Socioemotional Functioning in Youth with Borderline Personality Disorder

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Declaration

This thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or been awarded another degree or diploma.

No parts of this thesis have been submitted towards the award of any other degree or diploma in any other tertiary institution.

No other person's work has been used without due acknowledgment in the main text of the thesis.

All research procedures reported in the thesis received the approval of the relevant ethics committees (where required).

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List of Abbreviations

APD	Antisocial Personality Disorder
BPD	Borderline Personality Disorder
EMG	Electromyography
fMRI	Functional Magnetic Resonance Imaging
HC	Healthy Control
HADS	Hospital Anxiety and Depression Scale
HYPE	Helping Young People Early Program
IAPS	International Affective Picture System
MASC	Movie for the Assessment of Social Cognition
MDD	Major Depressive Disorder
Orygen	Orygen, The National Centre of Excellence in Youth Mental Health
OYH	Orygen Youth Health
PANAS	Positive and Negative Affect Schedule
RMET	Reading the Mind in the Eyes Test
RMS	Root Means Square
TOM	Theory of Mind
WASI	Wechsler Abbreviated Scale of Intelligence

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Abstract

This thesis makes an original contribution to our understanding of socioemotional functioning in borderline personality disorder (BPD) by critically examining social cognition and emotion regulation BPD research from a developmental perspective. It also extends on previous research, making a novel and important contribution to our understanding of sociocognitive functioning and emotion regulation ability in youth with first presentation BPD. This was achieved via two critical narrative reviews of the existing literature and two empirical studies, which examined aspects of social cognition and emotion regulation considered key to interpersonal functioning in BPD. The empirical studies assessed, 1) unconscious simulation processes, a key aspect of affective empathy, and 2) the application of two emotion regulation strategies, expressive suppression and cognitive reappraisal, in the regulation of negative and positive affect, in a standard laboratory context, as well as in the context of social rejection.

The reviews demonstrated that despite their shared diagnosis, important differences between young people and adults with BPD, in terms of their sociocognitive functioning and emotion regulation abilities, are evident. Future research and reviews should avoid conflating developmental age and stage of disorder. Instead, these processes, which are central to interpersonal functioning, need to be better understood over the course of BPD, especially early in its course.

The empirical studies demonstrated that socioemotional functioning in youth with first presentation BPD is not uniformly affected. Specifically, rapid facial mimicry was unimpaired, contradicting predictions that heightened unconscious motor mimicry leads to heightened emotional contagion, and associated emotion regulation difficulties. Future

research is needed to determine whether this finding also holds true for adults and young people later in the course of the disorder. Future research should also explore other factors that might lead to heightened emotional contagion and associated emotion regulation difficulties in BPD.

Emotion regulation ability was largely preserved in youth with first presentation BPD, and functioning was mostly similar to that of typically developing young people. Specifically, for the most part, they could apply expressive suppression and cognitive reappraisal, to regulate both positive and negative affect (felt subjectively and expressed behaviourally), in a standard laboratory context and in the context of social rejection, with similar effectiveness to that of healthy youth. However, youth with first presentation BPD were not only unable to apply cognitive reappraisal to regulate the behavioural expression of negative emotions in the context of social rejection, but its application in this context intensified their facial expression of negative affect. They also demonstrated a pattern of pervasively blunted positive affect, relative to healthy youth, across indices and contexts. Further research is needed to better understand whether the effectiveness of cognitive reappraisal can be improved in this context, or whether it is contraindicated. Given that social rejection is commonly experienced by this group, and given the common application of cognitive strategies in therapy, future research is clearly needed to better understand the effectiveness and consequences of this, and alternative strategies, for use in the context of social rejection by youth with first presentation BPD. Finally, while positive affect has often been neglected in BPD research, the evident pervasive blunting clearly needs greater research and clinical attention in this group.

Chapter 1: Introduction and Overview

1.1 Thesis Structure

This thesis is comprised of seven chapters. The current chapter (Chapter 1) provides an overview of the thesis and its structure, as well as the background, rationale and aims for the thesis as a whole. Chapter 2 provides a critical review of the BPD literature relating to social cognition. Chapter 3 provides a critical review of the BPD literature relating to emotion regulation. The reviews presented in Chapter 2 and 3 approach the literature from a developmental perspective, focused on the period between adolescence and adulthood. They first provide an overview of what is understood of normal development in the respective areas, and then review the adult BPD literature followed by the youth BPD literature. A complete and detailed methodology of the empirical research undertaken is then presented in Chapter 4. Following that, Chapters 5 and 6 present the findings of the two empirical studies which addressed key gaps identified in the research literature to date. Chapter 5 explored the rapid facial mimicry response, an unconscious motor mimicry process, which is a key aspect of affective empathy, and Chapter 6 explored the effective application of specific emotion regulation strategies across different contexts. Finally, Chapter 7 provides a summary and synthesis of the findings presented in this thesis and discusses implications for clinical practice and future research in the field.

