicing approach behavior towards excluding individuals. Further, studies have shown that receiving negative feedback when positive feedback is expected leads to better learning (Flechsenhar et al., 2022). As patients might evaluate their behavior while being socially excluded as helpful or adequate, giving them immediate negative feedback when avoidant behavior, that is no prosocial behavior, is shown, could be a way to train prosocial behavior during Cyberball.

From a cross-to a transdiagnostic approach

The theoretical framework suggested in Figure 1.1 is not limited to explain interpersonal dysfunction in patients with BPD and PDD only. Patients with BPD and PDD were chosen for this dissertation as both disorders are strongly associated with CM (Kleindienst et al., 2021; Struck, Krug, et al., 2020) and interpersonal dysfunction (Bird et al., 2018; Stoffers-Winterling et al., 2021). In fact, most mental disorders probably are associated with interpersonal difficulties to a certain degree (Porcelli et al., 2019) and CM is a transdiagnostic risk factor for the development of mental disorders (Hoppen & Chalder, 2018; Kessler et al., 2010), thus making the theoretical framework suggested in Figure 1.1. relevant for most mental disorders. In future studies, this cross-diagnostic approach should be expanded to a transdiagnostic approach including other diagnosis associated with interpersonal dysfunction. Patients with psychosis spectrum disorders, for example, are also a group that is prone to social exclusion and based on a systematic review including Cyberball studies have altered processes and coping strategies towards social exclusion compared to HC (Lincoln et al., 2021). Moreover, a systematic review also showed differences between various mental disorders and HC when being socially excluded concerning emotions, need threat, and neurobiological measures (Reinhard et al., 2020). Thus, further investigating the behavioral response across different mental disorders and the associations with adverse events is highly important to better understand the interpersonal problems that might play an important role in the development, deterioration, or maintenance of mental disorders in general.

Sample Size and causality

Further, to draw legitimate conclusions from the results of these studies, a replication in a larger sample size is needed (Fusar-Poli, 2019; Simons, 2014). Finally, longitudinal studies

are necessary in order to investigate causality of CM on RS and resilience or whether RS and resilience maintain interpersonal dysfunction or are consequences of it within a transdiagnostic framework.

General strengths and limitations

The studies included in this thesis are the first of their kinds for investigating the behavioral response to social exclusion across patients with BPD, patients with PDD and age and gender matched HC. Thus, the results of these studies contribute to a better understanding of interpersonal problems in patients with BPD and PDD and offer possible starting points to improve our knowledge on the etiology of interpersonal dysfunction. One major strength of the studies was the novel variant of Cyberball to assess the behavioral response during the game aiming at really looking at a social interaction rather than only relying on self-report data about behavioral reactions, feelings during or after the social exclusion, or behavioral intentions. Further, by using partial exclusion, the excluder still tossed 5% of ball tosses towards the participant, which allowed more ecological validity as this form of exclusion seems more likely in everyday life compared to total exclusion. Moreover, the methodology of the Cyberball paradigm had several strength: the order of exclusion and control condition was randomized, pictures used to present the alleged co-players were previously rated as average (Roayaee et al., 2020), and pictures were randomized to the left and right side as well as who was the includer and excluder. Lastly, the BPD sample used had 50% of male patients, which is rare in der literature of BPD studies.

However, there are some limitations that need to be addressed. First, while the response to social exclusion was real time data, all other constructs were assessed with self-report data. Especially assessing CM comes along with challenges. A meta-analysis found poor agreement between retrospective and prospective assessment of CM (Baldwin et al., 2019). In general, prevalence of CM is probably underestimated as subtypes of CM like emotional abuse and neglect are often not visible and, thus, might be less detected (Lippard & Nemeroff, 2020). Further, often CM is not experienced as harmful by the child, as it might be used to it or experience it as the only way of affection (Clancy & McNally, 2005), and thus not reported as CM. While prospectively and retrospectively reported CM are both associated with more psychopathology (Scott et al., 2012), retrospective and prospective assessment might differentiate two groups of individuals with CM (Baldwin et al., 2019). Thus, it is important

to emphasize that the findings in this thesis only apply to those with self-reported CM. However, different questionnaires where used to assess adversity in this thesis and both resulted in showing the same association between CM and the playing behavior during Cyberball.

Moreover, while the new Cyberball offered advantages as outlined above, the length of the game of 12 minutes might have been too long, as boredom significantly increased in all groups equally in both conditions with the exception of patients with PDD during the control condition. Thus, future studies should shorten the duration of Cyberball as boredom could influence playing behavior, especially during period 3.

Finally, as the age of patients with PDD was significantly older compared to the pictures presented in Cyberball, this could have also led to less prosocial behavior as one might have already felt more like not belonging to the group. However, PDD patients did not report feeling more excluded compared to BPD patients and $HC_{PDD,}$ who were as old as PDD patients, did show an increase in prosocial behavior.

While the order of the condition was randomized, the impact of the baseline period should also be considered. A study showed that participants were hurt more when inclusion was followed by exclusion compared to exclusion from the start (Buckley et al., 2004). Furthermore, prosocial behavior, aggressive behavior, and withdrawal are suggested behavioral reactions to social exclusion (Williams, 2009). However, the question arises as to what kind of playing behavior could be interpreted as aggressive or withdrawal behavior. While excluding the excluder could be interpreted as aggressive behavior, withdrawal behavior might be more difficult to define within the context of Cyberball. Yet, while not changing the playing behavior might also resemble a form of withdrawal, actual withdrawal behavior like leaving the situation was not possible in the current paradigm. So, it would be of interest to give an additional option in which the participant could decide to leave the situation. In fact, when given the opportunity to quit the game, those completely excluded quit faster than those only partially excluded (Williams et al., 2000).

Finally, patients were predominantly recruited from a psychiatric clinic and received pharmacotherapy. While, the use of tranquilizers on the day of Cyberball lead to an exclusion from the study, the impact of pharmacotherapy on the questionnaires and playing behavior remains open and needs to be taken into consideration.

Implications for clinical research and clinical practice

The results of this thesis indicate the immense impact previous negative interpersonal experience have on the behavior during social exclusion. Therefore, therapists need to be sensibilized to assess CM and negative life experience in general and to ask patients about their experience of social exclusion in daily life and how they emotionally and behaviorally respond to it. Further, while RS did not correlate with the playing behavior, CM was significantly associated with RS. Thus, the impact of CM on the expectation and anxiety of rejection should be addressed in psychotherapy when patients report CM or other forms of interpersonal trauma. The fact that it was able to show that previous negative interpersonal experiences have an impact on our behavior even in an experimental paradigm such as Cyberball, clearly shows that it is necessary to acknowledge that negative interpersonal experience outline our mental health (Schilbach, 2016; Schilbach, 2019).

Individuals with interpersonal trauma have difficulties differentiating new experiences from previous ones and thus perceive situations, especially ambiguous ones, as threatening due to e.g., a disturbed process in the hippocampus (Lecei & van Winkel, 2020; Yassa & Stark, 2011). An essential part of psychotherapy is, therefore, to learn the differences between the past and the present. As outlined above, patients with BPD and PDD often report CM and interpersonal trauma. Therapies tailored for patients with BPD and PDD already address this subject. In dialectical behavior therapy (DBT, Linehan, 1993) for BPD patients, one way to tackle the problem of confusing the past with the present is to explicitly write down the parts that differentiate the current from the interpersonal traumatic situation. Also, in the cognitive behavioral analysis system of psychotherapy (CBASP, McCullough, 2000), the therapist tries to teach the patient that certain thoughts occur and behavior is triggered in certain situations because of our previous interpersonal experience. While, both therapy programs address this issue because of the detrimental effects of adversity on our interpersonal behavior, it should be even more emphasized and difficult situations should be carefully evaluated if they remind the patient of previous hurtful ones. It needs to be said, that while these therapies try to improve social functioning the underlying mechanisms never really have been investigated nor have the theoretical models they are built on (Flechsenhar et al., 2022). With the results of the studies presented in this thesis new insights have been gained to justify that these approaches have a valid theoretical ground.

Psychological interventions to improve interpersonal functioning are rare and often neglected in psychotherapy (Bertsch & Herpertz, 2021). Thus, identifying transdiagnostic risk factors and maintenance factors for psychopathology is beneficial in developing prevention and therapeutic strategies. However, these strategies also need to be tested against already established therapeutic strategies to be justified (Ehring, 2021). Of course, while prevention of CM would be the ultimate goal, interventions focusing on the reconsolidation and reprocessing of experienced CM might hold the possibility of decreasing interpersonal problems eventually leading to mental disorders (Gama et al., 2021).

Finally, in HC positive experiences were associated with higher resilience and more prosocial behavior. While this was only true in HC; it might have been due to limited variance in positive experiences found in patients. Yet, these results are very encouraging as they suggest that increasing positive experiences and reassuring our patients to get in touch with others to make new positive experiences, might indeed be helpful and important in improving their interpersonal behavior and eventually their interpersonal relationships. Another promising result is that a short intervention on resilience helped to increase prosocial behavior after being socially excluded in HC (Shi et al., 2022).

Conclusion

This thesis illustrates how patients with BPD and PDD showed an altered immediate reaction to social exclusion compared to HC. Instead of immediately trying to reconnect with the excluder in a prosocial manner, patients with PDD did not show this behavior, and those with BPD to a lesser extent compared to HC. CM in general but especially emotional neglect while growing up and adversity during youth and adulthood are associated with less prosocial behavior, while positive experiences during youth seem to enhance prosocial behavior, at least in HC. CM is associated with increased RS. Resilience seems to benefit from positive life experiences especially during adulthood in HC, whereas there were no associations with negative life events. The trajectories of negative interpersonal experiences seem to be so strong that they even become visible in an experiment inducing social exclusion. This underlies how important research on better understanding the effect of CM on interpersonal behavior is and that future studies need to replicate these findings as well as focusing on changeable and thus possible therapeutically useable mediators explaining these potential pathways.

Zusammenfassung

Als soziales Wesen ist der Mensch auf Beziehungen zu anderen angewiesen. Nach Baumeister and Leary (1995) ist es das fundamentale Bedürfnis nach Zugehörigkeit, während Leary et al. (1995) den Selbstwert als Hauptgrund sehen warum Menschen motiviert sind in Beziehungen mit anderen zu treten. Die soziale Baseline Theorie geht davon aus, dass der Normalzustand für Menschen einer in Beziehungen ist und ein Mangel daran ausgeglichen werden muss (Coan & Sbarra, 2015). Um interpersonelle Beziehungen aufzubauen und aufrechtzuerhalten braucht es interpersonelle Fertigkeiten, insbesondere dann, wenn Beziehungen in Gefahr sind oder ein sozialer Ausschluss droht. Nach dem „temporal need threat“ Model nach Williams (2007) führt sozialer Ausschluss zunächst zu einer reflexiven Phase in welcher unangenehme und schmerzhafte Gefühle sowie bedrohte Bedürfnisse auftreten. In der zweiten oder reflektiven Phase wird über den sozialen Ausschluss nachgedacht und basierend darauf welche Bedürfnisse bedroht wurden das Verhalten ausgerichtet. Es wird angenommen, dass die Bedrohung des Bedürfnisses nach Zugehörigkeit und Selbstwertgefühl prosoziales Verhalten fördert, während die Bedrohung des Bedürfnisses nach Kontrolle aggressives Verhalten verstärken kann (Williams, 2007, 2009). Ständige soziale Ausgrenzung erschöpft die Ressourcen zur Erfüllung der bedrohten Bedürfnisse und führt zur dritten Stufe der Resignation in der Depression, Entfremdung und Hilflosigkeit im Vordergrund stehen und das Rückzugsverhalten verstärken (Williams, 2009). Insbesondere das experimentelle Paradigma Cyberball eignet sich um sozialen Ausschluss zu induzieren (Hartgerink et al., 2015). Der Proband spielt ein virtuelles Ballspiel mit zwei angeblichen Mitspielern und wird nach einer Weile ausgeschlossen. Der Großteil bisheriger Forschung untersuchte wie sich Personen nach dem Cyberball Paradigma in einer neuen sozialen Situation verhalten, welchen Effekt der Ausschluss also auf eine neue Situation hat. Das Verhalten während des sozialen Ausschlusses wurde jedoch bislang vernachlässigt. Erste Studien, die das Verhalten während des Cyberball Paradigmas analysierten, zeigen bei gesunden Stichproben eine sofortige Erhöhung der Ballwürfe zum Exkluder; diese Zuwendung wurde als prosoziales Verhalten beschrieben (Dewald-Kaufmann et al., 2021; Xu et al., 2017). Gerade Menschen mit psychischen Störungen zeigen häufig Schwierigkeiten im interpersonellen Bereich (Cotter et al., 2018). Dies zeigt sich auch bei Menschen mit Borderline Persönlichkeitsstörung (BPS) und persistierender depressiver Störung (PDS).

Zwar gibt es Studien in denen PatientInnen mit BPS and PDS Cyberball spielten, jedoch wurde bislang noch nicht das Verhalten während des Cyberball Paradigma im Vergleich zu Gesunden Kontrollen (GK) untersucht (Reinhard et al., 2020).

In der Psychotherapie gehen wir davon aus, das frühere Erfahrungen unsere heutigen Verhaltensweisen beeinflussen. Es stellt sich also die Frage welchen Einfluss negative interpersonelle Erfahrungen wie Missbrauch und Vernachlässigung auf unser Verhalten in einer sozialen Ausschlusssituation haben. So zeigten sich Kindesmisshandlungen (KM) beispielsweise als prädiktiv für distanziertes Verhalten wie soziale Isolation oder Vermeidung von Nähe im Erwachsenalter (Back et al., 2020). KM sind mit ca. 15 % in der Allgemeinbevölkerung häufig und mit 56 bis 75 % sehr weit vertreten unter psychischen Störungen. Auch bei BPS sind die Prävalenzen von KM mit 71.1 % (Porter et al., 2020) und bei PDS mit 60 - 76 % (Brakemeier et al., 2015; Negele et al., 2015; Struck, Krug, et al., 2020) hoch. Es können verschiedene Subtypen von KM unterschieden werden: emotionaler Missbrauch, emotionale Vernachlässigung, körperlicher Missbrauch, körperliche Vernachlässigung und sexueller Missbrauch. Meistens tritt ein Subtyp nicht isoliert auf und das Kumulieren verschiedener Subtypen ist mit einer schweren Psychopathologie verbunden (Cloitre et al., 2009; Mills et al., 2013; Putnam et al., 2013). Auch die Altersstufe in welcher KM auftritt kann entscheidend sein (Lippard & Nemeroff, 2020). Zwar gibt Hinweise darauf, dass bestimmte Subtypen von KM zu unterschiedlichen Psychopathologien führen können und auch der Zeitpunkt einen entscheidenden Einfluss haben kann (Khan et al., 2015), jedoch ist die Datenlage hier unzureichend.

Interpersonelle Probleme sind eines der Hauptsymptome bei BPS und umfassen Symptome wie instabile soziale Beziehungen, ängstliche Beschäftigung mit realem oder imaginärem Verlassenwerden sowie eine zwischenmenschliche Hypersensibilität, wie sie im neuen alternativen Modell des DSM-5 beschrieben wird (American Psychiatric Association, 2015, pp. 908-914). Längsschnittstudien berichten über fortbestehende Beeinträchtigungen des sozialen Funktionsniveaus bei BPS trotz Remission der allgemeinen BPS Symptome (Alvarez-Tomás et al., 2017; Barnicot & Crawford, 2019; Choi-Kain et al., 2010; Gunderson et al., 2011; Zanarini et al., 2012; Zeitler et al., 2020). Im Gegensatz dazu sagten positive zwischenmenschliche Beziehungen die Remission von BPD über einen Zeitraum von vier Jahren voraus (Skodol et al., 2007). In einer Studie wurde sogar festgestellt, dass zwischenmenschliche Stressfaktoren die tägliche körperliche Gesundheit von BPS Patientinnen negativ beeinflussen (Hepp et al., 2020). Patienten mit PDS berichten häufig von

interpersonellen Ängste (Klein et al., 2020) und werden als passiv und distanzschaffend im Vergleich zu Patienten mit unipolarer Depression und GK wahrgenommen (Bird et al., 2018; Constantino et al., 2008). Bislang wurde der Effekt von KM auf interpersonelle Probleme unzureichend untersucht. Auch gibt es bislang noch keine Studien in denen der Effekt von KM auf das Verhalten während Cyberball untersucht wurde. Auch ist unklar was den möglichen Zusammenhang zwischen KM und dem Verhalten während sozialem Ausschluss mediiert. Zwei mögliche und in dieser Dissertation untersuchte Mediatoren sind Zurückweisungssensibilität und Resilienz.

Zurückweisungssensibilität beschreibt die kognitive und affektive Disposition wie auf sozialen Ausschluss reagiert wird. Menschen mit einer hohen Zurückweisungssensibilität erwarten in sozialen Situationen Zurückweisung und haben Angst davor (Downey & Feldman, 1996). Außerdem nehmen sie Zurückweisung schneller wahr und zeigen sowohl emotionale als auch behaviorale Überreaktionen auf die Zurückweisung (Downey & Feldman, 1996). Letzteres kann tatsächliche Zurückweisung und somit interpersonelle Schwierigkeiten hervorrufen. Ferner sind auch frühere negative interpersonelle Erfahrungen mit einer höheren Zurückweisungssensibilität assoziiert (Downey & Feldman, 1996). Zurückweisungssensibilität korreliert außerdem mit einer Vielzahl an psychischen Störungen, darunter auch mit der BPS (Cavicchioli & Maffei, 2020; Gao et al., 2017; Heekerens et al., 2022; Rosenbach & Renneberg, 2011; Sato et al., 2020) und mit depressiven Störungen (Gao et al., 2017). Resilienz beschreibt die Fähigkeit sich angesichts negativer Lebensereignisse wie extremen Stress bedingt durch interpersonelle Probleme oder Bedrohungen anzupassen. Wenn es gelingt Resilienz zu entwickeln, kann dies die negativen Auswirkungen neuer Bedrohungen, wie hier sozialer Ausschluss, abschwächen (American Psychiatric Association, 2020). Während BPS mit einer niedrigen Resilienz assoziiert ist, gibt es noch keine Studien die Resilienz bei PDS untersucht haben. Bislang wurde der mediierende Effekt von Zurückweisungssensibilität und Resilienz auf den Zusammenhang zwischen KM und das Verhalten in einer sozialen Ausschlusssituation noch nicht untersucht. Deshalb war das Ziel dieser Dissertation diese Forschungslücken zu schließen. In *Studie I* wurde die unmittelbare Verhaltensreaktion auf sozialen Ausschluss während des Cyberball Paraigmas bei PatientInnen mit BPS und PDS im Vergleich zu einer GK untersucht. In *Studie II* wurde der Zusammenhang zwischen KM und den verschiedenen Subtypen und der Verhaltensreaktion während Cyberball untersucht und der mediierende Effekt von Zurückweisungssensibilität getestet. In *Studie III* wurde der Zusammenhang zwischen negativen und positiven

interpersonellen Lebensereignissen in verschiedenen Lebensphasen mit der Verhaltensreaktion während Cyberall untersucht und der mediierende Effekt von Resilienz getestet.

Das Hauptziel von *Studie I* war es, die unmittelbare Verhaltensreaktion auf sozialen Ausschluss bei Patienten mit BPS and PDS im Vergleich zu nach Alter und Geschlecht gematchten GK zu untersuchen. Auf Grundlage der bisherigen Forschung wurde ein Unterschied im Verhalten bei beiden Patientengruppen im Vergleich zu GK erwartet. Insgesamt wurden 36 PatientInnen mit BPS, 34 PatientInnen mit PDS und 70 GK eingeschlossen. Alle StudienteilnehmerInnen spielten eine Variante des Cyberball Paradigmas das partiellen Ausschluss induzierte und so eine Verhaltensreaktion auf den sozialen Ausschluss zuließ. Den TeilnehmerInnen wurde mitgeteilt, dass sie gegen zwei andere gleichgeschlechtliche ProbandInnen aus anderen Uni-Kliniken ein virtuelles Ballspiel spielen werden. In den ersten zwei Minuten erhielten die ProbandInnen 50% der Ballwürfe der anderen beiden SpielerInnen. In der Experimentalbedingung erfolgte ein 10-minütiger sozialer Ausschluss indem einer der SpielerInnen zum Exkluder wurde und der ProbandIn nur noch 5 % der Bälle zuwarf, während die andere SpielerIn inkludierend blieb und weiterhin 50 % der Bälle zuwarf. In der Kontrollbedingung veränderten die beiden Mitspielenden das Verhalten aus der Baseline Periode nicht. Die Reihenfolge ob zuerst die Experimental- oder die Kontrollbedingung gespielt wurde sowie die Anordnung der Bilder (links, rechts) des Exkluders und Inkluder erfolgte randomisiert. Vor und nach dem Spiel füllten die ProbandInnen Fragebögen zur Einschätzung der Mitspieler, der aktuellen Emotionen und Anspannung aus, und nach dem Spiel zu Bedürfnisbedrohung und Verhaltensintentionen. Es zeigte sich, dass PatientInnen eine unterschiedliche unmittelbare Reaktion auf partiellen sozialen Ausschluss im Vergleich zu der GK zeigten. Während die GK die Ballwürfe zum Exkluder sofort ab Beginn des partiellen Ausschlusses erhöhten, zeigten PatientInnen mit PDS signifikant weniger Ballwürfe zum Exkluder. PatientInnen mit BPS zeigten ebenfalls eine abgeschwächte Annäherung zum Exkluder im Vergleich zur GK, wobei der Unterschied nicht signifikant war, sich allerdings auch nicht von den PDS PatientInnen signifikant unterschied. Die Manipulation der sozialen Ausgrenzung war in jeder Gruppe erfolgreich, was sich in signifikant weniger geschätzten Ballwürfen in der Experimentalbedingung im Vergleich zur Kontrollbedingung zeigte. PatientInnen mit BPS fühlten sich signifikant mehr ausgegrenzt als die GK_{BPS}. Interessanterweise berichteten PatientInnen mit PDS und BPS im Vergleich zu GK vor dem Spiel über mehr negative und weniger positive Emotionen. Die Höhe der

Veränderung der Emotionen unterschied sich jedoch nicht zwischen den Gruppen. Es gab keine signifikanten Unterschiede zwischen den Gruppen in Bezug auf die Bewertungen der einschließenden und ausschließenden Mitspieler und wiederum keine signifikanten Unterschiede in Bezug auf das Ausmaß der Veränderung vor und nach dem Spiel. Unabhängig von der Bedingung waren die Bedürfnisse bei BPS PatientInnen signifikant stärker bedroht als bei der GK_{BPS}, und PatientInnen mit PDS zeigten eine signifikant höhere Bedrohung des Selbstwertes im Vergleich zu der GK_{PDS}. Außerdem war das Spielverhalten nicht signifikant mit der allgemeinen Bedürfnisbefriedigung oder dem Gefühl der Ausgrenzung korreliert.