1.2 Borderline Personality Disorder: Features, Prevalence and Course

Borderline personality disorder (BPD) is characterised by a pervasive pattern of unstable interpersonal relationships, affects, self-image, and impulsivity (American Psychiatric Association, 2013). Its personal, social, and economic costs are severe

(Chanen, Sharp, Hoffman, & Global Alliance for Prevention and Early Intervention for Borderline Personality Disorder, 2017), and include chronic psychosocial dysfunction (Gunderson & Lyons-Ruth, 2008; Gunderson et al., 2011; Lis & Bohus, 2013; Stanley & Siever, 2010; Zanarini et al., 2007), marked burden on carers (R. C. Bailey & Grenyer, 2013), and high rates of health service utilisation (Ansell, Sanislow, McGlashan, & Grilo, 2007; Bender et al., 2001). Individuals with BPD also have a disproportionately high suicide rate 50 times higher than that found in the general population, with 8 to 10 per cent of those diagnosed completing suicide (American Psychiatric Association Work Group on Bordeline Pesonality Disorder, 2001; Pompili, Girardi, Ruberto, & Tatarelli, 2005).

Diagnostically, BPD features lessen significantly over time (Gunderson et al., 2011; Zanarini, Frankenburg, Bradford Reich, & Fitzmaurice, 2012). Relatively long-lasting remissions spanning 2-8 years are common, and rates of reoccurrence (i.e., diagnostic symptoms reaching diagnostic threshold again following a period of remission) are low (Gunderson et al., 2011; Zanarini et al., 2012). Nevertheless, adaptive day-to-day psychosocial functioning within social and occupational milieus is much more elusive, and remains chronically impaired despite remission (Gunderson et al., 2011; Zanarini, Frankenburg, Bradford Reich, & Fitzmaurice, 2010a, 2010b).

1.3 Interpersonal Dysfunction in BPD

Importantly, while many diagnostic features of BPD lessen gradually during adulthood (Gunderson et al., 2011; Zanarini et al., 2012), interpersonal dysfunction persists, and remains the most severe and debilitating aspect of the disorder (Gunderson et al., 2011; Lis & Bohus, 2013). Such difficulties include relational conflict, frequent episodes of break-ups and reconciliations, poor social problem solving, and high levels of relational aggression (Bouchard, Sabourin, Lussier, & Villeneuve, 2009; Bray, Barrowclough, & Lobban, 2007; Gunderson, 2007). The severity and pervasiveness of interpersonal dysfunction in BPD is such that it differentiates BPD from mental state disorders (Axis I disorders in DSM-IV-TR) and personality disorders (Axis II disorders in DSM-IV-TR) (Lazarus, Cheavens, Festa, & Rosenthal, 2014; Wilson, Stroud, & Durbin, 2017). In addition, individuals with BPD demonstrate pervasive impairments across all interpersonal domains (such as romantic, parent-child, family, and peer), in contrast with most other personality disorders for which individuals tend to experience domain specific impairments (Wilson et al., 2017).

Despite such pervasive interpersonal impairments, the various factors and processes that might contribute to and maintain interpersonal dysfunction in BPD are not well understood. Two processes considered central to healthy interpersonal functioning are social cognition and emotion regulation (Adolphs, 2001; Brothers, 2002; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Gross, 2002; Southam-Gerow & Kendall, 2002). Social cognition (Jeung & Herpertz, 2014; Roepke, Vater, Preißler, Heekeren, & Dziobek, 2013) and emotion regulation (Carpenter & Trull, 2013; Crowell, Beauchaine, & Linehan, 2009; Linehan, 1993; Putnam & Silk, 2005) are thought to be impaired in BPD and thus thought to contribute to the chronic and pervasive interpersonal dysfunction associated with the disorder.