In *Studie II* zeigte sich, dass in der Stichprobe von PatientInnen mit BPS und PDS und alters- und geschlechtsgleichen GK, KM signifikant mit weniger Ballwürfen zum Exkluder während Cyberball korreliert war. Dieses Ergebnis deutet auf ein geringeres prosoziales Verhalten gegenüber dem Exkluder in Abhängigkeit vom erlebten KM hin. In der gesamten Stichprobe waren KM und emotionaler Missbrauch und Vernachlässigung signifikant mit weniger Ballwürfen zum Exkluder korreliert. Bei PatientInnen mit BPS korrelierte die emotionale Vernachlässigung und bei PatientInnen mit PDS KM insgesamt sowie sexueller und körperlicher Missbrauch signifikant mit weniger Ballwürfen zum Exkluder. Überraschenderweise waren die Zurückweisungssensibilität als auch die Erwartung und Angst vor Zurückweisung nicht mit dem Spielverhalten signifikant assoziiert. In der Gesamtstichprobe und in der Patientenstichprobe waren KM und alle Subskalen signifikant mit höherer Zurückweisungssensibilität sowie mit der Erwartung und der Angst vor Zurückweisung korreliert. Die Mediationsanalysen zeigten keinen mediierenden Effekt von Erwartung und Angst vor Zurückweisung auf die Beziehung zwischen KM und dem Spielverhalten. Die Zurückweisungssensibilität war signifikant höher bei PatientInnen mit BPS beziehungsweise PDS im Vergleich zu GK_{BPD} beziehungsweise GK_{PDS} ausgeprägt. Unter den Patientengruppen, zeigten PatientInnen mit BPS signifikant höhere Werte für die Zurückweisungssensibilität. Während KM und alle Subtypen bei PatientInnen mit BPS im Vergleich zu GK_{BPS} signifikant höher ausgeprägt waren, zeigten PatientInnen mit PDS im Vergleich zu GK_{PDS} signifikant höhere Werte für KM insgesamt sowie für emotionale und körperliche Vernachlässigung und emotionalen Missbrauch. Außerdem berichteten Patienten mit BPS im Vergleich zu PatientInnen mit PDS signifikant häufiger über körperliche Misshandlung und Vernachlässigung.

Die Ergebnisse der *Studie III* zeigten in der Stichprobe mit PatientInnen mit BPS und PDS eine signifikante Korrelation zwischen negativen Erfahrungen in der Jugend und im

Erwachsenenalter und weniger Ballwürfen zum Exkluder, also weniger prosozialem Verhalten. In der GK waren positive Erfahrungen in der Jugend mit mehr Ballwürfen zum Exkluder, d. h. mehr prosozialem Verhalten, verbunden. Überraschenderweise waren in der Patientenstichprobe weder negative noch positive Erfahrungen mit Resilienz assoziiert. In der GK waren positive Erfahrungen insgesamt und im Erwachsenenalter signifikant mit mehr Resilienz korreliert. Resilienz mediierte den Effekt von positiven oder negativen Lebenserfahrungen auf das Spielverhalten nicht. PatientInnen mit BPS beziehungsweise PDS berichteten signifikant häufiger über negative und signifikant seltener über positive Erfahrungen in der Kindheit, Jugend und im Erwachsenenalter sowie über eine geringere Resilienz als GK_{BPS} beziehungsweise GK_{PDS}. Darüber hinaus berichteten Patienten mit BPS im Vergleich zu Patienten mit PDS sowohl über signifikant mehr negative Erfahrungen insgesamt sowie in der Kindheit und Jugend als auch über geringe Resilienz, wobei diese Unterschiede nach einer Korrektur aufgrund multipler Testung nicht mehr signifikant waren.

Das Ziel dieser Dissertation war es das Verhalten in einer sozialen Ausschlusssituation bei PatientInnen mit BPS und PDS im Vergleich zu einer GK zu analysieren. Ferner sollte der Zusammenhang von vorherigen interpersonellen Erfahrungen und diesem Verhalten analysiert werden und mögliche mediierende Effekte von Zurückweisungssensibilität und Resilienz auf diese Beziehung untersucht werden. Die Ergebnisse weißen auf ein weniger stark ausgeprägtes prosoziales Verhalten gegenüber dem Exkluder in der Patientengruppe im Vergleich zu GK hin. KM und vor allem emotionale Vernachlässigung, negative Erlebnisse im Jugend und Erwachsenenalter waren mit signifikant weniger prosozialem Verhalten gegenüber dem Exkluder assoziiert und Zurückweisungssensibilität und Resilienz mediierten diesen Zusammenhang nicht. Die Ergebnisse dieser Dissertation leisten einen wichtigen Beitrag zu einem besseren Verständnis der Unterschiede auf Verhaltensebene in PatientInnen mit BPS und PDS im Vergleich zu GK, die möglicherweise interpersonelle Probleme hervorrufen und aufrechterhalten. Schließlich zeigen die Ergebnisse dieser Dissertation, dass insbesondere emotionale Vernachlässigung und interpersonelle Erlebnisse in der Jugend und im Erwachsenenalter einen so starken Einfluss auf unser soziales Verhalten haben, dass sich dies sogar in einer experimentellen Ausschlusssituation zeigt.

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Appendix A: Supplementary Material Study I

Table A1

Comorbidities in Patients with Borderline Personality Disorder and Persistent Depressive Disorder

Comorbidities	BPD (*n*=36)		PDD (*n*=34)	
	n	%	*n*	%
MDE, current	17	47.2	16	47.1
MDE, lifetime	29	80.6	32	94.1
PDD (DSM 5)	14	38.9	34	100
PDD with persistent major depressive episode	3	21.4	11	32.4
PDD with pure dysthymic syndrome	1	7.1	1	2.9
PDD with intermittent major depressive episodes, with current episode	5	35.7	6	17.6
PDD with intermittent major depressive episodes, without current episode	5	35.7	16	47.1
Bipolar I or II disorder	1	2.8	0	0
Any psychotic disorder	7	19.4	0	0
Any substance use disorder	16	44.4	7	20.6
Any anxiety disorder (except PTSD)	22	61.1	12	35.3
PTSD	15	41.7	5	14.7
Any somatoform disorder	2	5.5	2	5.9
Any eating disorder	8	22.2	4	11.8
Any cluster-A PD	9	25.0	0	0
Any other cluster-B PD (except BPD)	1	2.8	0	0
BPD	36	100	0	0
Fear of abandoment.	23	63.9	0	0
Intense and unstable interpersonal relationships	25	69.4	0	0
Identity disturbance	20	55.6	0	0
Impulsivity	26	72.2	2	
Suicidal behavior and self-harm	32	94.1	2	94.3
Affective instability	33	91.7	11	6.1
Chronic feelings of emptiness	31	86.1		33.3

Comorbidities	BPD (*n*=36)		PDD (*n*=34)	
Explosive Anger	25	69.4	1	1.4
Disassociative symptoms or paranoid thoughts	24	66.7	3	11.1
Any cluster-C PD	14	38.9	15	44.1
Without psychotropic medication	7	19.4	7	20.6
Antipsychotics	16	44.4	12	35.3
Antidepressants	19	52.8	15	44.1
Lithium	0	0	5	14.7
Amphetamine	7	19.4	8	23.5
Anticonvulsiva	5	13.9	7	20.6

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, PD = personality disorder

Table A2

Mixed Analysis of Variance for Inner Tension

	Mixed ANOVA						
				Interactions			
	Condition	Group	Time	Condition*Time	Group*Time	Condition*Group	Condition*Time*Group
Inner tension	$F(1,132)=9.48$, $\eta_p^2=.07$, ***p*=.003**	$F(3,132)=32.91$, $\eta_p^2=.43$, ***p*<.001**	$F(1,132)=1.77$, $\eta_p^2=.01$, $p=.186$	$F(1,132)=1.39$, $\eta_p^2=.01$, $p=.241$	$F(3,132)=0.11$, $\eta_p^2=.00$, $p=.953$	$F(2,132)=1.66$, $\eta_p^2=.04$, $p=.179$	$F(3,132)=0.46$, $\eta_p^2=.01$, $p=.708$

Note. Group = BPD, PDD, $HC_{BPD,}$ $HC_{PDD,}$ BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients, Condition = experimental vs. control condition; Group: patients with borderline personality disorder, patients with persistent depressive disorder and age and gender matched healthy controls, Time = before and after the Cyberball paradigm, $\alpha = .05$; significant results are in bold face

Specific Note. Inner tension was assessed on a scale ranging from 0 to 100 % (no to very high inner tension) before and after Cyberball. Inner tension was higher in BPD and PDD patients compared to the matched HC groups in both conditions, all *p*s < .001, group: $F(3,132) = 32.91$, $\eta^2 = .43$, $p < .001$. Changes in tension from before to after the game were nonsignificant and similar between groups, Condition x Time x Group: $F(3, 132) = 0.46$, $\eta_p^2 = .01$, $p = .71$, except that PDD patients experienced a significant decrease after the game in the control condition, $p_{FDR} = .001$.

Table A3

Means, Standard Deviations, and One-Way Analyses of Variance for Inner Tension

	BPD (*n*=36)				PDD (*n*=34)				HC_{BPD} (*n*=36)				HC_{PDD} (*n*=34)							
	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	One-Way ANOVA (pre)	p_{FDR}	One-Way ANOVA (delta)	p_{FDR}
Experimental Condition																				
Inner tension *M*(SD)	49.79 (21.34)	48.68 (27.31)	*t*(33)=0.32, *p*=.753	.753	44.76 (25.19)	39.72 (26.17)	t(32)=1.34, *p*=.189	.189	15.00 (21.80)	12.89 (16.87)	*t*(35)=1.34, *p*=.189	.231	14.73 (19.34)	14.85 (17.36)	t(33)=-0.07, *p*=.947	.947	*F*(3,133)=25.13, ***p*< .001**[a]	**<.001**	*F*(3,133)=0.59, *p*=.620[+]	.620
Control Condition																				
Inner tension *M*(SD)	49.00 (21.42)	48.00 (25.15)	*t*(34)=0.41, *p*=.685	.753	44.00 (21.84)	35.51 (19.91)	t(32)=3.60, ***p*=.001**	**.001**	12.86 (15.72)	10.50 (17.00)	*t*(35)=1.22, *p*=.231	.231	16.03 (17.26)	11.76 (17.56)	t(33)=1.85, *p*=.074	.148	*F*(3,134)=32.86, ***p*< .001**[b]	**<.001**	*F*(3,134)=2.05, *p*=.103	.206

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; FDR = false discovery rate; post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; α = .05, significant results are indicated in bold face

Specific Note [a] BPD vs. HC_{BPD}: p<.001, BPD vs. HC_{PDD}: p<.001, PDD vs. HC_{PDD}: p<.001, PDD vs. HC_{BPD}: p<.001, BPD vs. PDD: p=.706 HC_{BPD} vs. HC_{PDD}: p=.901. [b] BPD vs. HC_{BPD}: p<.001, BPD vs. HC_{PDD}: p<.001, PDD vs. HC_{PDD}: p<.001, PDD vs. HC_{BPD}: p<.001, BPD vs. PDD: p=.78, HC_{BPD} vs. HC_{PDD}: p=1.000

Table A4

Means, Standard Deviations, One-Way Analyses of Variance, and Mixed Analysis of Variance for the Behavioral Intention List

	BPD (n =36)				PDD (n =34)				HC_{BPD} (n=36)				HC_{PDD} (n =34)								mixed ANOVA		
Behavioral Inentions	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	ANOVA EC	p_{FDR}	ANOVA CC	p_{FDR}	Condition	Group	Interactions
Pleseant activities M(SD)	0.19 (0.24)	0.27 (0.30)	t(34)=1.87, p=.070	.122	0.33 (0.32)	0.49 (0.35)	t(33)=3.12, ***p*=.004**	**.010**	0.54 (0.32)	0.58 (0.31)	t(35)=1.43, p=.160	.366	0.46 (0.31)	0.54 (0.30)	t(32)=2.07, ***p*=.046**	.092	F(3,136)=9.82, ***p*<.001**[a]	**.001**	F(3,134)=6.76, ***p*< .001**[f]	**<.001**	F(1,134)=19.42, η_p^2=.13, ***p*< .001**	F(2,134)=9.04, η_p^2=.17, ***p*< .001**	F(3,134)=1.35, η_p^2=.03 , p=.260
Verbalizing M(SD)	0.19 (0.24)	0.03 (0.12)	t(34)=-2.85, ***p*=.007**	**.049**	0.21 (0.28)	0.03 (0.12)	t(33)=-3.78, ***p*=.001**	**.005**	0.11 (0.27)	0.01 (0.08)	t(35)= -2.22, ***p*=.033**	.198	0.15 (0.26)	0.00 (0.00)	t(32)=-3.29, ***p*=.002**	**.012**	F(3,76)=0.94, p=.425[+]	.425	F(3,134)=0.74, p=.530	.561	F(1,134)=35,51, η_p^2=.21, ***p*< .001**	F(3,134)=1.24, η_p^2=.03, p=.297	F(3,134)=0,62, η_p^2=.01, p=.604
Selfharming M(SD)	0.17 (0.28)	0.13 (0.22)	t(34)=-1.03, p=.310	.310	0.00 (0.00)	0.00 (0.00)	-		0.02 (0.07)	0.02 (0.09)	t(35)=0.00, p=1.000	1.000	0.01 (0.04)	0.00 (0.00)	t(32)= -1.00, p=.325	.390	F(3,136)=10.14, ***p*<.001**[b+]	**<.001**	F(3,134)=8.95, ***p*<.001**[1,g+]	**<.001**	F(1,134)=1.31, η_p^2=.01, p=.255	F(3,134)=12.50, η_p^2=.22, ***p*<.001**	F(3,134)=0.85, η_p^2=.02, p=.456
Escape M(SD)	0.32 (0.39)	0.21 (0.32)	t(34)=-1.71, p=.097	.136	0.18 (0.26)	0.10 (0.19)	t(33)=-1.85, p=.073	.122	0.01 (0.06)	0.01 (0.06)	-		0.01 (0.06)	0.00 (0.00)	t(32)=-1.00, p=.325	.390	F(3,69)=11.95, ***p*<.001**[c+]	**<.001**	F(3,134)=9.00, ***p*<.001**[1,h+]	**<.001**	F(1,134)=6.38, η_p^2=.04, ***p*=.013**	F(3,134)=16.166, η_p^2=.27, ***p*<.001**	F(3,134)=1.89, η_p^2=.04, p=.135
Aggression M(SD)	0.12 (0.24)	0.04 (0.11)	t(34)=-2.05, p=.048	.119	0.00 (0.00)	0.00 (0.00)	-		0.01 (0.06)	0.00 (0.00)	t(35)=-1.00, p=.324	.486	0.00 (0.00)	0.00 (0.00)	-		F(3,136)=7.81, ***p*<.001**[d+]	**<.001**	F(3,134)=4.30, ***p*=.006**[1,i+]	**.008**	F(1,134)=4.77, η_p^2=.03, ***p*=.031**	F(3,134)=10.31, η_p^2=.19, ***p*<.001**	F(3,134)=3.67, η_p^2=.08, ***p*=.014**
Passivity M(SD)	0.41 (0.31)	0.51 (0.35)	t(34)=2.03, p=.051	.119	0.37 (0.28)	0.32 (0.24)	t(33)= -0.90, p=.374	.467	0.15 (0.26)	0.19 (0.27)	t(35)=1.36, p=.183	.366	0.20 (0.25)	0.12 (0.22)	t(32)=-2.39, ***p*=.023**	.069	F(3,136)=7.16, ***p*< .001**[e]	**<.001**	F(3,134)=13.25, ***p*< .001**[j]	**<.001**	F(1,134)=0.07, η_p^2=.00, p=.792	F(3,134)=11.87, η_p^2=.21, ***p*<.001**	F(3,134)=3.77, η_p^2=.08, ***p*=.012**
Addressing M(SD)	0.14 (0.26)	0.21 (0.28)	t(34)=1.41, p=.169	.197	0.26 (0.28)	0.25 (0.25)	t(33)=-0.37, p=.711	.711	0.29 (0.25)	0.29 (0.25)	t(35)=0.00, p=1.000	1.000	0.27 (0.25)	0.29 (0.25)	t(32)= 0.37 p=.712	.712	F(3,136)=2.48, p=.063	.073	F(3,134)=0.69, p=.561	.561	F(1,134)=0.62, η_p^2=.00, p=.431	F(3,134)=1.83, η_p^2=.04 p=.145	F(3,134)=0.69, η_p^2=.01, p=.558

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients, EC = experimental condition, CC = control condition, FDR = false discovery rate; Condition: experimental vs. control condition; Group: BPD, PDD, HC_{BPD}, HC_{PDD}, post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; α = .05, significant results are indicated in bold face

Specific Note. [a] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p = .001, PDD vs. HC_{PDD}: p = .222, PDD vs. HC_{BPD}: p = .020, HC_{BPD} vs. HC_{PDD}: p = .753, BPD vs. PDD: p = .191 [b] BPD vs. HC_{BPD}: p = .022, BPD vs. HC_{PDD}: p = .009, PDD vs. HC_{PDD}: p = .750, PDD vs. HC_{BPD}: p = .298, HC_{BPD} vs. HC_{PDD}: p = .763, BPD vs. PDD: p = .006 [c] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = .005, PDD vs. HC_{BPD}: p = .005,

HC_{BPD} vs. HC_{PDD}: p = 1.000, BPD vs. PDD: p = .247 [d] BPD vs. HC_{BPD}: p = .001, BPD vs. HC_{PDD}: p = .001, PDD vs. HC_{PDD}: p = 1.000, PDD vs. HC_{BPD}: p = .990, HC_{BPD} vs. HC_{PDD}: p = .990, BPD vs. PDD: p = .001 [e] BPD vs. HC_{BPD}: p = .001, BPD vs. HC_{PDD}: p = .010, PDD vs. HC_{PDD}: p = .048, PDD vs. HC_{BPD}: p = .008, HC_{BPD} vs. HC_{PDD}: p = .938, BPD vs. PDD: p = .952 [f] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p = .003, PDD vs. HC_{PDD}: p = .865, PDD vs. HC_{BPD}: p = .569, HC_{BPD} vs. HC_{PDD}: p = .960, BPD vs. PDD: p = .029 [g] BPD vs. HC_{BPD}: p = .002, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = 1.000, PDD vs. HC_{BPD}: p = .889, HC_{BPD} vs. HC_{PDD}: p = .892, BPD vs. PDD: p < .001 [h] BPD vs. HC_{BPD}: p = .005, BPD vs. HC_{PDD}: p = .003, PDD vs. HC_{PDD}: p = .027, PDD vs. HC_{BPD}: p = .063, HC_{BPD} vs. HC_{PDD}: p = .750, BPD vs. PDD: p = .313 [i] BPD vs. HC_{BPD}: p = .019, BPD vs. HC_{PDD}: p = .023, PDD vs. HC_{PDD}: p = 1.000, PDD vs. HC_{BPD}: p = 1.000, HC_{BPD} vs. HC_{PDD}: p = 1.000, BPD vs. PDD: p = .021 [j] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = .018, PDD vs. HC_{BPD}: p = .215, HC_{BPD} vs. HC_{PDD}: p = .694, BPD vs. PDD: p = .026

The Behavioral Intention List (BIL, Staebler, 2008) consists of 21 behaviors, which can be assigned to Pleasant Activities, Aggression Against Others, Addressing the Investigator, Verbalize Exclusion, Selfharming, Escape, and Passivity.

In both conditions at the end of the game, BPD patients showed more intentions to selfharm, to engage in aggressive and passive behavior, to escape, and less to engage in pleasant activities as well as to address the investigator compared to HC_{BPD}, all ps < .02, while PDD patients reported more intentions for passivity and to escape compared to HC_{PDD}, all ps < .05. Only intentions towards verbalize exclusion increased after the experimental compared to the control condition in all groups similarly except in HC_{BPD}, condition: $F(1, 134) = 35.51$, $p < .001$, $\eta_p^2 = .21$; BPD p_{FDR}= .049, PDD:, p_{FDR} = .005, $HC_{BPD:}$ p_{FDR} = .198, HC_{PDD}: p_{FDR} = .012. Additionally, PDD patients reported fewer intentions to do pleasant activities after the experimental compared to control condition, p_{FDR}=.010. In both conditions, BPD patients were more aggressive and showed more selfharming intentions compared to PDD patients (all ps <. 021); after the control condition they additionally had more intentions towards passivity and to engage less in pleasant activities (both ps < .029).