Both processes have received increased research attention within the BPD literature over the past fifteen to twenty years. However, the vast majority of this research has focused on adults with established disorder ranging broadly in age (18-65 years, with the mean age across studies approximately 30 years[1]). In comparison, little

[1] This figure is based on the studies reviewed in Chapters 2 and 3 of this thesis.

attention has been given to young people (10-24 years[2]), despite evidence that the disorder's onset typically occurs between puberty and young adulthood (Biskin, 2015; Chanen, 2015; Chanen & McCutcheon, 2013). In addition, the average age of onset of BPD is around thirteen years (Zanarini, Frankenburg, Khera, & Bleichmar, 2001), BPD in youth occurs at strikingly similar rates compared with adults (Chanen et al., 2004; Chanen, Jovev, Djaja, et al., 2008; Grilo et al., 1996; Korzekwa, Dell, Links, Thabane, & Webb, 2008; Torgersen, Kringlen, & Cramer, 2001), youth and adults demonstrate similar rates of diagnostic stability (Chanen et al., 2004), and comparable rates of symptoms are evident in BPD adolescent inpatients compared with adults (Zanarini et al., 2017). A continued focus on adults and a lack of focus on young people limits understanding of the aetiology, course, and consequences of sociocognitive and emotion regulation difficulties in BPD.

1.4 The Importance of Applying a Developmental Approach to Understanding Social Cognition and Emotion Regulation in BPD

A developmental psychopathological approach to BPD advocates improved understanding of the development of the disorder, including impairments evident early in its course (Chanen, 2015; Chanen & Kaess, 2012; Chanen et al., 2017; Lenzenweger & Cicchetti, 2005; Sharp & Tackett, 2014b). This approach proposes that various environmental, biological, temperamental, sociocognitive, and genetic risk factors for the disorder are present throughout childhood (Chanen, Berk, & Thompson, 2016; Chanen & McCutcheon, 2013; T. C. Geiger & Crick, 2010; Sharp & Tackett, 2014a), and that precursors of personality pathology are also likely evident

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[2] The World Health Organisation defines individuals aged 10-24 years as 'young people', 10-19 years as 'adolescents', and 15-24 years as 'youth' (World Health Organisation, 2014).

early in life (Chanen & McCutcheon, 2013; Hecht, Cicchetti, Rogosch, & Crick, 2014). For example, a combination of environmental (e.g., exposure to abuse or neglect) and biological risk factors (e.g., predisposition to be overly sensitive to stimuli perceived as aversive) might precede the affective instability and mood reactivity characteristic of BPD, which might then lead to behavioural (e.g., aggressive behaviour) and biological (e.g., increased heart-rate) difficulties with emotion regulation (Carlson, Egeland, & Sroufe, 2009; T. N. Crawford, Cohen, Chen, Anglin, & Ehrensaft, 2009; T. C. Geiger & Crick, 2010; Schore, 2015; Sroufe, 1996).

While such factors might place individuals *at risk* of BPD, certain features of BPD might also be *consequences* of the chronic experience of the disorder (Lenzenweger & Cicchetti, 2005; Stepp et al., 2014). Longer duration of illness increases exposure to iatrogenic harm (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes, Clark, & Chanen, 2015), and to the consequences of stressful life events associated with BPD (Pagano et al., 2004; Wingenfeld et al., 2011). Understanding sociocognitive functioning and emotion regulation in adults with BPD is important but insufficient to achieve a complete understanding of the disorder's aetiology and course. This requires a stronger focus on BPD earlier in the course of the disorder, which is currently lacking.

Understanding BPD when it typically first emerges, that is, in adolescence and young adulthood, will inform early intervention efforts which aim to treat the disorder earlier with a view to preventing the long-term damaging impact it can have (Chanen & Kaess, 2012; Fonagy et al., 2015; Kaess, Brunner, & Chanen, 2014). Young people with early stage BPD afford us a unique opportunity to examine factors at the onset of the disorder that might be related to the chronic interpersonal dysfunction seen in BPD over a lifetime. In fact, research with typically developing young people indicates that this stage of development is a sensitive period for adapting to the social environment, and in particular for sociocognitive development and emotion regulation (Ahmed, Bittencourt-Hewitt, & Sebastian, 2015; Blakemore & Mills, 2014). More broadly it is a crucial period for the development and establishment of important life skills, social roles, relationships, and vocational pathways (Arnett, 2010), all of which require good enough interpersonal skills.