Staebler, K., 2008. Reactions to social exclusion in borderline personality disorder: Emotional, facial, physiological and behavioral data. In K. Staebler (Ed.), Emotional responses in borderline personality disorder (pp. 48-90). Freie Universität Berlin.

Table A5

Means, Standard Deviations, Pairwise t-tests, One-Way Analyses of Variance, and Mixed Analysis of Variance for the Need Threat Scale and Subscales

NTS Subscales	BPD (n =36)				PDD (n =34)				HC_{BPD} (n=36)				HC_{PDD} (n =34)				ANOVA				mixed ANOVA		
	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	p_{FDR}	CC	p_{FDR}	Condition	Group	Interactions
Overall need fulfillment M(SD)	2.37 (0.74)	3.01 (0.64)	t(34)=4.29, ***p*<.001**	**<.001**	2.73 (0.84)	3.34 (0.62)	t(30)=6.12, ***p*<.001**	**<.001**	3.46 (0.62)	3.81 (0.42)	t(35)=3.48, ***p*=.001**	**.002**	3.04 (0.58)	3.70 (0.59)	t(32)=5.74, ***p*<.001**	**<.001**	F(3,74)=16.82, ***p*<.001**[a+]	**<.001**	F(3,132)=13.68, ***p*< .001**[p]	**<.001**	F(1,131)=90.37, η_p^2=.41, ***p*< .001**	F(3,131)=20.29, η_p^2=.32, ***p*< .001**	F(3,131)=1.59, η_p^2=.03, p=.195
Belonging M(SD)	2.58 (1.02)	3.69 (0.93)	t(34)=4.94, ***p*<.001**	**<.001**	3.09 (1.16)	4.10 (0.74)	t(33)=6.35, ***p*<.001**	**<.001**	3.71 (0.80)	4.43 (0.65)	t(35)=4.82, ***p*<.001**	**<.001**	3.22 (0.98)	4.20 (0.99)	t(33)=4.98, ***p*<.001**	**<.001**	F(3,136)=8.29, ***p*<.001**[b]	**<.001**	F(3,135)=4.81, ***p*=.003**[q]	**.005**	F(1,135)=107.05, η_p^2=.44, ***p*< .001**	F(3,135)=9.49, η_p^2=.17, ***p*< .001**	F(3,135)=0.85, η_p^2=.02, p=.467
Self-esteem M(SD)	2.01 (0.83)	2.37 (0.88)	t(34)=2.14, ***p*=.039**	**.042**	2.26 (0.99)	2.91 (0.98)	t(31)=4.50, ***p*<.001**	**<.001**	3.60 (0.75)	3.89 (0.65)	t(35)=2.43, ***p*=.020**	**.030**	2.99 (0.72)	3.70 (0.85)	t(33)=4.10, ***p*<.001**	**<.001**	F(3,135)=27.41, ***p*<.001**[c]	**<.001**	F(3,134)=23.74, ***p*<.001**[r]	**<.001**	F(1,133)=43.26, η_p^2=.24, ***p*< .001**	F(3,133)=35.02, η_p^2=.44, ***p*< .001**	F(3,133)=1.86, η_p^2=.04, p=.139
Control M(SD)	1.50 (0.76)	1.90 (0.82)	t(34)=2.66, ***p*=.012**	**.015**	1.68 (0.57)	2.00 (0.71)	t(31)=2.87, ***p*=.007**	**.007**	2.07 (0.82)	2.19 (0.88)	t(35)=1.20, p=.239	.256	2.03 (0.72)	2.29 (0.79)	t(32)=2.22, ***p*=.034**	**.042**	F(3,135)=5.28, ***p*=.002**[d]	**.002**	F(3,133)=1.55 p=.203	.213	F(1,132)=29.46, η_p^2=.13, ***p*< .001**	F(3,132)=3.72, η_p^2=.08, ***p*=.013**	F(3,132)=0.98, η_p^2=.02, p=.406
Meaningful existence M(SD)	3.40 (1.15)	4.09 (0.85)	t(34)=3.29, ***p*=.002**	**.003**	3.70 (1.34)	4.34 (1.01)	t(32)=3.14, ***p*=.004**	**.005**	4.45 (0.87)	4.72 (0.69)	t(35)=1.88, p=.069	.080	3.99 (0.97)	4.67 (0.71)	t(33)=4.10, ***p*<.001**	**<.001**	F(3,75)=7.21, ***p*<.001**[e+]	**<.001**	F(3,74)=4.78, ***p*=.004**[s+]	**.005**	F(1,134)=39.23, η_p^2=.23, ***p*< .001**	F(3,134)=7,25, η_p^2=.14, ***p*<.001**	F(3,134)=1.26, η_p^2=.03, p=.291
Ostracism intensity M(SD)	6.48 (2.06)	3.70 (1.74)	t(32)=-6.14, ***p*<.001**	**<.001**	5.36 (2.45)	3.12 (1.63)	t(32)=-6.25, ***p*<.001**	**<.001**	4.19 (1.95)	2.58 (1.46)	t(35)=-4.43, ***p*<.001**	**<.001**	5.79 (2.11)	2.94 (1.86)	t(33)=-7.46, ***p*<.001**	**<.001**	F(3,134)=6.55, ***p*<.001**[f]	**<.001**	F(3,134)=2.45, p=.067	.078	F(1,132)=147.59, η_p^2=.53, ***p*< .001**	F(3,132)=6.97, η_p^2=.14, ***p*< .001**	F(3,132)=2.25, η_p^2=.05, p=.086
Ball tosses (%)	18.09 (7.65)	29.20 (7.04)	t(34)=7.80, ***p*<.001**	**<.001**	21.29 (8.21)	32.94 (8.29)	t(32)=9.77, ***p*<.001**	**<.001**	23.26 (6.47)	30.96 (6.86)	t(35)=5.14, ***p*<.001**	**<.001**	19.50 (6.57)	30.65 (6.85)	t(33)=8.58, ***p*<.001**	**<.001**	F(3,136)=3.16, ***p*=.027**[g]	**.027**	F(3,134)=1.52, p=.213	.213	F(1,134)=231.59, η_p^2=.63, ***p*< .001**	F(3,134)=2.72, η_p^2=.06, ***p*=.047**	F(3,134)=1.82, η_p^2=.04, p=.146
During the game I felt ….																							
Good M(SD)	2.00 (0.90)	2.52 (1.00)	t(32)=2.58, ***p*=.015**	**.017**	2.56 (1.05)	3.15 (0.99)	t(33)=3.58, ***p*=.001**	**.001**	3.94 (0.89)	4.22 (0.76)	t(35)=2.14, ***p*=.039**	**.049**	3.39 (0.97)	3.88 (1.02)	t(32)=2.69, ***p*=.011**	**.015**	F(3,136)=29.29, ***p*<.001**[h]	**<.001**	F(3,132)=22.14, ***p*<.001**[t]	**<.001**	F(1,132)=30.50, η_p^2=.19, ***p*<.001**	F(3,132)=34.15, η_p^2=.44, ***p*<.001**	F(3,132)=0.64, η_p^2=.01, p=.588
Bad M(SD)	2.94 (1.00)	2.14 (1.11)	t(34)=-3.57, ***p*=.001**	**.002**	2.50 (1.31)	1.68 (0.94)	t(33)=-3.79, ***p*=.001**	**.001**	1.56 (0.77)	1.22 (0.54)	t(35)=-2.65, ***p*=.012**	**.020**	1.79 (1.04)	1.38 (0.85)	t(33)=-1.91, p=.065	.065	F(3,74)=16.81, ***p*<.001**[i+]	**<.001**	F(3,72)=7.21, ***p*<.001**[u+]	**<.001**	F(1,135)=35.59, η_p^2=.21, ***p*<.001**	F(3,135)=15.92, η_p^2=.26, ***p*<.001**	F(3,135)=1.67, η_p^2=.04, p=.177
Friendly M(SD)	2.20 (1.26)	3.26 (0.98)	t(34)=3.54, ***p*=.001**	**.002**	2.03 (1.00)	3.62 (0.85)	t(33)=6.09, ***p*<.001**	**<.001**	1.47 (0.88)	4.19 (0.86)	t(35)=12.15, ***p*<.001**	**<.001**	1.76 (1.07)	3.79 (0.91)	t(33)=7.29, ***p*<.001**	**<.001**	F(3,136)=14.97, ***p*<.001**[j]	**<.001**	F(3,135)=6.61, ***p*<.001**[v]	**<.001**	F(1,135)=18.66, η_p^2=.12, ***p*<.001**	F(3,135)=14.59, η_p^2=.24, ***p*<.001**	F(3,135)=3.09, η_p^2=.06, ***p*=.029**
Unfriendly M(SD)	2.20 (1.26)	1.69 (0.80)	t(34)=-2.78, ***p*=.009**	**.012**	2.03 (1.01)	1.61 (0.97)	t(32)=-1.91, p=.065	.065	1.47 (0.88)	1.17 (0.45)	t(35)=-2.23, ***p*=.032**	**.044**	1.76 (1.07)	1.38 (0.65)	t(33)=-2.13, ***p*=.040**	**.046**	F(3,75)=3.25, ***p*=.026**[k+]	**.005**	F(3,71)=4.79, ***p*=.004**[w+]	**.027**	F(1,134)=20.03, η_p^2=.13, ***p*<.001**	F(3,134)=4.87, η_p^2=.10, ***p*=.003**	F(3,134)=0.23, η_p^2=.00, p=.872
Angry M(SD)	2.91 (1.20)	1.97 (1.04)	t(34)=-4.43, ***p*<.001**	**<.001**	2.26 (1.16)	1.62 (0.98)	t(33)=-3.85, ***p*=.001**	**.001**	1.42 (0.84)	1.06 (0.23)	t(35)=-2.71, ***p*=.010**	**.019**	2.00 (0.89)	1.32 (0.68)	t(33)=-3.70, ***p*=.001**	**.001**	F(3,136)=13.51, ***p*<.001**[l]	**<.001**	F(3,62)=12.22, ***p*<.001**[x+]	**<.001**	F(1,135)=55.66, η_p^2=.29, ***p*<.001**	F(3,135)=15.52, η_p^2=.26, ***p*<.001**	F(3,135)=1.86, η_p^2=.04, p=.138
Sad M(SD)	2.71 (1.27)	2.09 (1.12)	t(34)=10.89, ***p*<.001**	**<.001**	2.44 (1.40)	1.74 (0.99)	t(33)=10.18, ***p*<.001**	**<.001**	1.19 (0.47)	1.11 (0.32)	t(35)=20.92, ***p*<.001**	**<.001**	1.35 (0.60)	1.12 (0.41)	t(33)=15.92, ***p*<.001**	**<.001**	F(3,71)=21.66, ***p*<.001**[m+]	**<.001**	F(3,69)=11.72, ***p*<.001**[y+]	**<.001**	F(1,135)=24.62, η_p^2=.15, ***p*<.001**	F(3,135)=22.94, η_p^2=.34, ***p*<.001**	F(3,135)=3.30, η_p^2=.07, ***p*=.023**

NTS Subscales	BPD (n =36)				PDD (n =34)				HC_{BPD} (n=36)				HC_{PDD} (n =34)				ANOVA				mixed ANOVA		
	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	CC	Pairwise t-test	p_{FDR}	EC	p_{FDR}	CC	p_{FDR}	Condition	Group	Interactions
Stressed M(SD)	3.23 (1.28)	3.09 (1.29)	t(34)=11.41, ***p*<.001**	**<.001**	2.52 (1.33)	2.27 (1.04)	t(32)=8.12, ***p*=.001**	**.001**	1.36 (0.80)	1.33 (0.72)	t(35)=4.64, ***p*<.001**	**<.001**	1.71 (1.00)	1.32 (0.53)	t(33)=5.14, ***p*<.001**	**<.001**	F(3,74)=21.35, ***p*<.001**[n+]	**<.001**	F(3,72)=24.27, ***p*<.001**[z+]	**<.001**	F(1,134)=4.76, η_L^2=.03, ***p*=.031**	F(3,134)=31.51, η_p^2=.41, ***p*<.001**	F(3,134)=0.69, η_p^2=.01, p=.560
Relaxed M(SD)	1.86 (1.17)	1.97 (1.12)	t(34)=0.63, p=.535	.535	2.27 (1.11)	2.76 (1.12)	t(32)=3.34, ***p*=.002**	**.002**	3.97 (1.03)	4.14 (0.99)	t(35)=1.03, p=.310	.310	3.56 (1.21)	4.00 (1.01)	t(33)=2.08, ***p*=.045**	**.048**	F(3,136)=28.28, ***p*<.001**[o]	**<.001**	F(3,134)=33.26, ***p*<.001**[aa]	**<.001**	F(1,134)=11.59, η_L^2=.08, ***p*=.001**	F(3,134)=39.11, η_p^2=.47, ***p*<.001**	F(3,134)=1.12, η_p^2=.02, p=.342

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients, EC = experimental condition, CC = control condition, FDR = false discovery rate; Condition: experimental vs. control condition; Group: BPD, PDD, HC_{BPD}, HC_{PDD}, post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; α = .05, significant results are indicated in bold face

Specific Note. [a] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = .200, PDD vs. HC_{BPD}: p = .001, BPD vs. PDD: p = .200, HC_{BPD} vs. HC_{PDD}: p = .034, [b] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p = .026, PDD vs. HC_{PDD}: p = .942, PDD vs. HC_{BPD}: p = .048, BPD vs. PDD: p = .111, HC_{BPD} vs. HC_{PDD}: p = .179, [c] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = .003, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .543, HC_{BPD} vs. HC_{PDD}: p = .012, [d] BPD vs. HC_{BPD}: p = .007, BPD vs. HC_{PDD}: p = .014, PDD vs. HC_{PDD}: p = .139, PDD vs. HC_{BPD}: p = .084, BPD vs. PDD: p = .833, HC_{BPD} vs. HC_{PDD}: p = .997, [e] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p = .089, PDD vs. HC_{PDD}: p = .701, PDD vs. HC_{BPD}: p = .030, BPD vs. PDD: p = .746, HC_{BPD} vs. HC_{PDD}: p = .163, [f] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p = .653, PDD vs. HC_{PDD}: p = .849, PDD vs. HC_{BPD}: p = .119, BPD vs. PDD: p = .205, HC_{BPD} vs. HC_{PDD}: p = .013 [g] BPD vs. HC_{BPD}: p = .024, BPD vs. HC_{PDD}: p = .913, PDD vs. HC_{PDD}: p = .703, PDD vs. HC_{BPD}: p = .704, BPD vs. PDD: p = .301, HC_{BPD} vs. HC_{PDD}: p = .136 [h] BPD vs. HC_{BPD}: p < .001, BPD vs HC_{PDD}: p < .001, PDD vs HC_{PDD}: p = .002, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .092, HC_{BPD} vs. HC_{PDD}: p = .226 [i] BPD vs. HC_{BPD}: p < .001, BPD vs HC_{PDD}: p < .001, PDD vs HC_{PDD}: p = .076, PDD vs. HC_{BPD}: p = .003, BPD vs. PDD: p = .338, HC_{BPD} vs. HC_{PDD}: p = .699 [j] BPD vs. HC_{BPD}: p < .001, BPD vs HC_{PDD}: p < .001, PDD vs HC_{PDD}: p = .057, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .377, HC_{BPD} vs. HC_{PDD}: p = .228 [k] BPD vs. HC_{BPD}: p = .041, BPD vs HC_{PDD}: p = .478, PDD vs HC_{PDD}: p = .720, PDD vs. HC_{BPD}: p = .074, BPD vs. PDD: p = .957, HC_{BPD} vs. HC_{PDD}:

$p = .602$ [l] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p = .001$, PDD vs HC_{PDD}: $p = .717$, PDD vs. HC_{BPD}: $p = .004$, BPD vs. PDD: $p = .034$, HC_{BPD} vs. HC_{PDD}: $p = .090$ [m] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p = .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .770$, HC_{BPD} vs. HC_{PDD}: $p = .609$ [n] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p = .019$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .197$, HC_{BPD} vs. HC_{PDD}: $p = .393$ [o] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .575$, HC_{BPD} vs. HC_{PDD}: $p = .421$ [p] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p = .093$, PDD vs. HC_{BPD}: $p = .011$, BPD vs. PDD: $p = .060$, HC_{BPD} vs. HC_{PDD}: $p = .870$, [q] BPD vs. HC_{BPD}: $p = .002$, BPD vs. HC_{PDD}: $p = .060$, PDD vs. HC_{PDD}: $p = .963$, PDD vs. HC_{BPD}: $p = .363$, BPD vs. PDD: $p = .178$, HC_{BPD} vs. HC_{PDD}: $p = .662$ [r] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p = .003$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .029$, HC_{BPD} vs. HC_{PDD}: $p = .778$, [s] BPD vs. HC_{BPD}: $p = .005$, BPD vs. HC_{PDD}: $p = .016$, PDD vs. HC_{PDD}: $p = .443$, PDD vs. HC_{BPD}: $p = .285$, BPD vs. PDD: $p = .673$, HC_{BPD} vs. HC_{PDD}: $p = .987$ [t] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p = .010$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .036$, HC_{BPD} vs. HC_{PDD}: $p = .437$ [u] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p = .012$, PDD vs HC_{PDD}: $p = .537$, PDD vs. HC_{BPD}: $p = .080$, BPD vs. PDD: $p = .248$, HC_{BPD} vs. HC_{PDD}: $p = .788$ [v] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p = .069$, PDD vs HC_{PDD}: $p = .851$, PDD vs. HC_{BPD}: $p = .042$, BPD vs. PDD: $p = .349$, HC_{BPD} vs. HC_{PDD}: $p = .252$ [w] BPD vs. HC_{BPD}: $p = .007$, BPD vs HC_{PDD}: $p = .315$, PDD vs HC_{PDD}: $p = .686$, PDD vs. HC_{BPD}: $p = .094$, BPD vs. PDD: $p = .983$, HC_{BPD} vs. HC_{PDD}: $p = .134$ [x] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p = .017$, PDD vs HC_{PDD}: $p = .486$, PDD vs. HC_{BPD}: $p = .013$, BPD vs. PDD: $p = .474$, HC_{BPD} vs. HC_{PDD}: $p = .149$ [y] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .028$, HC_{BPD} vs. HC_{PDD}: $p = 1.000$ [z] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .928$, HC_{BPD} vs. HC_{PDD}: $p = .982$ [aa] BPD vs. HC_{BPD}: $p < .001$, BPD vs HC_{PDD}: $p < .001$, PDD vs HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .015$, HC_{BPD} vs. HC_{PDD}: $p = .947$

After the game, the participants filled out the German version of the Need Threat Scale (NTS, Grzyb, 2005; Zadro et al., 2004), which consists of 12 items assessing the levels of need fulfillment during the game in retrospect (Overall Need Fulfillment, Belonging, Self-Esteem, Control, Meaningful Existence) on a Likert scale from 1 (not at all) to 5 (very much). Additionally, the NTS assesses eight mood items asking how participants

felt during the game in retrospect and has three items for manipulation check. The two items “I was excluded” and “I was ignored” were added up for ostracism intensity. The third item asks for estimation of perceived ball tosses.

Each group experienced less overall need fulfillment after experimental compared to after control condition, condition: $F(1,131) = 90.37$, $\eta_p^2 = .41$, $p < .001$, all $p_{FDRs} < .002$; this was also true for each subscale, all $p_{FDRs} < .042$, except in HC_{BPD} with no difference considering need for control and meaningful existence. BPD patients had a higher level of need threat on all subscales compared to HC_{BPD} after both conditions, all ps $< .007$, except for “control” in the control condition. In both conditions, PDD patients experienced more need threat than HC_{PDD} for self-esteem only, both ps $= .003$. BPD patients reported lower self-esteem, $p = .029$, in the control condition compared to PDD patients. HC_{PDD} showed significantly higher ostracism intensity, $p = .013$ and more need threat considering overall need fulfillment, $p = .034$, and self-esteem, $p = .012$ in the experimental condition compared to HC_{BPD}. In sum, all groups reported having experienced significantly lower pleasant feelings (good, friendly) and significantly higher negative feelings (angry, sad, stressed) during experimental compared to control condition retrospectively

Grzyb, K. R., 2005. Sozialer Ausschluss und automatisches Zielstreben [Social exclusion and automatic goal persuit]. Konstanz University.