1.5 Overall Objectives

The overarching aim of the current thesis was to explore sociocognitive and emotion regulation impairments in young people with BPD that might underlie interpersonal dysfunction in the disorder. This was addressed via two critical reviews and two empirical studies. The aim of the reviews was to provide a critical examination and synthesis of the existing research literature regarding social cognition and emotion regulation in BPD from a developmental perspective. To do this the reviews placed current findings in the BPD literature in the context of normative developmental findings and paid particular attention to arising aberrant developmental patterns within BPD.

In addition, the reviews enabled the identification of key gaps in the existing social cognition and emotion regulation BPD literature, some of which were explored via two empirical studies. Study 1 investigated the rapid facial mimicry response, which is considered to be a low-level affective empathy mechanism thought to underlie higher order empathic processes important for interpersonal functioning. Previous research has not explored low-level affective empathy mechanisms, which are theorised to contribute to interpersonal dysfunction in BPD (Herpertz, Jeung, Mancke, & Bertsch, 2014). The focus was on understanding such mechanisms early in the trajectory of BPD in contrast to typically developing peers.

Difficulties in emotion regulation have been widely implicated to underlie the interpersonal deficits associated with BPD (Carpenter & Trull, 2013; Herr, Rosenthal, Geiger, & Erikson, 2013; Linehan, 1993; Putnam & Silk, 2005). However, findings with respect to the application of emotion regulation strategies have generally not borne this out. For example, adult patients with BPD have been found to be able to apply cognitive reappraisal strategies as effectively as healthy controls to manage negative emotions (Baczkowski et al., 2016; Fitzpatrick & Kuo, 2016). This suggests that other factors, such as the context within which emotion regulation takes place need to be considered. For instance, individuals with BPD are theorised to be biologically predisposed to experience heightened sensitivity to rejection cues in their environment (Gunderson, 2007). Therefore, it might be that individuals with BPD do not have generalised difficulties with applying emotion regulation strategies, but instead experience a specific impairment only in certain contexts, such as those involving social rejection. Study 2 explored the ability of youth with first presentation BPD to apply emotion regulation strategies in a standard laboratory context versus a social rejection context.

The focus of the empirical studies was on understanding such mechanisms early in the trajectory of BPD, in contrast to typically developing peers. Accordingly, the sample consisted of first presentation BPD youth, aged 15-25 years, who met three or more BPD diagnostic criteria (American Psychiatric Association, 2000). The presence of subthreshold BPD features in youth first presenting for psychiatric care is clinically significant. It is associated with more severe mental illness and poorer adaptive functioning compared with that seen in youth presenting for psychiatric care with no features of BPD (K. N. Thompson et al., in press). Therefore, youth presenting with three to four features were included along with those who met five to nine features. They were compared with a matched sample of healthy peers to shed light on deviations from typical development. The focus of the empirical studies was not to apply a categorical diagnostic approach and make observations regarding the differences between BPD and other clinical disorders, but instead to describe deviations from normative development. Research and intervention focused on youth with first presentation BPD, including those with subthreshold features, is important because they are the ideal target group for early intervention efforts, with a view to preventing the chronic dysfunction that persists in BPD.

Chapter 2: A Critical Review and Synthesis of Social Cognition Research in Borderline Personality Disorder: A Developmental Perspective

2.1 Preamble

This chapter provides a critical examination and novel synthesis of the existing literature relating to social cognition in BPD within a developmental framework. It does this by reorganising the existing BPD social cognition literature according to developmental periods and considers findings alongside what is understood of normative development. The aim of this approach was to reflect on existing findings and apparent inconsistencies, and to draw attention to any arising developmental patterns that might otherwise not be evident. In addition, this chapter identifies gaps that remain to be addressed, and makes recommendations for future research.

2.2 Introduction

Social cognition encompasses a range of mental processes that underpin, and are involved in, making sense of the social world and facilitating social interactions (Adolphs, 2001; Brothers, 2002; Fiske & Taylor, 2016). These processes include the perception and interpretation of social information, such as the feelings, thoughts and intentions of others (Brothers, 2002; Ostrom, 1984). The resulting representations of oneself in relation to others guide both automatic and voluntary social behaviour (Adolphs, 2001; Adolphs & Spezio, 2009).