Zadro, L., Williams, K. D., & Richardson, R., 2004. How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology*, *40*(4), 560-567. https://doi.org/https://doi.org/10.1016/j.jesp.2003.11.006

Table A6

Mixed Analysis of Variance for the Emotion Scale and Subscales

	Mixed ANOVA						
					Interactions		
Emotions	Condition	Group	Time	Condition*Time	Group*Time	Condition*Group	Condition*Time*Group
Positive emotions	$F(1,135)=2.05$, $\eta_p^2=.01$, $p=.154$	$F(3,135)=17.00$, $\eta_p^2=.27$, **$p<.001$**	$F(1,135)=9.05$, $\eta_p^2=.06$, **$p=.003$**	$F(1,135)=7.82$, $\eta_p^2=.05$, **$p=.006$**	$F(3,135)=1.21$, $\eta^2=.03$, $p=.307$	$F(3,135)=3.47$, $\eta_p^2=.07$, **$p=.018$**	$F(3,135)=1.35$, $\eta_p^2=.03$, $p=.260$
Self-focused negative emotions	$F(1,135)=10.25$, $\eta_p^2=.07$, **$p=.002$**	$F(3,135)=32.67$, $\eta_p^2=.42$, **$p<.001$**	$F(1,135)=0.61$, $\eta_p^2=.00$, $p=.435$	$F(1,135)=9.48$, $\eta^2=.07$, **$p=.003$**	$F(3,135)=1.41$, $\eta^2=.03$, $p=.243$	$F(3,135)=2.35$, $\eta_p^2=.05$, $p=.076$	$F(3,135)=0.88$, $\eta_p^2=.02$, $p=.452$
Other-focused negative emotions	$F(1,135)=21.74$, $\eta_p^2=.14$, **$p<.001$**	$F(3,135)=12.18$, $\eta_p^2=.21$, **$p<.001$**	$F(1,135)=68.46$, $\eta_p^2=.34$, **$p<.001$**	$F(1,135)=35.69$, $\eta_p^2=.21$, **$p<.001$**	$F(3,135)=2.13$, $\eta^2=.04$, $p=.100$	$F(3,135)=1.34$, $\eta^2=.03$, $p=.265$	$F(3,135)=1.85$, $\eta_p^2=.04$, $p=.141$
Anger	$F(1,135)=16.94$, $\eta_p^2=.11$, **$p<.001$**	$F(3,135)=13.91$, $\eta_p^2=.24$, **$p<.001$**	$F(1,135)=19.12$, $\eta_p^2=.12$, **$p<.001$**	$F(1,135)=16.52$, $\eta_p^2=.11$, **$p<.001$**	$F(3,135)=2.20$, $\eta_p^2=.05$, $p=.091$	$F(3,135)=1.35$, $\eta_p^2=.03$, $p=.262$	$F(3,135)=0.62$, $\eta_p^2=.01$, $p=.601$
Affection	$F(1,135)=12.09$, $\eta_p^2=.08$, **$p=.001$**	$F(3,135)=0.48$, $\eta_p^2=.01$, $p=.697$	$F(1,135)=2.60$ $\eta_p^2=.02$, $p=.109$	$F(1,135)=17.53$, $\eta_p^2=.01$, **$p<.001$**	$F(3,135)=1.36$, $\eta_p^2=.03$, $p=.258$	$F(3.135)=1.20$, $\eta_p^2=.03$, $p=.311$	$F(3,135)=.20$, $\eta_p^2=.00$, $p=.895$
Fear	$F(1,133)=2.57$, $\eta_p^2=.02$, $p=.111$	$F(3,133)=21.81$, $\eta_p^2=.33$, $p<$**$.001$**	$F(1,135)=54.84$, $\eta_p^2=.29$, **$p<.001$**	$F(3,135)=12.09$, $\eta_p^2=.00$, $p=.759$	$F(3,133)=12.69$, $\eta_p^2=.22$, **$p<.001$**	$F(3,133)=0.56$, $\eta_p^2=.01$, $p=.640$	$F(3,133)=2.27$, $\eta_p^2=.05$, $p=.083$
Sadness	$F(1,135)=8.02$, $\eta_p^2=.06$, **$p=.005$**	$F(3,135)=27.38$, $\eta_p^2=.38$, **$p<.001$**	$F(1,135)=0.00$, $\eta_p^2=.00$, $p=.947$	$F(1,135)=1.72$, $\eta_p^2=.01$, $p=.192$	$F(3,135)=1.15$, $\eta_p^2=.02$, $p=.332$	$F(3,135)=2.23$, $\eta_p^2=.05$, $p=.088$	$F(3,135)=0.18$, $\eta_p^2=.00$, $p=.908$
Contentment	$F(1,135)=18.70$, $\eta_p^2=.12$, **$p<.001$**	$F(3,135)=45.61$, $\eta_p^2=.50$, **$p<.001$**	$F(1,135)=2.05$, $\eta_p^2=.01$, $p=.155$	$F(1,135)=13.13$, $\eta_p^2=.09$, **$p<.001$**	$F(3,135)=2.70$, $\eta_p^2=.06$, **$p=.048$**	$F(3,135)=1.51$, $\eta_p^2=.03$, $p=.215$	$F(3,135)=1.91$, $\eta_p^2=04$, $p=.131$
Hurt	$F(1,135)=6.39$, $\eta_p^2=.04$, **$p=.013$**	$F(3,135)=16.34$, $\eta_p^2=.27$, **$p<.001$**	$F(1,135)=4.84$, $\eta_p^2=.03$, **$p=.030$**	$F(1,135)=24.55$, $\eta_p^2=.15$, **$p<.001$**	$F(3,135)=0.44$, $\eta_p^2=.01$, $p=.727$	$F(3,135)=0.51$, $\eta_p^2=.01$, $p=.677$	$F(3,135)=1.91$, $\eta_p^2=.04$, $p=.131$
Lonliness	$F(1,135)=5.57$, $\eta_p^2=.04$, **$p=.020$**	$F(3,135)=25.60$, $\eta_p^2=.36$, **$p<.001$**	$F(1,135)=6.54$, $\eta_p^2=.05$, **$p=.012$**	$F(1,135)=4.86$, $\eta_p^2=.03$, **$p=.029$**	$F(3,135)=2.10$, $\eta_p^2=.04$, $p=.104$	$F(3,135)=2.56$, $\eta_p^2=.05$, $p=.058$	$F(3,135)=0.13$, $\eta_p^2=.00$, $p=.941$
Resentment	$F(1,133)=12.60$, $\eta_p^2=.09$, **$p=.001$**	$F(3,133)=12.29$, $\eta_p^2=.22$, **$p<.001$**	$F(1,133)=17.62$, $\eta_p^2=.12$, **$p<.001$**	$F(1,133)=53.17$, $\eta_p^2=.29$, **$p<.001$**	$F(3,133)=0.60$, $\eta_p^2=.01$, $p=.615$	$F(3,133)=0.21$, $\eta_p^2=.00$, $p=.888$	$F(3,133)=2.71$, $\eta_p^2=.06$, **$p=.048$**
Amusement	$F(1,135)=10.99$, $\eta_p^2=.07$, **$p=.001$**	$F(3,135)=49.05$, $\eta_p^2=.52$, **$p<.001$**	$F(1,135)=8.28$, $\eta_p^2=.06$, **$p=.005$**	$F(1,135)=10.57$, $\eta_p^2=.07$, **$p=.001$**	$F(3,135)=4.15$, $\eta_p^2=.08$, **$p=.008$**	$F(3,135)=2.37$, $\eta_p^2=.05$, $p=.074$	$F(3,135)=0.63$, $\eta_p^2=.01$, $p=.595$
Contempt	$F(1,135)=14.34$, $\eta_p^2=.10$, **$p<.001$**	$F(3,135)=4.23$, $\eta_p^2=.09$, **$p=.007$**	$F(1,135)=5.54$, $\eta_p^2=.04$**, $p=.020$**	$F(1,135)=19.98$, $\eta_p^2=.13$, **$p<.001$**	$F(3,135)=0.82$, $\eta_p^2=.02$, $p=.484$	$F(3,135)=1.47$, $\eta_p^2=.03$, $p=.227$	$F(3,135)=2.79$, $\eta_p^2=.06$, **$p=.043$**
Surprise	$F(1,135)=0.16$, $\eta_p^2=.00$, $p=.687$	$F(3,135)=0.32$, $\eta_p^2=.01$, $p=.812$	$F(1,135)=6.87$, $\eta_p^2=.05$, **$p=.010$**	$F(1,135)=0.13$, $\eta_p^2=.00$, $p=.723$	$F(3,135)=3.99$, $\eta_p^2=.08$, **$p=.009$**	$F(3,135)=0.85$, $\eta_p^2=.02$, $p=.470$	$F(3,135)=1.34$, $\eta_p^2=.03$, $p=.264$
Despair	$F(1,135)=3.52$, $\eta_p^2=.02$, $p=.063$	$F(3,135)=15.41$, $\eta_p^2=.25$, **$p<.001$**	$F(1,135)=2.12$, $\eta_p^2=.01$, $p=.148$	$F(1,135)=0.29$, $\eta_p^2=.00$, $p=.589$	$F(3,135)=1.59$, $\eta_p^2=.03$, $p=.194$	$F(3,135)=2.33$, $\eta_p^2=.05$, $p=.077$	$F(3,135)=0.70$, $\eta_p^2=.00$, $p=.976$
Pride	$F(1,135)=2.92$, $\eta_p^2=.02$, $p=.090$	$F(3,135)=5.80$, $\eta_p^2=.11$, **$p=.001$**	$F(1,135)=4.05$, $\eta_p^2=.03$, **$p=.046$**	$F(1,135)=0.56$, $\eta_p^2=.00$, $p=.456$	$F(3,135)=1.61$, $\eta_p^2=.03$, $p=.189$	$F(3,135)=0.25$, $\eta_p^2=.00$, $p=.864$	$F(3,135)=0.82$, $\eta_p^2=.02$, $p=.483$
Boredom	$F(1,135)=1.85$, $\eta_p^2=.01$, $p=.177$	$F(3,135)=2.28$, $\eta_p^2=.05$, $p=.082$	$F(1,135)=85.51$, $\eta_p^2=.39$, **$p<.001$**	$F(1,135)=2.00$, $\eta_p^2=.01$, $p=.160$	$F(3,135)=1.87$, $\eta_p^2=.04$, $p=.137$	$F(3,135)=0.79$, $\eta_p^2=.02$, $p=.501$	$F(3,135)=0.51$, $\eta_p^2=.01$, $p=.674$
Shame	$F(1,135)=0.05$, $\eta_p^2=.00$, $p=.818$	$F(3,135)=9.68$, $\eta_p^2=.18$, **$p<.001$**	$F(1,135)=9.11$, $\eta_p^2=.06$, **$p=.003$**	$F(1,135)=4.10$, $\eta_p^2=.03$, **$p=.045$**	$F(3,135)=1.72$, $\eta_p^2=.04$, $p=.167$	$F(3,135)=0.54$, $\eta_p^2=.01$, $p=.655$	$F(3,135)=0.48$, $\eta_p^2=.01$, $p=.694$

Note. Group = BPD, PDD, $HC_{BPD,}$ $HC_{PDD,}$ BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients,

Condition = experimental vs. control condition; Group: patients with borderline personality disorder, patients with persistent depressive disorder and age and gender matched healthy controls, Time = before and after the Cyberball paradigm; $\alpha = .05$; significant results are in bold face

Table A7

Means, Standard Deviations, Pairwise t-tests, and One-Way Analyses of Variance for the Emotion Scale's Subscales

Emotions	BPD (*n*=36)				PDD (*n* =34)				HC_{BPD} (*n* =36)				HC_{PDD} (*n* =34)							
	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	One-Way ANOVA (pre)	p_{FDR}	One-Way ANOVA (delta)	p_{FDR}
Experimental Condition																				
Positive emotions *M*(SD)	2.34 (0.79)	2.18 (0.93)	*t*(35)=1.48, *p*=.147	.441	2.48 (0.87)	2.47 (0.95)	t(33)=0.08, *p*=.937	.937	3.72 (1.02)	3.67 (1.03)	*t*(35)=0.81, *p*=.421	.421	3.63 (1.19)	3.17 (1.10)	*t*(33)=3.86, ***p*=.001**	**.002**	*F*(3,136)=19.68, ***p*< .001**[a]	**<.001**	*F*(3,71)=3.29, ***p*=.026**[g+]	.092
Self-focused negative emotions *M*(SD)	2.72 (1.32)	2.83 (1.35)	*t*(35)=-0.76, *p*=.453	.545	2.37 (1.25)	2.42 (1.33)	t(33)=-0.33, *p*=.740	.888	1.11 (0.28)	1.16 (0.29)	*t*(35)=-1.18, *p*=.247	.358	1.13 (0.31)	1.25 (0.43)	*t*(33)=-2,32, ***p*=.027**	**.040**	*F*(3,70)=26.96**,** ***p*< .001**[b+]	**<.001**	*F*(3,70)=0.37, *p*=.774[+]	.774
Other-focused negative emotions *M*(SD)	1.96 (1.21)	2.89 (1.29)	*t*(35)=-5.11, ***p*<.001**	**<.001**	1.73 (0.99)	2.39 (1.09)	t(33)=-3.83, ***p*=.001**	**.006**	1.23 (0.36)	1.68 (0.79)	*t*(35)=-4.12, ***p*<.001**	**<.001**	1.29 (0.34)	1.97 (0.84)	*t*(33)=-5.36, ***p*<.001**	**<.001**	*F*(3,71)=6.08, ***p*=.001**[c+]	**<.001**	*F*(3,136)=1.69, *p*=.172	.206
Control Condition																				
Positive emotions *M*(SD)	2.34 (0.83)	2.52 (1.15)	*t*(34)=-1.24, *p*=.225	.450	2.60 (0.92)	2.82 (1.07)	t(33)=-1.45, *p*=.155	.310	3.73 (1.01)	3.64 (1.09)	*t*(35)=1.06, *p*=.298	.358	3.63 (1.23)	3.51 (1.27)	*t*(33)=-1.15, *p*=.260	.312	*F*(3,135)=17.24, ***p*<.001**[d]	**<.001**	*F*(3,73)=1.96, *p*=.127[+]	.190
Self-focused negative emotions *M*(SD)	2.46 (1.05)	2.34 (1.30)	*t*(34)=0.61, *p*=.545	.545	2.39 (1.14)	2.01 (0.89)	t(33)=3.24, ***p*=.003**	**.009**	1.15 (0.28)	1.08 (0.19)	*t*(35)=2.16, ***p*=.038**	.114	1.15 (0.38)	1.13 (0.35)	*t*(33)=0.64, *p*=.524	.524	*F*(3,68)=28.46**,** ***p*<.001**[e+]	**<.001**	*F*(3,69)=2.80, ***p*=.046**[h+]	.092
Other-focused negative emotions *M*(SD)	2.12 (1.22)	2.26 (1.16)	*t*(34)= -0.67, *p*=.508	.545	1.76 (0.70)	1.67 (0.53)	t(33)=0.90, *p*=.374	.561	1.31 (0.51)	1.44 (0.47)	*t*(35)= -1.72, *p*=.095	.190	1.24 (0.38)	1.53 (0.55)	*t*(33)=-4.14, ***p*<.001**	<.00 1	*F*(2,72)=9.27, ***p*<.001**[f+]	**<.001**	*F*(3,73)=3.04, ***p*=.034**[i+]	.092

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; FDR = false discovery rate; Condition: experimental vs. control condition; Group: BPD, PDD, HC_{BPD}, HC_{PDD}, post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; $\alpha = .05$, significant results are indicated in bold face

Specific note. [a] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .928$, HC_{BPD} vs. HC_{PDD}: $p = .982$, [b] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .665$, HC_{BPD} vs. HC_{PDD}: $p = .994$, [c] BPD vs. HC_{BPD}: $p = .006$, BPD vs. HC_{PDD}: $p = .012$, PDD vs. HC_{PDD}: $p = .082$, PDD vs. HC_{BPD}: $p = .040$, BPD vs. PDD: $p = .805$, HC_{BPD} vs. HC_{PDD}: $p = .901$, [d] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .714$, HC_{BPD} vs. HC_{PDD}: $p = .973$ [e] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: p

< .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .994, HC_{BPD} vs. HC_{PDD}: p = 1.000, [f] BPD vs. HC_{BPD}: p = .004, BPD vs. HC_{PDD}: p = .001, PDD vs. HC_{PDD}: p = .002, PDD vs. HC_{BPD}: p = .015, BPD vs. PDD: p = .449, HC_{BPD} vs. HC_{PDD}: p = .935,[g] BPD vs. HC_{BPD}: p = .810, BPD vs. HC_{PDD}: p = .260, PDD vs. HC_{PDD}: p = .096, PDD vs. HC_{BPD}: p = .995, BPD vs. PDD: p = .847, HC_{BPD} vs. HC_{PDD}: p = .018,[h] BPD vs. HC_{BPD}: p = .994, BPD vs. HC_{PDD}: p = .964, PDD vs. HC_{PDD}: p = .029, PDD vs. HC_{BPD}: p = .994, BPD vs. PDD: p = .622, HC_{BPD} vs. HC_{PDD}: p = .804,[i] BPD vs. HC_{BPD}: p = 1.000, BPD vs. HC_{PDD}: p = .918, PDD vs. HC_{PDD}: p = .019, PDD vs. HC_{BPD}: p = .314, BPD vs. PDD: p = .750, HC_{BPD} vs. HC_{PDD}: p = .445

Before and after playing Cyberball, participants were asked to rate their current emotions on a Likert scale from 1 (not at all) to 7 (very much) on the Emotion Scale (ES) by Gross and Levenson (1995), which was adapted by Staebler et al. (2009) and complemented by Jobst et al. (2015) with the emotion “shame”. Following Jobst et al. (2015), the emotions (except shame) were divided into the three subscales: positive emotions (Affection, Contentment, Amusement, Surprise, Pride), self-focused negative emotions (Fear, Sadness, Hurt, Loneliness, Despair), and other-focused negative emotions (Anger, Resentment, Contempt, Boredom).

BPD and PDD patients showed lower positive and higher self-focused negative emotions before the game in each condition compared to their matched HC sample, all p_s < .001; other-focused negative emotions were higher in BPD patients compared to HC_{BPD} in both conditions, both ps < .006, while PDD patients differed from HC_{PDD} in the control, p = .002, and trendwise in the experimental condition, p = .082. Change on all emotion subscales from before to after the game were similar between all groups and conditions, Condition x Time x Group: all Fs(3, 135) < 1.85, all η_p^2 < .04, all ps > .141. The most consistent finding was an increase in other-focused negative emotions in all groups in the experimental condition, all p_{FDR}s < .006.

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Table A8

Means, Standard Deviations, Pairwise t-tests, and One-Way Analyses of Variance for the Emotion Scale (single items)