Deficits in social cognition are thought to underpin the enduring interpersonal dysfunction in BPD (Jeung & Herpertz, 2014; Roepke et al., 2013), and have been the focus of considerable research over the past fifteen to twenty years. The vast majority of this research, however, has focused on adults (ranging broadly in age from 18-65 years, with a mean age of around 30 years; see Tables 2.1 – 2.7 for study details). While there has been an increased focus on young people with BPD over the past decade, findings are often subsumed within the adult BPD literature (e.g., Daros, Zakzanis, & Ruocco, 2013; Kaiser, Jacob, Domes, & Arntz, 2016), which conflates key normative developmental periods for social cognition.

In addition, a lack of attention to clinical staging has meant that most research to date also conflates stages of illness. The clinical staging model overlaps with and extends from a developmental psychopathological approach and proposes a progression through clinical stages of the disorder (Chanen, 2015; Chanen & McCutcheon, 2013). Drawing on developmental psychopathological approaches, the clinical staging model proposes that BPD progresses through mild or non-specific symptoms (e.g., emotion regulation disturbance), which might then be followed by subthreshold features, and full threshold episode(s), which for some individuals develop into recurring or persistent unremitting disorder (Chanen et al., 2016). Because chronological age and stage of the disorder do not neatly align with age, such that end-stage persistent BPD is not only evident in adults, but can also be present, and reliably diagnosed, between puberty and emerging adulthood (Chanen, 2015), studies across different clinical stages of the disorder are also needed in order to understand the course of sociocognitive dysfunction in BPD.

Therefore, in order to be able to understand the developmental trajectory of sociocognitive functioning in BPD, consideration needs to ideally be given to both how the disorder manifests during different developmental periods, as well as at different stages of the disorder. That is, recognizing that developmental stage and stage of the disorder overlap and interact. This review represents a first step towards describing social cognition in BPD adopting a developmental framework. However, to date, most studies do not identify clinical stage. The current review will therefore focus on developmental age and will comment on stage wherever possible but notes that greater attention to stage of disorder is a challenge for future research.

2.2.1 Defining social cognition for the purpose of the current review.

Sociocognitive processes undergo major changes during the second and the third decades of life, and are especially sensitive to the various neurological, biological, cognitive and social changes that take place during that time (Ahmed et al., 2015; Blakemore & Mills, 2014; Brizio, Gabbatore, Tirassa, & Bosco, 2015; Klapwijk et al., 2013). For example, theory of mind/mentalizing ability (discussed in Section 2.7) continues to develop in late adolescence, brain regions associated with social functioning demonstrate structural and functional changes during adolescence, and adolescents and adults differ in their approach to social cognition tasks (Blakemore, 2012; Blakemore & Mills, 2014). Therefore, pooling studies of sociocognitive processes across the lifespan (e.g., adolescent and adult BPD studies) is likely to be misleading and might result in inaccurate conclusions. Studies are needed that focus on comparing BPD populations with same-aged peers at different developmental ages and clinical stages of disorder in order to understand when sociocognitive processes might begin to deviate from typical development, as well as the nature of these deviations.

Social cognition research in BPD is by and large siloed according to the various constructs that have been studied, and attempts at integrating findings are only recent (e.g., see model proposed by Herpertz et al., 2014). This siloing is likely influenced by the fact that social cognition encompasses various different, yet related mental processes (e.g., facial emotion recognition and empathy). Social-cognitive paradigms and assessment tools tend to focus on specific constructs (e.g., theory of mind or rejection sensitivity), and studies tend to select one specific area to research (e.g., empathy is generally studied separately from rejection sensitivity and facial emotion recognition). This review focuses on the sociocognitive processes with sufficiently robust research records in the adult BPD literature, as well as some exploration of the same processes in young people with BPD. The areas identified were: emotion recognition (see reviews by Daros et al., 2013; Mitchell, Dickens, & Picchioni, 2014), emotion sensitivity (e.g., Jovev et al., 2011), rejection sensitivity (e.g., Berenson et al., 2016), attentional bias to emotional stimuli (see reviews by Baer, Peters, Eisenlohr-Moul, Geiger, & Sauer, 2012; Kaiser et al., 2016), and empathy (which is often used interchangeably with the terms mentalisation and theory of mind (TOM)) (Dinsdale & Crespi, 2013; Sharp et al., 2011).