Emotions	BPD (*n*=36)				PDD (N=34)				HC_{BPD} (N=36)				HC_{PDD} (N=34)							
	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	One-way ANOVA (pre)	p_{FDR}	One-way ANOVA (delta)	p_{FDR}
Experimental Condition																				
Anger *M*(SD)	1.94 (1.43)	2.78 (1.53)	*t*(35)= -3.33, ***p*=.002**	**.009**	1.76 (1.44)	2.32 (1.68)	*t*(33)= -2.09, ***p*=.045**	.193	1.08 (0.28)	1.39 (0.87)	*t*(35)=-2.23, ***p*=.032**	.160	1.06 (0.24)	1.59 (0.86)	*t*(33)= -3.74, ***p*=.001**	**.007**	*F*(3,69)=6.83, ***p*< .001**[a+]	**<.001**	*F*(3,73)=1.25, *p*=.298[+]	.500
Affection *M*(SD)	2.83 (1.86)	2.22 (1.88)	*t*(35)=3.25, ***p*=.003**	**.010**	2.71 (1.62)	2.41 (1.18)	*t*(33)=1.26, *p*=.216	.294	3.11 (1.92)	2.86 (1.82)	*t*(35)=1.43, *p*=.163	.370	3.18 (1.82)	2.71 (1.62)	*t*(33)=3.06, **p=.004**	**.017**	*F*(3,136)=0.53, *p*=.665	.688	*F*(3,136)=0,78, *p*=.504	.720
Fear *M*(SD)	2.75 (1.78)	1.97 (1.38)	*t*(35)= 3.30, ***p*=.002**	**.009**	2.35 (1.47)	1.88 (1.22)	*t*(33)=2.77, ***p*=.009**	.054	1.14 (0.35)	1.08 (0.28)	*t*(35)=1.43, *p*=.160	.370	1.12 (0.33)	1.03 (0.17)	*t*(33)=1.79, *p*=.083	.191	*F*(3,70)=16.76, ***p*< .001**[b+]	**<.001**	*F*(3,69)=4.67, ***p*=.005**[x+]	.075
Sadness *M*(SD)	2.92 (1.54)	3.22 (1.97)	*t*(35)= -1.03, *p*=. 312	.468	2.74 (1.85)	2.74 (1.83)	*t*(33)=0.00, *p*=1.000	1.000	1.14 (0.42)	1.14 (0.35)	*t*(35)=0.00, *p*=1.000	1.00	1.18 (0.39)	1.24 (0.43)	*t*(33)=-0.81, *p*=.422	.703	*F*(3,70)=22.23, ***p*< .001**[c+]	**<.001**	*F*(3,69)=0.43, *p*=.734[+]	.816
Contentment *M*(SD)	2.83 (1.13)	2.22 (1.04)	*t*(35)= 2.74, ***p*=.010**	**.027**	2.71 (1.19)	2.82 (1.34)	*t*(33)= -0.52, *p*=.607	.674	5.22 (1.38)	4.97 (1.38)	*t*(35)=1.78, *p*=.083	.337	4.88 (1.25)	4.21 (1.51)	*t*(33)=3.100, ***p*=.004**	**.017**	*F*(3,136)=40.01, ***p*< .001**[d]	**<.001**	*F*(3,136)=3.17, ***p*=.026**[y]	.195
Hurt *M*(SD)	2.47 (1.67)	3.00 (1.85)	*t*(35)= -2.06, ***p*=.047**	.101	1.85 (1.42)	2.56 (1.56)	*t*(33)= -3.25, ***p*=.003**	**.022**	1.14 (0.54)	1.28 (0.70)	*t*(35)=-1.09, *p*=.281	.463	1.12 (0.33)	1.47 (0.83)	*t*(33)= -2.66, ***p*=.012**	**.045**	*F*(3,68)=9.78, ***p*< .001**[e+]	**<.001**	*F*(3,74)=1.92, *p*=.133[+]	.296
Loneliness *M*(SD)	3.08 (2.05)	3.69 (2.07)	*t*(35)= -3.56, ***p*=.001**	**.007**	2.68 (1.79)	2.94 (1.92)	*t*(33)= -1.16, *p*=.255	.333	1.11 (0.32)	1.22 (0.64)	*t*(35)=-1.28, *p*=.210	.393	1.18 (0.58)	1.41 (0.82)	*t*(33)= -2.26, ***p*=.030**	.090	*F*(3,65)=18.45, ***p*< .001**[f+]	**<.001**	*F*(3,72)=2.25, *p*=.089[+]	.222
Resentment *M*(SD)	1.89 (1.35)	2.89 (1.83)	*t*(35)= -4.07, ***p*<.001**	**<.001**	1.71 (1.31)	2.68 (1.68)	*t*(33)= -3.71, ***p*=.001**	**.010**	1.11 (0.40)	1.49 (0.92)	*t*(34)=-2.61, ***p*=.013**	.097	1.15 (0.56)	1.85 (1.23)	*t*(33)=-3.99, ***p*<.001**	**<.001**	*F*(3,70)=5.34, ***p*=.002**[g+]	**.003**	*F*(3,73)=2.43, *p*=.072[+]	.222
Amusement *M*(SD)	2.33 (1.12)	2.06 (1.14)	*t*(35)=1.47, *p*=.152	.268	2.79 (1.30)	2.65 (1.18)	*t*(33)=0.68, *p*=.500	.577	5.25 (1.25)	4.89 (1.37)	*t*(35)=3.17, ***p*=.003**	**.045**	4.91 (1.26)	4.15 (1.37)	*t*(33)=4.38, ***p*<.001**	**<.001**	*F*(3,136)=50.25, ***p*< .001**[h]	**<.001**	*F*(3,136)=2.23, *p*=.088	.222
Contempt *M*(SD)	1.61 (1.29)	2.36 (1.71)	*t*(35)= -3.26, ***p*=.002**	**.009**	1.47 (1.02)	1.74 (1.14)	*t*(33)= -1.27, *p*=.212	.294	1.17 (1.00)	1.36 (1.22)	*t*(35)=-1.56, *p*=.128	.370	1.03 (0.17)	1.44 (0.96)	*t*(33)= -2.51, ***p*=.017**	.057	*F*(3,60)=4.40, ***p*=.007**[+]	**.009**	*F*(2,74)=1.59, *p*=.200[+]	.388
Surprise *M*(SD)	1.94 (1.53)	2.56 (1.96)	*t*(35)= -2.23, ***p*=.032**	.080	2.32 (1.68)	2.32 (1.36)	*t*(33)=0.00, *p*=1.000	1.000	2.06 (1.29)	2.33 (1.64)	*t*(35)=-1.35, *p*=.185	.370	2.32 (1.65)	2.24 (1.41)	*t*(33)=0.40, *p*=.692	.853	*F*(3,136)=0.55, *p*=.652	.688	*F*(3,136)=1.87, *p*=.138	.296
Despair *M*(SD)	2.39 (1.61)	2.25 (1.57)	*t*(35)=0.60, *p*=.549	.667	2.24 (1.58)	1.97 (1.60)	*t*(33)=1.36, *p*=.184	.290	1.03 (0.17)	1.08 (0.37)	*t*(35)=-0.81, *p*=.422	.527	1.06 (0.24)	1.09 (0.29)	*t*(33)= -0.57, *p*=.571	.853	*F*(3,67)=14.62, ***p*<.001**[i+]	**.002**	*F*(3,70)=0.95, *p*=.420[+]	.663
Pride *M*(SD)	1.75 (1.27)	1.83 (1.54)	*t*(35)= -0.41, *p*=.681	.757	1.88 (1.20)	2.15 (1.21)	*t*(33)= -1.47, *p*=.152	.290	2.94 (1.90)	3.28 (1.92)	*t*(35)=-2.65, ***p*=.012**	.097	2.85 (1.78)	2.56 (1.50)	*t*(33)= 1.41, *p*=.169	.298	*F*(3,75)=5.53, ***p*=.002**[j+]	**.003**	*F*(3,136)=2.37, *p*=.073	.222
Boredom *M*(SD)	2.42 (1.73)	3.53 (1.81)	*t*(35)= -4.03, ***p*<.001**	**<.001**	1.97 (1.42)	2.82 (1.83)	*t*(33)=-3.56, ***p*=.001**	**.010**	1.58 (0.91)	2.53 (1.75)	*t*(35)=-3.75, ***p*=.001**	**.030**	1.91 (1.16)	3.00 (1.99)	*t*(33)= -3.26, ***p*=.003**	**.017**	*F*(3,74)=2.39, *p*=.076[+]	.091	*F*(3,136)=0.19, *p*=.901	.901
Shame *M*(SD)	2.25 (1.71)	2.14 (1.66)	*t*(35)=0.43 *p*=.669	.757	2.12 (1.43)	1.94 (1.50)	*t*(33)=.734, *p*=.468	.562	1.22 (0.90)	1.22 (0.87)	*t*(35)=0.00, *p*=1.000	1.000	1.06 (0.24)	1.06 (0.24)	*t*(33)=0.00, *p*=1.000	1.000	*F*(3,62)=11.38, ***p*< .001**[k+]	**.002**	*F*(3,69)=0.23, *p*=.875[+]	.901
Control Condition																				
Anger *M*(SD)	2.06 (1.41)	2.29 (1.56)	*t*(34)= -0.85, *p*=.402	.548	1.74 (1.14)	1.47 (1.11)	*t*(33)= 1.30, *p*=.203	.294	1.06 (0.23)	1.06 (0.23)	*t*(35)=0.00, *p*=1.00	1.000	1.09 (0.29)	1.12 (0.33)	*t*(33)= -0.44, *p*=.661	.853	*F*(3,68)=9.17, *p*< .001[l+]	**<.001**	*F*(3,69)=0.84, *p*=.474[+]	.711
Affection *M*(SD)	2.77 (1.94)	2.74 (2.03)	*t*(34)=0.13, *p*=.893	.914	2.88 (1.51)	3.21 (1.63)	*t*(33)= -1.38, *p*=.176	.290	3.03 (1.79)	3.22 (1.79)	*t*(35)=-1.00, *p*=.324	.462	2.97 (1.95)	3.26 (1.90)	*t*(33)= -1.41, *p*=.169	.298	*F*(3,135)=0.13, *p*< .939	.939	*F*(3,135)=0.56, *p*=.640	.800
Fear *M*(SD)	2.35 (1.43)	1.85 (1.37)	*t*(33)=2.09, ***p*=.045**	.101	2.47 (1.66)	1.47 (0.79)	*t*(33)=4.32, ***p*<.001**	**<.001**	1.06 (0.23)	1.03 (0.17)	*t*(35)=1.00, *p*=.324	.463	1.09 (0.29)	1.00 (0.00)	*t*(32)=1.79, *p*=.083	.191	*F*(3,66)=16.54, *p*< .001[m+]	**<.001**	*F*(3,63)=7.05, *p*<.001[z+]	**<.001**
Sadness *M*(SD)	2.66 (1.35)	2.69 (1.73)	*t*(34)=-0.11, *p*=.914	.914	2.59 (1.60)	2.26 (1.42)	*t*(33)=1.43, *p*=.162	.290	1.17 (0.45)	1.08 (0.28)	*t*(35)=1.36, *p*=183	.370	1.21 (0.73)	1.18 (0.46)	*t*(33)=0.44, *p*=.661	.853	*F*(2,68)=19.82, *p*<.001[n+]	**<.001**	*F*(3,69)=0.59, *p*=.623[+]	.800
Contentment *M*(SD)	2.63 (1.09)	2.97 (1.40)	*t*(34)=-1.53, *p*=.136	.268	3.15 (1.58)	3.53 (1.58)	*t*(33)= -1.43 *p*=.162	.290	5.28 (1.21)	5.17 (1.44)	*t*(35)=0.66, *p*=.513	.616	5.00 (1.39)	4.91 (1.19)	*t*(33)=0.49, *p*=.629	.853	*F*(3,135)=35.60, *p*< .001[o]	**<.001**	*F*(3,74)=1.56, *p*=.207[+]	.388
Hurt *M*(SD)	2.63 (1.72)	2.40 (1.77)	*t*(34)=0.93, *p*=.360	.514	2.06 (1.43)	1.79 (1.04)	*t*(33)=1.86, *p*=.071	.213	1.17 (0.45)	1.08 (0.28)	*t*(35)=1.36, *p*=.183	.370	1.24 (0.61)	1.15 (0.56)	*t*(33)=1.79, *p*=.083	.191	*F*(3,69)=11.14, *p*< .001[p+]	**<.001**	*F*(3,70)=0.57, *p*=.636[+]	.800

Appendix A: Supplementary Material Study I

Emotions	BPD (*n*=36)				PDD (N=34)				HC_{BPD} (N=36)				HC_{PDD} (N=34)							
	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	One-way ANOVA (pre)	p_{FDR}	One-way ANOVA (delta)	p_{FDR}
Loneliness *M*(SD)	2.69 (1.49)	2.86 (1.90)	*t*(34)=-0.59, *p*=.556	.667	2.74 (1.83)	2.71 (1.53)	*t*(33)=0.11, *p*=.915	.980	1.28 (0.88)	1.14 (0.35)	*t*(35)=1.22, *p*=.230	.406	1.15 (0.44)	1.15 (0.44)	*t*(33)=0.00, *p*=1.000	.298	*F*(3,67)=18.01, ***p*< .001**[q+]	**<.001**	*F*(3,70)=0.50, *p*=.686[+]	.816
Resentment *M*(SD)	2.31 (1.53)	2.00 (1.43)	*t*(34)=1.17, *p*=.249	.415	1.85 (1.00)	1.67 (0.96)	*t*(32)=0.92, *p*=.363	.454	1.14 (0.55)	1.06 (0.24)	*t*(34)=0.90, *p*=.373	.509	1.24 (0.43)	1.21 (0.48)	*t*(33)=0.33, *p*=.744	.853	*F*(3,70)=9.43, ***p*< .001**[r+]	**<.001**	*F*(3,70)=0.44, *p*=.723[+]	.816
Amusement *M* (SD)	2.60 (1.29)	2.63 (1.46)	*t*(34)=-0.13, p=.895	.914	2.71 (1.17)	3.15 (1.50)	*t*(33)= -1.97, *p*=.058	.193	5.11 (1.26)	4.92 (1.23)	*t*(35)=1.75, *p*=.090	.337	4.97 (1.31)	4.74 (1.42)	*t*(33)=1.44, *p*=.160	.298	*F*(3,135)=41.88, ***p*< .001**[s]	**<.001**	*F*(3,72)=2.48, *p*=.068[+]	.222
Contempt *M*(SD)	1.89 (1.55)	1.49 (1.15)	*t*(34)=1.48, *p*=.147	.268	1.38 (0.78)	1.12 (0.33)	*t*(33)=2.32, ***p*=.027**	.135	1.22 (1.02)	1.22 (1.02)	*t*(35)=0.00, *p*=1.000	1.00	1.06 (0.24)	1.06 (0.24)	*t*(33)=0.00, *p*=1.000	1.000	*F*(3,63)=4.87, ***p*=.004**[t+]	**.005**	*F*(3,69)=2.31, *p*=.084[+]	.222
Surprise *M*(SD)	1.80 (1.45)	2.63 (1.93)	*t*(34)=-2.93, ***p*=.006**	**.018**	2.32 (1.51)	2.76 (1.78)	*t*(33)= -1.63, *p*=.113	.268	2.14 (1.38)	2.00 (1.51)	*t*(35)=0.87, *p*=.392	.511	2.44 (1.56)	2.35 (1.82)	*t*(33)=0.37, *p*=.716	.853	*F*(3,135)=1.24, *p*=.296	.323	*F*(3,135)=3.65, ***p*=.014**[aa]	.140
Despair *M*(SD)	2.03 (1.38)	1.86 (1.11)	*t*(34)=0.74, *p*=.461	.601	2.09 (1.50)	1.79 (1.07)	*t*(33)=1.97, *p*=.058	.193	1.06 (0.23)	1.06 (0.23)	*t*(35)=0.00, *p*=1.00	1.000	1.12 (0.33)	1.15 (0.44)	*t*(33)= -0.44, *p*=.661	.853	*F*(3,67)=10.39, ***p*< .001**[u+]	**<.001**	*F*(3,67)=1.48, *p*=.229[+]	.404
Pride *M*(SD)	1.91 (1.22)	2.14 (1.42)	*t*(34)= -1.03, *p*=.309	.468	1.94 (1.18)	2.24 (1.33)	*t*(33)= -1.77, *p*=.086	.234	3.11 (1.92)	3.28 (1.91)	*t*(35)=-1.03, *p*=.310	.463	2.76 (1.72)	2.82 (1.87)	*t*(33)= -0.30, *p*=.768	.853	*F*(3,74)=4.98, ***p*=.003**[v+]	**.004**	*F*(3,135)=0.28, *p*=.842	.901
Boredom *M*(SD)	2.23 (1.52)	3.29 (1.86)	*t*(34)= -3.85, ***p*=.001**	**.007**	2.15 (1.62)	2.47 (1.56)	*t*(33)= -1.38, *p*=.176	.290	1.83(1.32)	2.44 (1.46)	*t*(35)=-2.51, ***p*=.017**	.102	1.59 (1.05)	2.74 (1.83)	*t*(33)= -4.72, ***p*<.001**	**<.001**	*F*(3,135)=1.54, *p*=.206	.238	*F*(3,135)=2.37, *p*=.073	.222
Shame *M*(SD)	2.37 (1.57)	1.77 (1.21)	*t*(34)= 3.26, ***p*=.003**	**.010**	2.12 (1.43)	1.76 (1.23)	*t*(33)=1.61, *p*=.116	.268	1.28 (0.97)	1.19 (0.71)	*t*(35)=1.36, *p*=.183	.370	1.24 (0.55)	1.09 (0.29)	*t*(33)= 1.71, *p*=.096	.206	*F*(3,70)=8.32, ***p*<.001**[w+]	**<.001**	*F*(3,69)=2.62, *p*=.058[+]	.222

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; FDR = false discovery rate; post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; α = .05, significant results are indicated in bold face

Specific Note. [a] BPD vs. HC_{BPD}: p = .005, BPD vs. HC_{PDD}: p = .001, PDD vs. HC_{PDD}: p = .009, PDD vs. HC_{BPD}: p = .030, BPD vs. PDD: p = .896, HC_{BPD} vs. HC_{PDD}: p = .996 [b] BPD vs. HC_{BPD}: p = .006, BPD vs. HC_{PDD}: p = .004, PDD vs. HC_{PDD}: p = .037, PDD vs. HC_{BPD}: p = .048, BPD vs. PDD: p = .953, HC_{BPD} vs. HC_{PDD}: p = .979 [c] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .739, HC_{BPD} vs. HC_{PDD}: p = .994 [d] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .970, HC_{BPD} vs. HC_{PDD}: p = .980 [e] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001, BPD vs. PDD: p = .968, HC_{BPD} vs. HC_{PDD}: p = .701 [f] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p = .027, PDD vs. HC_{BPD}: p = .041, BPD vs. PDD: p = .353, HC_{BPD} vs. HC_{PDD}: p = .997 [g] BPD vs. HC_{BPD}: p < .001, BPD vs. HC_{PDD}: p < .001, PDD vs. HC_{PDD}: p < .001, PDD vs. HC_{BPD}: p < .001BPD vs. PDD: p = .812, HC_{BPD} vs. HC_{PDD}: p = .937 [h] BPD vs. HC_{BPD}: p = .010, BPD vs. HC_{PDD}: p = .020, PDD vs. HC_{PDD}: p = .118, PDD vs. HC_{BPD}: p = .074, BPD vs. PDD: p = .939, HC_{BPD} vs. HC_{PDD}: p = .992 [i] BPD vs. HC_{BPD}: p <

.001, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .394$, HC_{BPD} vs. HC_{PDD}: $p = .676$ [j] BPD vs. HC_{BPD}: $p = .014$, BPD vs. HC_{PDD}: $p = .022$, PDD vs. HC_{PDD}: $p = .051$, PDD vs. HC_{BPD}: $p = .032$, BPD vs. PDD: $p = .970$, HC_{BPD} vs. HC_{PDD}: $p = .997$ [k] BPD vs. HC_{BPD}: $p = .012$, BPD vs. HC_{PDD}: $p = .001$, PDD vs. HC_{PDD}: $p = .001$, PDD vs. HC_{BPD}: $p = .015$, BPD vs. PDD: $p = .985$, HC_{BPD} vs. HC_{PDD}: $p = .720$ [l] BPD vs. HC_{BPD}: $p = .001$, BPD vs. HC_{PDD}: $p = .002$, PDD vs. HC_{PDD}: $p = .014$, PDD vs. HC_{BPD}: $p = .008$, BPD vs. PDD: $p = .724$, HC_{BPD} vs. HC_{PDD}: $p = .954$ [m] BPD vs. HC_{BPD}: $p = .968$, BPD vs. HC_{PDD}: $p = .999$, PDD vs. HC_{PDD}: $p = .997$, PDD vs. HC_{BPD}: $p = .433$, BPD vs. PDD: $p = .994$, HC_{BPD} vs. HC_{PDD}: $p = .999$ [n] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .989$, HC_{BPD} vs. HC_{PDD}: $p = .945$ [o] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .997$, HC_{BPD} vs. HC_{PDD}: $p = .993$ [p] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .372$, HC_{BPD} vs. HC_{PDD}: $p = .811$ [q] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p = .018$, PDD vs. HC_{BPD}: $p = .007$, BPD vs. PDD: $p = .445$, HC_{BPD} vs. HC_{PDD}: $p = .950$ [r] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{BPD}: $p = .001$, BPD vs. PDD: $p = .999$, HC_{BPD} vs. HC_{PDD}: $p = .857$ [s] BPD vs. HC_{BPD}: $p = .001$, BPD vs. HC_{PDD}: $p = .001$, PDD vs. HC_{PDD}: $p = .012$, PDD vs. HC_{BPD}: $p = .004$, BPD vs. PDD: $p = .448$, HC_{BPD} vs. HC_{PDD}: $p = .864$ [t] BPD vs. HC_{BPD}: $p < .001$, BPD vs. HC_{PDD}: $p < .001$, PDD vs. HC_{PDD}: $p = .014$, PDD vs. HC_{BPD}: $p < .001$, BPD vs. PDD: $p = .984$, HC_{BPD} vs. HC_{PDD}: $p = .968$ [u] BPD vs. HC_{BPD}: $p = .157$, BPD vs. HC_{PDD}: $p = .018$, PDD vs. HC_{PDD}: $p = .112$, PDD vs. HC_{BPD}: $p = .216$, BPD vs. PDD: $p = .328$, HC_{BPD} vs. HC_{PDD}: $p = .785$ [v] BPD vs. HC_{BPD}: $p = .001$, BPD vs. HC_{PDD}: $p = .003$, PDD vs. HC_{PDD}: $p = .004$, PDD vs. HC_{BPD}: $p = .002$, BPD vs. PDD: $p = .998$, HC_{BPD} vs. HC_{PDD}: $p = .799$ [w] BPD vs. HC_{BPD}: $p = .014$, BPD vs. HC_{PDD}: $p = .097$, PDD vs. HC_{PDD}: $p = .110$, PDD vs. HC_{BPD}: $p = .016$, BPD vs. PDD: $p = .1.000$, HC_{BPD} vs. HC_{PDD}: $p = .857$ [x] BPD vs. HC_{BPD}: $p = .023$, BPD vs. HC_{PDD}: $p = .033$, PDD vs. HC_{PDD}: $p = .153$, PDD vs. HC_{BPD}: $p = .023$, BPD vs. PDD: $p = .717$, HC_{BPD} vs. HC_{PDD}: $p = .954$ [y] BPD vs. HC_{BPD}: $p = .584$, BPD vs. HC_{PDD}: $p = .996$, PDD vs. HC_{PDD}: $p = .037$, PDD vs. HC_{BPD}: $p = .582$, BPD vs. PDD: $p = .061$, HC_{BPD} vs. HC_{PDD}: $p = .454$ [z] BPD vs. HC_{BPD}: $p = .224$, BPD vs. HC_{PDD}: $p = .003$, PDD vs. HC_{PDD}: $p = .003$, PDD vs. HC_{BPD}: $p = .001$, BPD vs. PDD: $p = .443$, HC_{BPD} vs. HC_{PDD}: $p = .697$ [aa] BPD vs. HC_{BPD}: $p = .025$, BPD vs. HC_{PDD}: $p = .042$, PDD vs. HC_{PDD}: $p = .422$, PDD vs. HC_{BPD}: $p = .327$, BPD vs. PDD: $p = .673$, HC_{BPD} vs. HC_{PDD}: $p = .999$

Table A9

Mixed Analysis of Variance for Ratings of Co-Players

	Mixed ANOVA						
				interactions			
Judgement of player	Condition	Group	Time	Condition*Time	Group*Time	Condition*Group	Condition*Time*Group
Sympathy	$F(1,135)=1.62$, $\eta_p^2=.01$, $p=.206$	$F(3,135)=0.08$ $\eta_p^2=.00$, $p=.970$	$F(1,135)=0.01$ $\eta_p^2=.00$, $p=.909$	$F(1,135)=0.22$, $\eta_p^2=.00$, $p=.637$	$F(3,135)=1.31$, $\eta_p^2=.03$, $p=.275$	$F(3,135)=1.33$, $\eta_p^2=.03$, $p=.267$	$F(3,135)=0.41$, $\eta_p^2=.01$, $p=.743$
Trustworthy	$F(1,135)=0.53$, $\eta_p^2=.00$, $p=.467$	$F(3,135)=0.86$, $\eta_p^2=.02$, $p=.462$	$F(1,135)=0.27$ $\eta_p^2=.00$, $p=.603$	$F(1,135)=2.79$, $\eta_p^2=.02$, $p=.097$	$F(3,135)=1.39$, $\eta_p^2=.03$, $p=.248$	$F(3,135)=2.89$, $\eta_p^2=.06$, **$p=.038$**	$F(3,135)=0.83$, $\eta_p^2=.02$, $p=.481$
Attractive	$F(1,135)=0.20$, $\eta_p^2=.00$, $p=.653$	$F(3,135)=1.92$, $\eta_p^2=.04$, $p=.130$	$F(1,135)=3.19$, $\eta_p^2=.02$, $p=.076$	$F(1,135)=0.68$, $\eta_p^2=.00$, $p=.411$	$F(3,135)=0.48$, $\eta_p^2=.01$, $p=.700$	$F(3,135)=0.14$, $\eta_p^2=.00$, $p=.936$	$F(3,135)=1.91$, $\eta_p^2=.04$, $p=.132$
Dominat	$F(1,135)=2.27$, $\eta_p^2=.02$, $p=.134$	$F(3,135)=0.65$, $\eta_p^2=.01$, $p=.581$	$F(1,135)=0.09$, $\eta_p^2=.00$, $p=.758$	$F(1,135)=0.53$, $\eta_p^2=.00$, $p=.470$	$F(3,135)=0.75$, $\eta_p^2=.02$, $p=.522$	$F(3,135)=1.55$, $\eta_p^2=.03$, $p=.204$	$F(3,135)=0.50$, $\eta_p^2=.01$, $p=.682$
Aggressive	$F(1,135)=0.30$, $\eta_p^2=.00$, $p=.586$	$F(3,135)=0.67$, $\eta_p^2=.01$, $p=.570$	$F(1,135)=0.01$, $\eta_p^2=.00$, $p=.910$	$F(1,135)=2.30$, $\eta_p^2=.02$, $p=.132$	$F(3,135)=1.27$, $\eta_p^2=.03$, $p=.286$	$F(3,135)=1.73$, $\eta_p^2=.04$, $p=.164$	$F(3,135)=1.01$, $\eta_p^2=.02$, $p=.390$

Note. Group = BPD, PDD, $HC_{BPD,}$ $HC_{PDD,}$ BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients, Condition = experimental vs. control condition; Group: patients with borderline personality disorder, patients with persistent depressive disorder and age and gender matched healthy controls, Time = before and after the Cyberball paradigm, $\alpha = .05$; significant results are in bold face

Specific note. Participants also rated their alleged co-players concerning Sympathy, Trustworthiness, Attractiveness, Dominance, and Aggressiveness on scales ranging from 0 (not at all) to 1 (very much) before and after the game. Ratings of players were similar between groups and conditions, Condition x Time x Group: all Fs(3, 135) < 1.91, all $\eta_p^2 < .04$, all ps > .13. In each group positive attributions towards the includer and negative towards the excluder increased in the experimental, and positive attributions towards both players increased in the control condition. The most consistent finding was a decrease in trustworthiness towards the excluding player in the experimental condition, all p_{FDR}s < .04.

Table A10

Means, Standard Deviations, Pairwise t-test, and One-Way Analyses of Variance for Ratings of Co-Players

	BPD (*n*=36)				PDD (*n*=34)				HC_{BPD} (*n*=36)				HC_{PDD} (*n*=34)							
	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	Pre	Post	Pairwise *t*-test	p_{FDR}	One-Way ANOVA (Pre)	p_{FDR}	One-Way ANOVA (Delta)	p_{FDR}
Experimental Condition																				
Includer																				
Sympathy *M*(SD)	0.58 (0.21)	0.63 (0.19)	*t*(35)= -1.38, *p*=.175	.233	0.63 (0.18)	0.67 (0.18)	*t*(33)=-1.13, *p*=.268	.344	0.61 (0.21)	0.69 (0.18)	*t*(35)=-2.14, ***p*=.040**	.067	0.59 (0.25)	0.65 (0.21)	*t*(33)=-2.01, *p*=.052	.107	*F*(3,136)=0.46, *p*=.710	.789	*F*(3,136)=0.25, *p*=.860	.986
Trustworthy *M*(SD)	0.49 (0.19)	0.59 (0.15)	*t*(35)=-3.06, ***p*=.004**	**.016**	0.56 (0.19)	0.64 (0.19)	*t*(33)=-2.50, ***p*=.018**	**.040**	0.57 (0.19)	0.65 (0.19)	*t*(35)=-2.76, ***p*=.009**	**.022**	0.54 (0.24)	0.62 (0.21)	*t*(33)=-1.95, *p*=.059	.107	*F*(3,136)=0.95, *p*=.418	.708	*F*(3,136)=0.11, *p*=.951	.986
Attractive *M*(SD)	0.46 (0.24)	0.50 (0.19)	*t*(35)=-1.30, *p*=.201	.251	0.54 (0.17)	0.58 (0.16)	*t*(33)=-1.43, *p*=.163	.233	0.46 (0.21)	0.49 (0.22)	*t*(35)=-2.80, ***p*=.008**	**.022**	0.48 (0.24)	0.51 (0.25)	*t*(33)=-1.17, *p*=.252	.388	*F*(3,136)=1.19, *p*=.315	.708	*F*(3,71)=0.05, *p*=.986[+]	.986
Dominat *M*(SD)	0.41 (0.25)	0.41 (0.20)	*t*(35)=0.02, *p*=.984	.984	0.36 (0.21)	0.39 (0.21)	*t*(33)=-1.07, *p*=.294	.346	0.38 (0.24)	0.36 (0.21)	*t*(35)=-0.43, *p*=.669	.714	0.36 (0.24)	0.39 (0.20)	*t*(33)=-0.67, *p*=.509	.599	*F*(3,136)=0.40, *p*=.756	.796	*F*(3,75)=0.40, *p*=.756[+]	.986
Aggressive *M*(SD)	0.36 (0.26)	0.30 (0.20)	*t*(35)=1.84, p=.074	.148	0.30 (0.22)	0.28 (0.20)	*t*(33)=0.66, *p*=.513	.540	0.29 (0.21)	0.21 (0.19)	*t*(35)=2.55, ***p*=.015**	**.027**	0.32 (0.25)	0.28 (0.20)	*t*(33)=1.03, *p*=.309	.412	*F*(3,136)=0.72, *p*=.544	.725	*F*(3,136)=0.66, *p*=.578	.986
Excluder																				
Sympathy *M*(SD)	0.63 (0.17)	0.33 (0.20)	*t*(35)= 7.19, ***p*<.001**	**<.001**	0.59 (0.16)	0.42 (0.22)	*t*(33)=4.96, ***p*<.001**	**<.001**	0.58 (0.21)	0.44 (0.29)	*t*(35)=2.88, ***p*=.007**	**.022**	0.55 (0.27)	0.43 (0.24)	*t*(33)=2.47, ***p*=.019**	.063	*F*(3,75)=0.76, *p*=.518[+]	.725	*F*(3,136)=3.40, *p*=.020[c]	.200
Trustworthy *M*(SD)	0.57 (0.19)	0.35 (0.21)	*t*(35)=6.03, ***p*<.001**	**<.001**	0.55 (0.16)	0.40 (0.20)	*t*(33)=4.22, ***p*<.001**	**<.001**	0.58 (0.20)	0.44 (0.26)	*t*(35)=3.48, ***p*=.001**	**.007**	0.56 (0.23)	0.43 (0.23)	*t*(33)=2.81, ***p*=.008**	**.044**	*F*(3,136)=0.10, *p*=.961	.961	*F*(3,136)=1.05, *p*=.371	.976
Attractive *M*(SD)	0.50 (0.19)	0.43 (0.20)	*t*(35)=3.05, ***p*=.004**	**.016**	0.55 (0.16)	0.48 (0.17)	*t*(33)=2.48, ***p*=.018**	**.040**	0.43 (0.22)	0.41 (0.25)	*t*(35)=1.00, *p*=.323	.380	0.43 (0.24)	0.41 (0.22)	*t*(33)=0.43, p=.667	.702	*F*(3,136)=2.93, *p*=.036[a]	.360	*F*(3,136)=1.51, *p*=.215	.976
Dominat *M*(SD)	0.37 (0.21)	0.46 (0.26)	*t*(35)=-1.77, *p*=.086	.156	0.44 (0.22)	0.52 (0.25)	*t*(33)=-2.51, ***p*=.017**	**.040**	0.40 (0.21)	0.39 (0.24)	*t*(35)=.042, *p*=.678	.714	0.35 (0.25)	0.48 (0.26)	*t*(33)=-3.04, ***p*=.005**	**.044**	*F*(3,136)=1.11, *p*=.348	.708	*F*(3,136)=0.83, *p*=.478	.976
Aggressive *M*(SD)	0.25 (0.19)	0.41 (0.24)	*t*(35)=-3.39, ***p*=.002**	**.013**	0.34 (0.25)	0.42 (0.25)	*t*(33)=-2.57, ***p*=.015**	**.040**	0.32 (0.21)	0.39 (0.26)	*t*(35)=-1.55, *p*=.131	.163	0.31 (0.24)	0.42 (0.23)	*t*(33)=-2.69, ***p*=.011**	**.044**	*F*(3,136)=0.94, *p*=.425	.708	*F*(3,136)=0.83, *p*=.478	.976
Control Condition																				
Player 1																				
Sympathy *M*(SD)	0.57 (0.16)	0.65 (0.19)	*t*(35)=-2.61, ***p*=.013**	**.043**	0.63 (0.16)	0.68 (0.15)	*t*(33)=-2.35, ***p*=.025**	**.050**	0.60 (0.22)	0.66 (0.17)	*t*(35)=-2.08, ***p*=.045**	.067	0.63 (0.22)	0.68 (0.21)	*t*(32)=-1.96, *p*=.059	.107	*F*(3,135)=0.77, *p*= .515	.725	*F*(3,135)=0.29, *p*= .831	.986

	BPD (n=36)				PDD (n=34)				HC_{BPD} (n=36)				HC_{PDD} (n=34)							
	Pre	Post	Pairwise t-test	p_{FDR}	Pre	Post	Pairwise t-test	p_{FDR}	Pre	Post	Pairwise t-test	p_{FDR}	Pre	Post	Pairwise t-test	p_{FDR}	One-Way ANOVA (Pre)	p_{FDR}	One-Way ANOVA (Delta)	p_{FDR}
Trustworthy M(SD)	0.50 (0.17)	0.57 (0.19)	t(35)=-1.89, p=.067	.148	0.58 (0.17)	0.63 (0.16)	t(33)=-2.00, p=.054	.090	0.56 (0.22)	0.62 (0.19)	t(35)=-1.94, p=.061	.081	0.57 (0.24)	0.63 (0.21)	t(32)=-2.34, **p=.026**	.067	F(3,135)=0.94, p= .421	.708	F(3,135)=0.07, p= .977	.986
Attractive M(SD)	0.45 (0.20)	0.48 (0.16)	t(35)=-0.95, p=.349	.410	0.50 (0.16)	0.56 (0.14)	t(33)=-3.02, **p=.005**	**.020**	0.41 (0.23)	0.47 (0.23)	t(35)=-3.23, **p=.003**	**.012**	0.43 (0.24)	0.48 (0.21)	t(32)=-2.74, **p=.010**	**.044**	F(3,75)=1.53, p= .214[+]	.708	F(3,135)=0.81, p= .488	.976
Dominat M(SD)	0.37 (0.22)	0.41 (0.20)	t(35)=--0.89, p=.381	.423	0.40 (0.20)	0.39 (0.21)	t(33)=0.36, p=.719	.719	0.36 (0.21)	0.36 (0.21)	t(35)=-0.09, p=.926	.926	0.34 (0.20)	0.39 (0.20)	t(32)=-1.05, p=.303	.412	F(3,135)=0.48, p= .695	.789	F(3,135)=2.01, p= .115	.767
Aggressive M(SD)	0.33 (0.23)	0.28 (0.24)	t(35)=1.42, p=.165	.233	0.32 (0.20)	0.29 (0.21)	t(33)=0.88, p=.387	.430	0.28 (0.23)	0.22 (0.21)	t(35)=2.06, **p=.047**	.067	0.23 (0.21)	0.24 (0.19)	t(32)=-0.19, p=.848	.848	F(3,135)=1.48, p= .223	.708	F(3,135)=0.84, p= .474	.976
Player 2																				
Sympathy M(SD)	0.57 (0.20)	0.64 (0.17)	t(35)=-1.91, p=.064	.148	0.55 (0.20)	0.65 (0.16)	t(33)=-3.07, **p=.004**	**.020**	0.59 (0.24)	0.68 (0.19)	t(35)=-2.64, **p=.012**	**.027**	0.61 (0.20)	0.66 (0.20)	t(32)=-1.71, p=.097	.162	F(3,135)=0.54, p= .658	.789	F(3,135)=0.48, p=.696	.986
Trustworthy M(SD)	0.52 (0.18)	0.57 (0.15)	t(35)=-1.65, p=.107	.165	0.49 (0.17)	0.61 (0.17)	t(33)=-4.34, **p<.001**	**<.001**	0.53 (0.23)	0.66 (0.18)	t(35)=-4.36, **p<.001**	**<.001**	0.63 (0.19)	0.64 (0.19)	t(32)=-0.60, p=.555	.617	F(3,135)=3.16, p= .027[b]	.360	F(3,135)=3.76, p=.012[d]	.200
Attractive M(SD)	0.44 (0.19)	0.49 (0.17)	t(35)=-2.47, **p=.018**	.051	0.51 (0.17)	0.55 (0.14)	t(33)=-2.18, **p=.036**	.065	0.45 (0.25)	0.51 (0.24)	t(35)=-3.79, **p=.001**	**.007**	0.46 (0.24)	0.48 (0.20)	t(32)=-0.75, p=.458	.572	F(3,74)=0.99, p= .403[+]	.708	F(3,75)=0.88, p= .451	.976
Dominat M(SD	0.36 (0.21)	0.36 (0.23)	t(35)=0.05, p=.963	.984	0.45 (0.20)	0.42 (0.19)	t(33)=1.11, p=.275	.344	0.42 (0.20)	0.31 (0.21)	t(35)=3.14, **p=.003**	**.012**	0.40 (0.23)	0.32 (0.20)	t(32)=2.75, **p=.010**	**.044**	F(3,135)=1.08, p= .358	.708	F(3,135)=0.10, p= .961	.986
Aggressive M(SD)	0.34 (0.21)	0.29 (0.21)	t(35)=1.66, p=.105	.165	0.37 (0.21)	0.31 (0.21)	t(33)=1.87, p=.071	.109	0.30 (0.23)	0.23 (0.18)	t(35)=2.55, **p=.015**	**.027**	0.30 (0.23)	0.23 (0.17)	t(32)=2.32, **p=.027**	.067	F(3,135)=0.98, p= .405	.708	F(3,135)=0.10, p= .961	.986

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; FDR = false discovery rate; post-hoc test: Tukey Test; [+] Levene's test significant in one-way ANOVA: results of Welch Test and Games-Howell Test are reported; α = .05, significant results are indicated in bold face

Specific Note. [a] BPD vs. HC_{BPD}: p = .466, BPD vs. HC_{PDD}: p = .394, PDD vs. HC_{PDD}: p = .062, PDD vs. HC_{BPD}: p = .081, HC_{BPD} vs. HC_{PDD}: p = .999, BPD vs. PDD: p = .767 [b] BPD vs. HC_{BPD}: p = .993, BPD vs. HC_{PDD}: p = .104, PDD vs. HC_{PDD}: p = .021, PDD vs. HC_{BPD}: p = .787, HC_{BPD} vs. HC_{PDD}: p = .181 BPD vs. PDD: p = .908 [c] BPD vs. HC_{BPD}: p = .050, BPD vs. HC_{PDD}: p = .024, PDD vs. HC_{PDD}: p = .814, PDD vs. HC_{BPD}: p = .940,

HC_{BPD} vs. HC_{PDD}: p = .989, BPD vs. PDD: p = .198 [d] BPD vs. HC_{BPD}: p = .210, BPD vs. HC_{PDD}: p = .757, PDD vs. HC_{PDD}: p = .052, PDD vs. HC_{BPD}: p = .993, HC_{BPD} vs. HC_{PDD}: p = .022, BPD vs. PDD: p = .354

Table A11

Results of Piecewise Linear Mixed Models (LMM) – Group Comparisons within the Control Condition

Period	Time interval (trials)	Contrast Group 1 vs. Group 2	Slope Group 1	Slope Group 2	*t*	*df*	*p*	*d* [95% CI]
1: no exclusion	[-10,0]	BPD vs. HC_{BPD}	0.022	0.001	-3.61	8175.79	<.001***	0.79 [0.37, 1.21]
1: no exclusion	[-10,0]	PDD vs. HC_{PDD}	0.011	0.003	-1.40	8175.24	.16	0.34 [-0.14, 0.82]
1: no exclusion	[-10,0]	BPD vs. PDD	0.022	0.011	-1.74	8176.31	.08	-0.41 [-0.88, 0.06]
1: no exclusion	[-10,0]	HC_{BPD} vs. HC_{PDD}	0.001	0.003	0.38	8174.64	.70	-0.09 [-0.52, 0.34]
2: immediate	[1,9]	BPD vs. HC_{BPD}	-0.012	0.002	4.23	8168.30	<.001***	-0.46 [-0.67, -0.25]
2: immediate	[1,9]	PDD vs. HC_{PDD}	-0.002	0.001	1.06	8168.30	.29	-0.15 [-0.42, 0.13]
2: immediate	[1,9]	BPD vs. PDD	-0.012	-0.002	2.87	8168.36	.004*	0.31 [0.09, 0.53]
2: immediate	[1,9]	HC_{BPD} vs. HC_{PDD}	0.002	0.001	-0.22	8168.24	.83	0.03 [-0.23, 0.28]
3: extinction	[10,50]	BPD vs. HC_{BPD}	0.001	0.000	-2.48	8167.88	.01**	0.32 [0.07, 0.56]
3: extinction	[10,50]	PDD vs. HC_{PDD}	0.001	0.001	0.63	8167.88	.53	-0.08 [-0.32, 0.17]
3: extinction	[10,50]	BPD vs. PDD	0.001	0.001	-0.71	8167.88	.48	-0.09 [-0.33, 0.16]
3: extinction	[10,50]	HC_{BPD} vs. HC_{PDD}	0.000	0.001	2.37	8167.87	.02*	-0.31 [-0.56, -0.06]

Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; CI = confidence interval; Effect size *d* and confidence intervals were calculated as recommended by Feingold (2009, 2015); *$p < .05$. **$p<.01$ ***$p<.001$

Table A12

Correlation between Passing Preference during the Extinction Period in the Experimental Condition and Age, Ostracism Intensity, Sense of Exclusion, and Need for Self-Esteem in Healthy Controls (n=70)

Variable	1	2	3	4	5	6
1. Passing Preference EC extinction period	-					
2. Slope EC extinction period	**.986**** [.979;.992]	-				
3. Age	.082 [-.116;.266]	.104 [-.102;.294]	-			
4. Overall need fulfillment	-.010 [-.257;.233]	-.054 [-.302;.198]	-.035 [-.288;.203]	-		
5. Self-esteem	.100 [-.131;296]	.071 [-.143;.271]	-.128 [-.371;.123]	**.784**** [.656;.884]	-	
6. Sense of exclusion	.029 [-.209;.269]	.045 [-.194;.275]	-.012 [-.263;.232]	**-.735**** [-.831;.606]	**-.492**** [-.673;-.299]	-

Note. BCa 95% bootstrapped Confidence Intervals are displayed in brackets, ** $p < .01$

Table A13

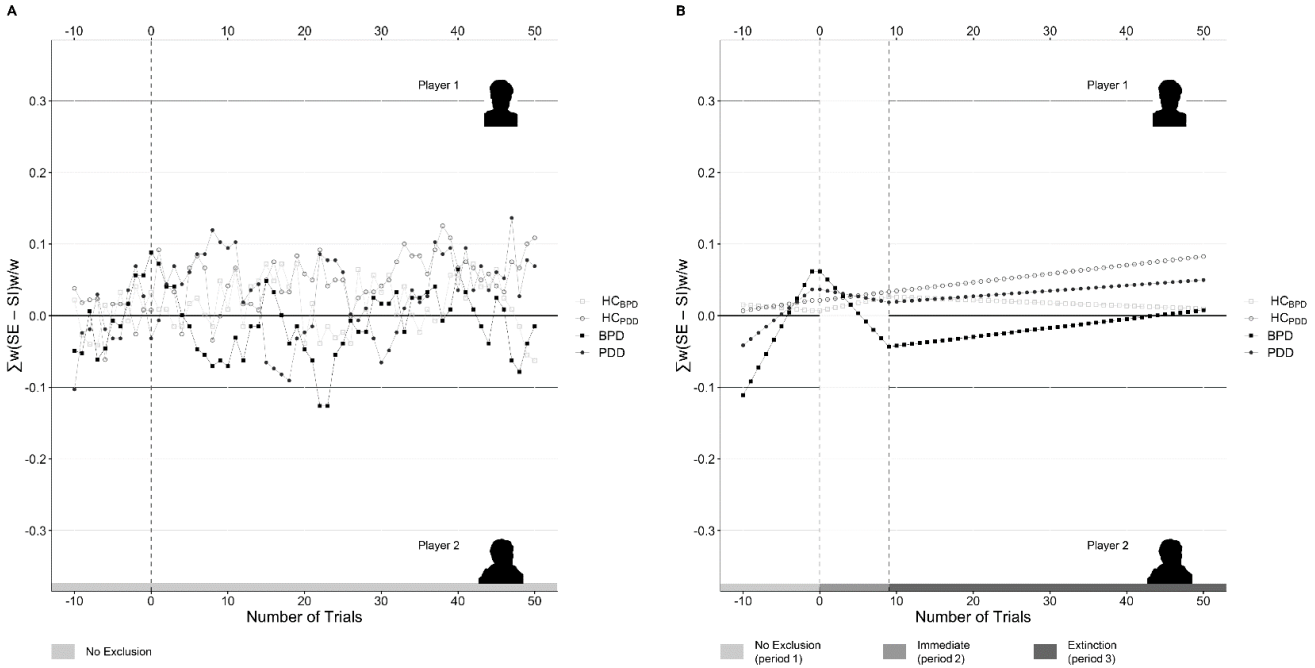
Correlation between Passing Preference during the Extinction Period in the Control Condition, and Age in Healthy Controls (n=70)

Variable	1	2	3
1. Passing Preference EC extinction period	-		
2. Slope EC extinction period	**.958**** [.933;.975]	-	
3. Age	-.087 [-.290;.149]	-.043 [-.239;.174]	-

Note. BCa 95% bootstrapped Confidence Intervals are displayed in brackets, ** $p < .01$

Figure A1

Passing Preference during the Control Condition

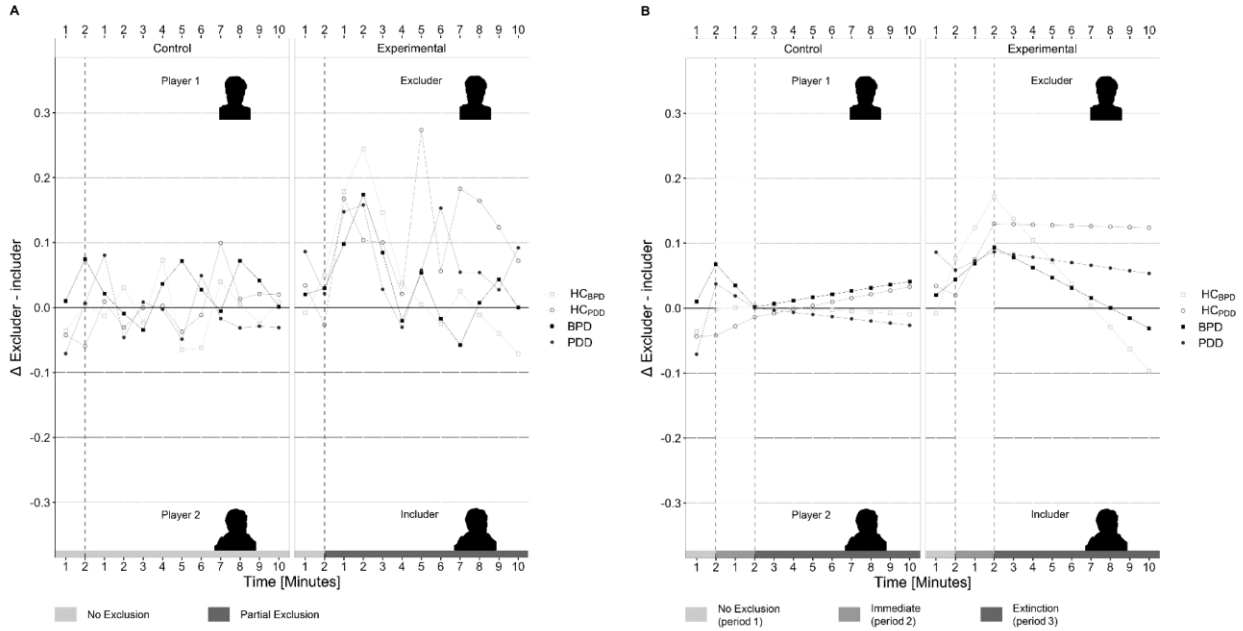


Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; A: Mean Passing Preference of each group; B: data fitted to each period using piece-wise Linear Mixed Models

Specific Note. The periods were created based on the playing behavior during the experimental condition; thus the periods do not have specific meaning in the control condition and cannot be simply compared to the experimental condition as number of observations were different

Figure A2

Passing Preference during the Experimental and Control Condition (minute-wise)



Note. BPD = patients with borderline personality disorder, PDD = patients with persistent depressive disorder, HC_{BPD} = age and gender matched healthy controls to the BPD patients, HC_{PDD} = age and gender matched healthy controls to the PDD patients; A: Mean Passing Preference of each group and condition minute-wise; B: data fitted to each period using piece-wise Linear Mixed Models in both conditions;

Specific Note. The periods were created based on the playing behavior during the experimental condition, thus the periods do not have specific meaning in the control condition and cannot be simply compared to the experimental condition, as number of observations were different

Comparison of psychological measures used before and after Cyberball with the current literature

In accordance with previous studies, BPD (Staebler et al., 2011) and PDD (Jobst et al., 2015) patients reported significantly lower positive and significantly higher self-focused negative emotions compared to HC. Additionally, BPD patients reported significant higher other-focused negative emotions before the game in both conditions compared to HC_{BPD}. Yet, the changes in emotional states were comparable between all groups. This suggests different starting points of emotional intensity, but a similar impact of SE on emotions respectively. Finally, in contrast to Weinbrecht et al. (2018), there were no decreases in negative emotions, except boredom, in BPD patients after the control condition. Prior findings of higher need threat on all scales in BPD patients (Seidl et al., 2020) and concerning self-esteem in PDD patients compared to HC could be replicated (Bauriedl-Schmidt et al., 2017). Both patient groups did not significantly differ from HC groups in rating the players at baseline and regarding changes in rating from before to after Cyberball in both conditions. These results contradict previous findings from other experimental studies in BPD patients who evaluated others as less trustworthy (Fertuck et al., 2013), more aggressive and, negative (Barnow et al., 2009). Like Roayaee et al. (2020), we found HC to decrease the excluder's trustfulness, however increased attractiveness and sympathy towards the includer could only be partly replicated.

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Appendix B: Supplementary Material Study II

Table B1

Correlations between age and CTQ and RSQ scores as well as passing preference [PP] during social exclusion (N=140) .

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ_{T}	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
age	-.047 [-.217;.142] *p* = .584	.070 [-.085;.219] *p* = .410	-.013 [-.165;.156] *p* = .881	.146 [-.017;306] *p* = .084	.062 [-.069;.186] *p* = .465	.107 [-.055;262] *p* = .209	-.012 [-.176;.156] *p* = .890	-.154 [-.283;-.023] *p* = .069	-.108 [-.242;.030] *p* = .203	-.164 [-.304;.-.013] *p* = .054

Note. PP: Passing Preference, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, RSQ: Rejection Sensitivity Questionnaire, higher PP scores indicate increased ball tosses towards the excluder, which was interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), $\alpha = .05$, significant results are indicated in bold face

Table B2

Correlations between CTQ and RSQ scores as well as passing preference [PP] during social exclusion in patients with BPD (N=36)

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
PP	-	-.140 [-.403;.117] *p* = .417	-.204 [-.486;.096] *p* = .232	-.167 [-.533;.247] *p* = .331	.078 [-.181;.304] *p* = .653	**-.342** [-.562;-.077] *p* = .041	-.115 [-.186;.373] *p* = .503	-.104 [-.185;.415] *p* = .545	.102 [-.156;.390] *p* = .553	.150 [-.183;.467] *p* = .383
CTQ_{total}		-	**.826** [.713;.913] *p* <.001	**.871** [.720;.944] *p* <.001	**.802** [.508;906] *p* <.001	**.779** [.561;.904] *p* <.001	**.793** [.628;.901] *p* <.001	**.422** [.121;.687] *p* =.010	**.446** [.154;.701] *p* =.006	.272 [-.070;.513] *p* =.109
CTQ_{EA}			-	**.604** [.324;.786] *p* <.001	**.574** [.256;.785] *p* <.001	**.593** [.331;.787] *p* <.001	**.590** [.307;.798] *p* <.001	**.442** [.205;.689] *p* =.007	**.445** [.208;.700] *p* =.007	**.338** [.058;.570] *p* =.044
CTQ_{PA}				-	**.638** [.126;.845] *p* <.001	**.650**[.383;.824] *p* <.001	**.621** [.373;.823] *p* <.001	.187 [-.217;.579] *p* =.276	.229 [-.121;.591] *p* =.178	.083 [-.364;.452] *p* =.629
CTQ_{SA}					-	**.415** [-.005;.669] *p* =.012	**.616** [.183;.801] *p* <.001	.319 [-.080;.641] *p* =.058	.271 [-.137;.598] *p* =.111	**.277** [-.107;.502] *p* =.102
CTQ_{EN}						-	**.502** [.245;.756] *p* =.002	**433** [.058;.665] *p* =.008	**.479** [.162;.698] *p* =.003	.226 [.566;.186] *p* =.185
CTQ_{PN}							-	**.364** [-.047;.650] *p* =.029	**.432** [.083;.693] *p* =.009	.186 [-.180;.444] *p* =.278
RSQ_T								-	**.914** [.795;.957] *p* <.001	**.798** [.662;.887] *p* <.001
RSQ_E									-	**.514** [.152;.725] *p* =.001

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), significant results are indicated in bold face.

Table B3

Correlations between CTQ and RSQ scores as well as passing preference [PP] during social exclusion in patients with PDD (N=34)

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
PP	-	**-.376** [-.621;-.065] *p* = .028	-.112 [-.442;.214] *p* = .530	**-.372** [-.648;.028] *p* = .031	**-.467** [-.746;.010] *p* = .005	-.237 [-.528;.096] *p* = .177	-.299 [-.552;.103] *p* = .085	-.010 [-.340;.335] *p* = .953	-.077 [-.452;.257] *p* = .666	-.001 [-.304;.335] *p* = .995
CTQ_{total}		-	**.851** [.695;.942] *p* <.001	**.603** [.287;.801] *p* <.001	**.565** [-.014;.819] *p* <.001	**.810** [.689;.923] *p* <.001	**.725** [.415;.864] *p* <.001	**.476** [.188;.707] *p* =.004	**.532** [.291;.735] *p* =.001	.330 [-.055;.662] *p* =.056
CTQ_{EA}			-	**.448** [.120;.719] *p* =. 008	.209 [-.099;.603] *p* = .235	**.699** [.509;.827] *p* <.001	**.509** [.151;.748] *p* =.002	**.441** [.092;.708] *p* =.009	**.496** [.212;.730] *p* =.003	.290 [-.116;.657] *p* =.096
CTQ_{PA}				-	.197 [-.185;.691] *p* =.265	.296 [.012;.548] *p* =.089	**.565** [.145;.796] *p* <.001	.166 [-.135;.403] *p* =.347	.124 [-.169;.383] *p* =.486	.233 [-.063;.466] *p* =.186
CTQ_{SA}					-	.261 [-.050;.460] *p* =.136	**.414** [-.023;.867] *p* =.015	.255 [.083;.596] *p* =.145	.294 [.103;.621] *p* =.092	.102 [-.144;.491] *p* =.566
CTQ_{EN}						-	**.404** [.121;.639] *p* =.018	**.360** [.024;.643] *p* =.037	**.470** [.194;.689] *p* =.005	.244 [.-.179;.630] *p* =.164
CTQ_{PN}							-	**.462** [.224;.665] *p* =.006	**.424** [.195;.633] *p* =.013	.376 [.082;.638] *p* =.029
RSQ_T								-	**.888** [.801;.943] *p* <.001	**.806** [.677;.892] *p* <.001
RSQ_E									-	**.504** [.260;.698] *p* =.002

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), significant results are indicated in bold face.

Table B4

Correlations between CTQ and RSQ scores as well as passing preference [PP] during social exclusion in patients (N=70)

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
PP	-	-.207 [-.425;-.011] *p* = .085	-.138 [-.348;.083] *p* = .255	-.184 [-.463;.069] *p* = .127	-.154 [-.458;.123] *p* = .202	**-.272** [-.442;-.086] *p* = .023	-.021 [-.239;.169] *p* = .865	.084 [-.118;.277] *p* = .489	.044 [-.170;.240] *p* = .716	.105 [-.123;.313] *p* = .387
CTQ_{total}		-	**.820** [.746;.885] *p* <.001	**.803** [.669;.880] *p* <.001	**.724** [.494;.847] *p* <.001	**.782** [.653;.872] *p* <.001	**.785** [.663;.865] *p* <.001	**.484** [.276;.642] *p* <.001	**.508** [.309;.668] *p* <.001	**.354** [.126;.538] *p* =.003
CTQ_{EA}			-	**.522** [.332;.676] *p* <.001	**.413** [.145;.609] *p* <.001	**.653** [.506;.766] *p* <.001	**.548** [.332;.718] *p* <.001	**.447** [.252;.623] *p* <.001	**.475** [.287;.632] *p* <.001	**.339** [.097;.544] *p* =.004
CTQ_{PA}				-	**.523** [.119;.772] *p* <.001	**.516** [.322;.661] *p* <.001	**.633** [.458;.781] *p* <.001	**.252** [-.039;.501] *p* =.035	**.249** [.008;.462] *p* =.037	.206 [-.079;.432] *p* =.087
CTQ_{SA}					-	**.357** [.124;.534] *p* =.002	**.559** [.222;.771] *p* <.001	**.327** [.063;.550] *p* =.006	**.305** [.066;.513] *p* =.010	**.243** [-.001;.449] *p* =.043
CTQ_{EN}						-	**.463** [.286;.652] *p* <.001	**.410** [.183;.581] *p* <.001	**.482** [.270;.638] *p* <.001	**.259** [.-.036;.519] *p* =.030
CTQ_{PN}							-	**.467** [.245;.639] *p* <.001	**.476** [.255;.644] *p* <.001	**.349** [.139;.518] *p* =.030
RSQ_T								-	**.908** [.834;.948] *p* <.001	**.822** [.736;.887] *p* <.001
RSQ_E									-	**.551** [.326;.708] *p* <.001

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), significant results are indicated in bold face.

Table B5

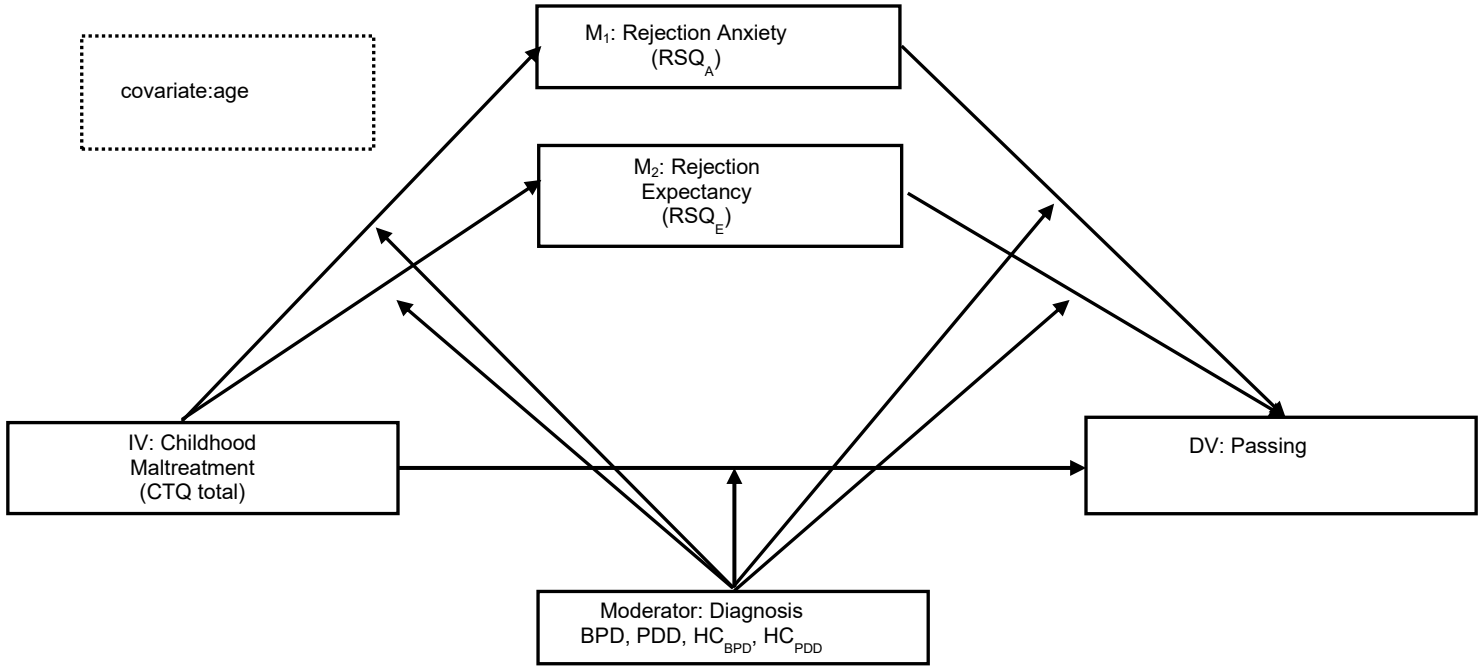
Correlations between CTQ and RSQ scores as well as passing preference [PP] during social exclusion in HC (N=70)

	PP	CTQ_{total}	CTQ_{EA}	CTQ_{PA}	CTQ_{SA}	CTQ_{EN}	CTQ_{PN}	RSQ	$RSQ_{Expectancy}$	$RSQ_{Anxiety}$
		r [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r* [BCa*CI*]	*r [BCaCI]*	*r [BCaCI]*	*r [BCaCI]*
PP	-	.045 [-.113;-.216] *p* = .710	-.013 [-.192;.154] *p* = .914	.012 [-.140;.227] *p* = .922	.017 [-.118;.215] *p* = .887	-.014 [-.220; .189] *p* = .910	.196 [-.009;.403] *p* = .105	007 [-.222;.204] *p* = .954	-.008 [-.206;.173] *p* = .948	-.061 [-.295;.170] *p* = .615
CTQ_{total}		-	**.907** [.816;.951] *p* <.001	**.761** [.494;.878] *p* <.001	**.305** [.090;.699] *p* =.010	**.805** [.687;.895] *p* <.001	**.714** [.343;.858] *p* <.001	**.244** [-.056;.481] *p* =.042	**.309** [.006;.584] *p* =.009	.064 [-.199;.313] *p* =.597
CTQ_{EA}			-	**.617** [.247;.816] *p* <.001	.175 [-.011;.626] *p* =.146	**.702** [.539;.813] *p* <.001	**.557** [.068;.774] *p* <.001	.139 [-.169;.398] *p* =.252	.155 [-.106;.467] *p* =.201	.020 [-.225;.276] *p* =.871
CTQ_{PA}				-	**.340** [-.055;.694] *p* =.004	**.424** [.104;.613] *p* <.001	**.527** [-.008;.755] *p* <.001	**.202** [-.188;.458] *p* =.093	.226 [-.193;.500] *p* =.060	.066 [-.232;.277] *p* =.588
CTQ_{SA}					-	.019 [-.192;.395] *p* =.877	.071 [-.146;.438] *p* =.561	.081 [-.076;.369] *p* =.507	.120 [-.103;.412] *p* =.321	.083 [-.051;.329] *p* =.495
CTQ_{EN}						-	**.390** [.049;.617] *p* <.001	**.300** [.019;.535] *p* =.012	**.379** [.115;.617] *p* =.001	.120 [-.140;.394] *p* =.323
CTQ_{PN}							-	.125 [-.184;.378] *p* =.302	.201 [-.091;.470] *p* =.095	-.048 [-.287;.188] *p* =.693
RSQ_T								-	**.845** [.750;.908] *p* <.001	**.865** [.807;.926] *p* <.001
RSQ_E									-	**.521** [.340;.686] *p* <.001

Note. PP: passing preference during social exclusion, RSQ: Rejection Sensitivity Questionnaire, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, higher PP scores indicate increased ball tosses towards the excluder, that were interpreted as prosocial behavior (Barton et al., 2021; Dewald-Kaufmann et al., 2021), significant results are indicated in bold face.

Figure B1

Proposed model



Note. Mediation model of the effect of emotional neglect measured by the Childhood Trauma Questionnaire subscale for emotional neglect on passing preference during Cyberball through rejection anxiety and expectancy measured by the Rejection Sensitivity Questionnaire, HC: healthy controls, BPD: borderline personality disorder, PDD: persistent depressive disorder, IV = independent variable, $M_{1, 2}$ = mediating variable, DV = dependent variable

Table B6

Summary of Mediation Analyses (10,000 Bootstrap Samples)

IV	MV	DV	Effect of IV on MV (*a*)	Effect of IV on DV	Effect of RSQ_A on DV (*b*)	Effect of RSQ_E on DV	RSQA, RSQE, IV -> DV R^2	Direct Effect (*c*)	Indirect Effect (*a* x *b*)	95% CI	Total Effect (*c'*)
CTQ_{total}		PP		**-.004**	-.004	.026	3.93 F(3,136) = 1.85,	**-.004**	.001	[-.001;.003]	**-.003**
				p = .040	*p* = .887	*p* = .540	*p* = .140	*p* = .040			*p* = .025
	RSQ_A		**.036**						-.000	[-.002;.002]	
			p <.001								
	RSQ_E		**.036**						.001	[-.002;.004]	
			p <.001								
CTQ_{EA}		PP		-.009	-.004	.014	2.86 F(3,136) = 1.34,	-.009	.001	[-.006;.009]	**-.008**
				p = .098	*p* =.897	*p* = .745	*p* = .266	*p* = .098			*p* =. 049
	RSQ_A		**.114**						-.000	[-.007;.006]	
			p <.001								
	RSQ_E		**.109**						.002	[-.007;.011]	
			p <.001								
CTQ_{PA}		PP		-.012	-.007	-.003	2.82 F(3,136) = 1.32,	-.012	-.001	[-.007;.005]	-.013
				p = .102	*p* = .819	*p* = .948	*p* = .272	*p* = .102			*p* = .052
	RSQ_A		**.108**						-.001	[-.007;.005]	
			p <.001								
	RSQ_E		**.104**						-.000	[-.008;.007]	
			p <.001								
CTQ_{SA}		PP		.009	-.007	-.006	2.22 F(3,136) = 1.03,	-.009	-.001	[-.007;.004]	-.011
				p = .174	*p* = .808	*p* = .874	*p* = .381	*p* = .174			*p* = .094
	RSQ_A		**.098**						-.001	[-.007;.004]	
			p <.001								
	RSQ_E		**.093**						-.001	[-.008;.006]	
			p <.001								
CTQ_{PN}		PP		.005	-.009	-.026	1.09 F(3,136) = 0.50,	.005	-.006	[-.015;.004]	-.001
				p = .593	*p* = .755	*p* = .525	*p* = .683	*p* = .593			*p* = .900
	RSQ_A		**.151**						-.001	[-.010;.007]	
			p <.001								
	RSQ_E		**.163**						-.004	[-.017;.009]	
			p <.001								
CTQ_{EN}		PP					**6.36 F(3,136) = 3.08**,	**-.016**	.005	[-.002;.013]	**-.011**
							p = .030	*p* = .006			*p* = .007
	RSQ_A		**.114**	**-.016**	-.003	.048			-.000	[-.007;.006]	
			p <.001	*p* = .006	*p* = .907	*p* = .270					
	RSQ_E		**.115**						.006	[-.003;.015]	
			p <.001								

Note. IV = independent variable, MV = mediating variable, DV = dependent variable, PP: Passing Preference, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, RSQ: Rejection Sensitivity Questionnaire, $\alpha = .05$, significant results are indicated in bold face

Table B7

Summary of Mediation Analyses with covariates age (10,000 Bootstrap Samples)

IV	MV	DV	Effect of IV on MV	Effect of age on MV	Effect of IV on DV	Effect of RSQ_A on DV	Effect of RSQ_E on DV	Effect of age on DV	Age, RSQA, RSQE, IV -> DV R^2	Direct Effect	Indirect Effect		Total Effect
			(*a*)			(*b*)				(*c*)	(*a* x *b*)	95% CI	(*c'*)
CTQ_{total}		PP			-.004	-.006	.025	-.001	3.99 F(4,135) = 1.40,	-.004	.001	[-.002;.003]	**-.003**
					p = .052	*p* = .856	*p* = .559	*p* =.777	*p* = .237	*p* = .052			*p* = .027
	RSQ_A		**.037**	**-.020**							-.000	[-.002;.002]	
			p <.001	*p* = .004									
	RSQ_E		**.036**	**-.012**							.001	[-.002;.004]	
			p <.001	*p* = .011									
CTQ_{EA}		PP			-.009	-.006	.013	-.001	3.09 F(4,135) = 1.08,	-.009	.001	[-.006;.008]	**-.008**
					p = .112	*p* =.838	*p* = .755	*p* = .575	*p* = .371	*p* = .112			*p* =. 049
	RSQ_A		**.113**	**-.015**							-.000	[-.007;.006]	
			p <.001	*p* = .027									
	RSQ_E		**.109**	-.008							.001	[-.007;.010]	
			p <.001	*p* = .119									
CTQ_{PA}		PP			-.011	-.008	-.003	-.001	2.92 F(4,135) = 1.02,	-.011	-.001	[-.008;.005]	-.012
					p = .130	*p* = .781	*p* = .934	*p* = .712	*p* = .402	*p* = .130			*p* = .061
	RSQ_A		**.119**	**-.021**							-.001	[-.008;.005]	
			p <.001	*p* = .008									
	RSQ_E		**.110**	-.013							-.000	[-.008;.008]	
			p <.001	*p* = .032									
CTQ_{SA}		PP			-.009	-.010	-.006	-.001	1.56 F(4,135) = 0.85,	-.009	-.002	[-.008;.004]	-.010
					p = .200	*p* = .754	*p* = .873	*p* = .579	*p* = .498	*p* = .200			*p* = .102
	RSQ_A		**.102**	**-.018**							-.001	[-.007;.004]	
			p <.001	*p* = .023									
	RSQ_E		**.095**	-.010							-.001	[-.008;.006]	
			p <.001	*p* = .097									
CTQ_{EN}		PP							6.36 F(4,135) = 2.29,	**-.016**	.005	[-.002;.014]	**-.011**
									p = .063	*p* = .008			*p* = .008
	RSQ_A		**.119**	**-.022**	**-.016**	-.003	.048	.000			-.000	[-.007;.006]	
			p <.001	*p* = .001	*p* = .008	*p* = .915	*p* = .272	*p* = .952					
	RSQ_E		**.118**	**-.015**							.006	[-.003;.016]	
			p <.001	*p* = .001									
CTQ_{PN}		PP			.005	-.012	-.026	-.002	1.49 F(4,135) = 0.51,	.005	-.006	[-.016;.004]	-.001
					p = .566	*p* = .689	*p* = .524	*p* = .460	*p* = .728	*p* = .566			*p* = .895
	RSQ_A		**.151**	**-.016**							-.002	[-.011;.006]	
			p <.001	*p* = .041									
	RSQ_E		**.163**	-.008							-.004	[-.018;.009]	
			p <.001	*p* = .154									

Note. IV = independent variable, MV = mediating variable, DV = dependent variable, PP: Passing Preference, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, RSQ: Rejection Sensitivity Questionnaire, $\alpha = .05$, significant results are indicated in bold face

Table B8

Index of Moderated Mediation of all Models

		CTQ_{total} Index 95% CI	CTQ_{EA} Index 95% CI	CTQ_{PA} Index 95% CI	CTQ_{SA} Index 95% CI	CTQ_{EN} Index 95% CI	CTQ_{PN} Index 95% CI
HC_{BPD} (W1)	RSQ_A	.000 [-.005;.007]	.000 [-.016;.015]	-.001 [-.025;.024]	-.007 [-.074;.036]	.000 [-.014;.019]	.002 [-.017;.025]
	RSQ_E	-.001 [-.017;.005]	-.001 [-.032; -013]	-.004 [-.048;.028]	-.006 [-.107;.032]	-.006 [-.044;.017]	.001 [-.038;.023]
BPD (W2)	RSQ_A	.001 [-.004;.005]	.003 [-.014;.017]	.001 [-.022;.020]	.002 [-.034;.034]	.001 [-.014;.019]	.001 [-.014;.017]
	RSQ_E	.000 [-.015;.006]	.003 [-.028;.019]	-.003 [-.038;.025]	-.003 [-.104;.034]	.001 [-.035;.028]	.001 [-.037;.026]
PDD (W3)	RSQ_A	.001 [-.004;.006]	.001 [-.016;.012]	.004 [-.019;.026]	.000 [-.038;.035]	.001 [-.015;.019]	.005 [-.013;.031]
	RSQ_E	.001 [-.015;.009]	-.002 [-.035;.015]	-005 [-.043;.022]	-.002 [-.105;.037]	-005 [-.043;.021]	.001 [-.045;.034]

Note. HC: healthy controls, BPD: borderline personality disorder, PDD: persistent depressive disorder, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, RSQ: Rejection Sensitivity Questionnaire, E: expectancy, A: anxiety, $\alpha = .05$, significant results are indicated in bold face

Table B9

Index of Moderated Mediation of all Models with Covariate Age

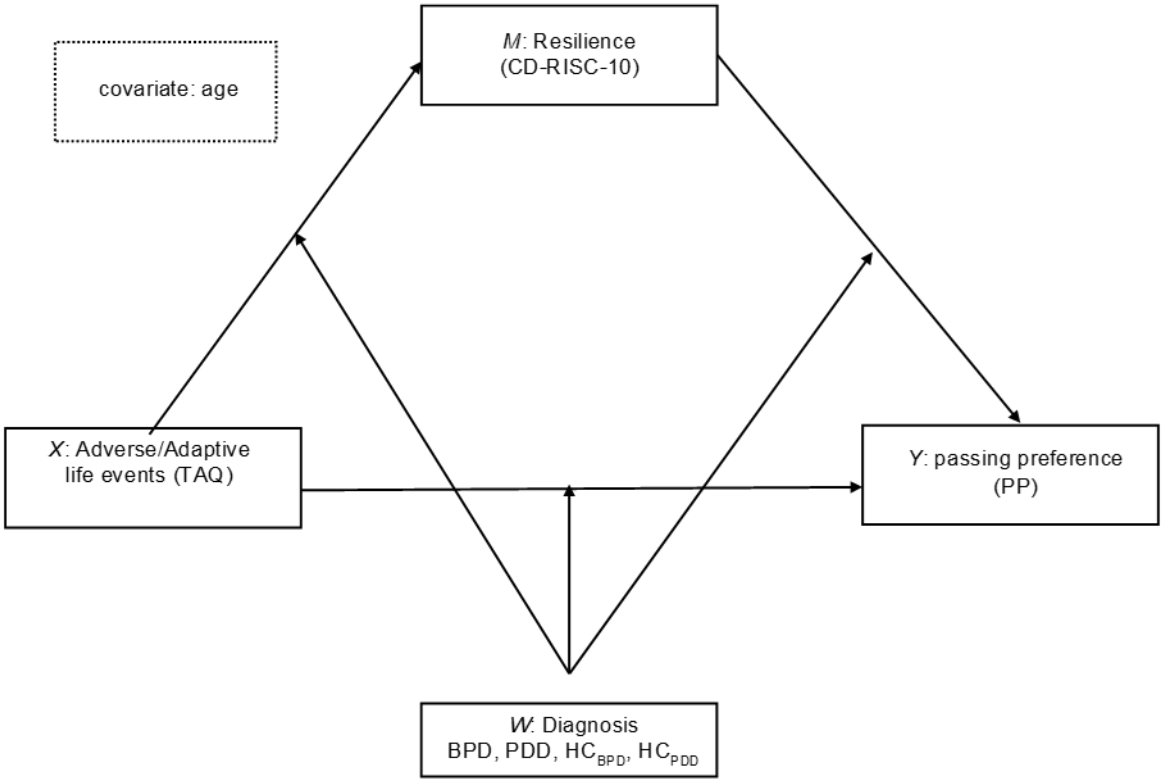
		CTQ_{total} Index 95% CI	CTQ_{EA} Index 95% CI	CTQ_{PA} Index 95% CI	CTQ_{SA} Index 95% CI	CTQ_{EN} Index 95% CI	CTQ_{PN} Index 95% CI
HC_{BPD} (W1)	RSQ_A	.000 [-.005;.006]	.000 [-.016;.016]	-.002 [-.027;.023]	-.007 [-.078;.037]	-.001 [-.017;.021]	.003 [-.019;.030]
	RSQ_E	-.001 [-.018;.005]	-.001 [-.032;.015]	-.005 [-.047;.031]	-.007 [-.113;.034]	-.008 [-.050;.021]	.001 [-.042;.025]
BPD (W2)	RSQ_A	.001 [-.004;.006]	.003 [-.013;.017]	.001 [-.022;.020]	.002 [-.030;.034]	.002 [-.016;.023]	.001 [-.016;.020]
	RSQ_E	-.000 [-.016;.007]	.003 [-.028;.020]	-.003 [-.038;.025]	-.003 [-.108;.036]	.001 [-.041;.033]	.001 [-.039;.028]
PDD (W3)	RSQ_A	.001 [-.004;.007]	.001 [-.015;.013]	.005 [-.020;.028]	.000 [-.033;.036]	.000 [-.017;.022]	.006 [-.015;.035]
	RSQ_E	.000 [-.016;.008]	-.003 [-.036;.014]	-.006 [-.045;.022]	-.003 [-.111;.038]	-.006 [-.049;.024]	.000 [-.048;.036]

Note. HC: healthy controls, BPD: borderline personality disorder, PDD: persistent depressive disorder, CTQ: Childhood Trauma Questionnaire, EA: emotional abuse, EA: emotional abuse, PA: physical abuse, SA: sexual abuse, EN: emotional neglect, PN: physical neglect, RSQ: Rejection Sensitivity Questionnaire, E: expectancy, A: anxiety, $\alpha = .05$, significant results are indicated in bold face

Appendix C: Supplementary Material Study III

Figure C1

Proposed model



Note. Mediation model of the effect of adverse and adaptive life events during childhood, youth and adulthood measured with the Traumatic Antecedents Questionnaire (TAQ) on passing preference (PP) during Cyberball through resilience measured with the Connor-Davidson Resilience Questionnaire (CD-RISC-10), HC = healthy controls, BPD = borderline personality disorder, PDD= persistent depressive disorder, *X* = independent variable, *M* = mediating variable, *W* = moderating variable, *Y* = dependent variable

Table C1

Conditional Process Analyses with Age as a Covariate

	Resilience, CD-RISC-10 (*M*)	Passing Preference, PP (*Y*)
Predictor	Coefficients (*SE*)	Coefficients (*SE*)
TAQ_N (*X*)	-.712 (1.24), *p* = .566	.05 (.05), *p* = .328
Group (*W*)	-12.47 (2.40), ***p* < .001**	.35 (.22), *p* = .103
Resilience (*M*)	-	.02 (.01), *p* = .193
Interaction term		
X × *W*	R^2 = .00, *F* (1,130) = 0.02, *p* = .885	R^2 = .02, *F* (1,128) = 2.21, *p* = .140
M × *W*		R^2 = .03, *F* (1,128) = 3.69, *p* = .057
	Effects (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.01 (.03), *p* = .797	-.044; .058
Patients	-.04 (.018), ***p* = .031**	-.077; -.004
Conditional indirect effects		
Healthy Controls	-.001	-.011; .008
Patients	-.007	-.007; .023
Index of moderated mediation	.008	-.009; .026
TAQ_{NC} (*X*)	-4.27 (3.31), *p* = .199	.21 (.15), *p* = .168
Group (*W*)	-13.19 (1.83), ***p* < .001**	.28 (.21), *p* = .180
Resilience (*M*)	-	.02 (.01), *p* = .172
Interaction term		
X × *W*	R^2 = .00, *F* (1,130) = 0.63, *p* = .427	R^2 = .02, *F* (1,128) = 2.28, *p* = .133
M × *W*		R^2 = .03, *F* (1,128) = 3.60, *p* = .060
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.08 (.07), *p* = .259	-.061; .223
Patients	-.04 (.04), *p* = .299	-.130; .040
Conditional indirect effects		
Healthy Controls	-.01	-.050; .022
Patients	.02	-.013; .049
Index of moderated mediation	.022	-.018; .074
TAQ_{NY} (*X*)	-.85 (3.26) *p* = .795	.08 (.14), *p* = .575
Group (*W*)	-12.33 (2.25) ***p* < .001**	.33 (.21), *p* = .117
Resilience (*M*)	-	.02 (.01), *p* = .200
Interaction term		
X × *W*	R^2 = .00, *F* (1,130) = 0.01, *p* = .933	R^2 = .10, *F* (1,128) = 1.45, *p* = .231
M × *W*		R^2 = .26, *F* (1,128) = 3.67, *p* = .058
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	-.02 (.07), *p* = .772	-.150; .112
Patients	-.12 (.05), ***p* = .016**	-.213; -.023
Conditional indirect effects		
Healthy Controls	-.00	-.025; .019
Patients	.02	-.021; .054
Index of moderated mediation	.02	-.026; .059
TAQ_{NA} (*X*)	.15 (3.32) *p* = .964	.12 (.14), *p* = .396
Group (*W*)	-12.38 (2.54) ***p* < .001**	.35 (.21), *p* = .095
Resilience (*M*)	-	.01 (.01), *p* = .221
Interaction term		
X × *W*	R^2 = .00, *F* (1,131) = 0.06, *p* = .805	R^2 = .02, *F* (1,129) = 2.35, *p* = .128
M × *W*		R^2 = .02, *F* (1,129) = 3.37, *p* = .069
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	-.01 (.07), *p* = .869	-.141; .119
Patients	-.14 (.06), ***p* = .013**	-.255; -.031
Conditional indirect effects		
Healthy Controls	-.00	-.021; .017
Patients	.01	-.027; .053
Index of moderated mediation	.01	-.029; .057

	Resilience, CD-RISC-10 (*M*)	Passing Preference, PP (*Y*)
Predictor	Coefficients (*SE*)	Coefficients (*SE*)
TAQ_P (*X*)	4.65 (2.28) ***p* = .044**	.20 (.11) *p* = .067
Group (*W*)	4.99 (9.84) *p* = .613	.87 (.45) *p* = .053
Resilience (*M*)	-	.01 (.01) *p* = .528
Interaction term		
X × *W*	R^2 = .01, *F* (1,130) = 2.85, *p* = .094	R^2 = .02, *F* (1,128) = 2.95, *p* = .088
M × *W*		R^2 = .01, *F* (1,128) = 1.66, *p* = .200
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.10 (.05), *p* = .054	-.002; .208
Patients	.01 (.02), *p* = .607	-.023; .039
Conditional indirect effects		
Healthy Controls	-.01	-.060; .015
Patients	-.01	-.026; .002
Index of moderated mediation	-.00	-.029; .052
TAQ_{PC} (*X*)	6.21 (5.61) *p* = .271	.36 (.25) *p* = .155
Group (*W*)	-5.51 (8.08) *p* = .505	.60 (.38) *p* = .114
Resilience (*M*)	-	.01 (.01) *p* = .345
Interaction term		
X × *W*	R^2 = .00, *F* (1,130) = 0.73, *p* = .395	R^2 = .01, *F* (1,128) = 1.61, *p* = .208
M × *W*		R^2 = .02, *F* (1,128) = 2.47, *p* = .118
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.20 (.12), *p* = .118	-.051; .444
Patients	.03 (.03), *p* = .330	-.033; .098
Conditional indirect effects		
Healthy Controls	-.00	-.068; .031
Patients	-.02	-.053; .004
Index of moderated mediation	-.01	-.061; .053
TAQ_{PY} (*X*)	5.47 (5.55) *p* = .326	.46 (.25) *p* = .063
Group (*W*)	-6.48 (7.88) *p* = .413	.72 (.37) *p* = .053
Resilience (*M*)	-	.01 (.01) *p* = .346
Interaction term		
X × *W*	R^2 = .00, *F* (1,130) = 0.59, *p* = .443	R^2 = .02, *F* (1,128) = 2.73, *p* = .101
M × *W*		R^2 = .02, *F* (1,128) = 2.54, *p* = .114
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.25 (.12), ***p* = .041**	.011; .490
Patients	.04 (.03), *p* = .209	-.024; .110
Conditional indirect effects		
Healthy Controls	-.00	-.071; .031
Patients	-.01	-.046; .005
Index of moderated mediation	-.01	-.056; .060
TAQ_{PA} (*X*)	13.55 (5.23) ***p* = .011**	.28 (.25) *p* = .257
Group (*W*)	5.19 (7.64) *p* = .498	.50 (.35) *p* = .164
Resilience (*M*)	-	.01 (.01) *p* = .501
Interaction term		
X × *W*	R^2 = .02, *F* (1,131) = 5.18, ***p* = .024**	R^2 = .01, *F* (1,129) = 1.71, *p* = .193
M × *W*	-	R^2 = .01, *F* (1,129) = 1.48, *p* = .226
	Effect (*SE*)	***95% CI***
Conditional direct effects		
Healthy Controls	.11 (.12), *p* = .355	-.129; .358
Patients	-.06 (.04), *p* = .178	-.136; .025
Conditional indirect effects		
Healthy Controls	-.01	-.117; .068
Patients	-.01	-.044; .018
Index of moderated mediation	-.00	-.083; .109

Note. *X* = independent variable, *M* = mediating variable, *W* = moderating variable, *Y* = dependent variable , PP = passing preference during social exclusion, higher PP scores indicate increased ball tosses towards the excluder (Barton et al., 2021; Dewald-Kaufmann et al., 2021), TAQ = Traumatic Antecedents Questionnaire, TAQ_N = total score negative life

events, TAQ_{NC} = adverse events during childhood, TAQ_{NY} = adverse events during youth, TAQ_{NA} = adverse events during adulthood, TAQ_{P} = total score adaptive life events, TAQ_{PC} = adaptive events during childhood, TAQ_{PY} = adaptive events during youth, TAQ_{PA} = adaptive events during adulthood, $\alpha = .05$, significant results are indicated in bold face

Specific Note. The TAQ was filled out by 35 patients with BPD, 31 patients with PDD, by 36 HC_{BPD} and by 33 HC_{PDD}; the CD-RISC-10 was filled out by 36 patients with BPD, 33 patients with PDD, by 36 HC_{BPD} and by 34 HC_{PDD}