2.2.2 Aim and scope of the current review.

The aim of this review was to summarise and synthesise the existing literature relating to social cognition in BPD, and to reflect on existing findings, inconsistencies and arising patterns, within a developmental framework. The review focused on studies that compared behavioural outcomes between groups. It neither focused on other types of analyses, including correlation, regression, and factor analysis, nor did it seek to review neuroimaging studies. However, reference is made to these types of studies and methodologies where relevant. The narrative review is complemented by tables that summarise the key features and findings of group comparison studies. This review represents a first step towards describing social cognition in BPD using a developmental framework. It maps what is currently known about sociocognitive functioning in BPD from adolescence through adulthood and places these findings in the context of what is known of normative sociocognitive development. However, it should be noted that this is not an exhaustive review of normative developmental research, but rather, an overview of key findings to date is provided.

2.3 Attentional Bias Towards Emotional Stimuli

2.3.1 Purpose of attentional bias towards emotional stimuli.

An attentional bias towards emotional, and in particular threatening stimuli, facilitates rapid adaptive behaviours that provide an evolutionary advantage (Boyer & Bergstrom, 2011; Pool, Brosch, Delplanque, & Sander, 2016). An abnormally heightened attentional bias towards threat, however, can amplify scanning of the environment even in the absence of threat. This leads to increased arousal to innocuous stimuli, increased maladaptive physiological and behavioural responses, and greater use of maladaptive regulatory strategies to avoid threat. In turn, these responses can perpetuate a bidirectional feedback loop resulting in fear and anxiety, and further increased threat detection and hypervigilance (Fox, Cahill, & Zougkou, 2010; Kimble et al., 2014; Van Bockstaele et al., 2014).

At a conscious level, trouble with attention allocation (such as difficulty disengaging attention or heightened avoidance) can also have maladaptive consequences. For example, difficulty disengaging from threat (i.e. heightened/prolonged attention towards threat) is associated with increased internalizing symptoms (such as chronic heightened stress and rumination) in healthy primary aged children as well as in children with *distress disorders*[3] (Salum et al., 2013). Difficulty disengaging from emotive stimuli also interferes with the ability to maintain goal-directed behaviour, a key developmental achievement during

[3] *Distress disorders,* as defined by the authors, included generalised anxiety disorder, depressive disorders, and post-traumatic stress disorder (Salum et al., 2013).

adolescence (Monk et al., 2003). Increased avoidance of emotional, and in particular threatening stimuli, is associated with greater internalizing symptoms in children with *fear-related disorders*[4] (Salum et al., 2013), and generalised anxiety disorder in adolescents (Monk et al., 2006). Treatments that focus on problems with attention allocation to emotional stimuli should therefore take the patient group into account and address the direction of attention allocation (i.e., whether the difficulty is with respect to heightened attention towards or away from threat) (Salum et al., 2013).

2.3.2 Typical development of attentional bias towards emotional stimuli from adolescence through adulthood.

In typically developing populations attention allocation is commonly assessed using variants[5] of the emotional stroop task, during which, for example, participants are shown emotive words and are asked to rapidly name the colour that the words are printed in. An *interference* score is typically calculated by subtracting the reaction time for neutral stimuli from the reaction time for the target emotive stimuli. A positive interference score therefore indicates greater attention towards the emotional stimuli. Emotional stroop studies with typically developing individuals suggest that brain regions involved in the regulation of attention allocation to emotional stimuli, and associated emotion regulation, continue to develop between childhood and adulthood (Hwang et al., 2014; Sebastian, Roiser, et al., 2010; Veroude, Jolles, Croiset, & Krabbendam, 2013). However, behavioural responses on the emotional stroop task do not suggest continued development between childhood and adulthood.

[4] *Fear-related disorders,* as defined by the authors, included phobias and social anxiety disorder (Salum et al., 2013).
[5] While the traditional stroop paradigm uses words as stimuli, various normative developmental studies that have used the emotional stroop paradigm have used emotive stimuli (such as images) instead of emotive words. Also, instead of asking participants to name the colour that the words are printed in, participants might be required to count the number of numerical digits (e.g., Hwang, White, Nolan, Sinclair, & Blair, 2014).

Therefore, a ceiling effect might be at play, whereby the emotional stroop task might not be sensitive enough to detect behavioural developmental changes (Hwang et al., 2014; Sebastian, Roiser, et al., 2010; Veroude et al., 2013).

The emotional dot-probe task appears to be more behaviourally sensitive, and can detect behavioural differences in attention allocation between childhood and adulthood (Reinholdt-Dunne, Mogg, Esbjorn, & Bradley, 2012). In this task, participants are typically simultaneously shown an emotionally salient (e.g., an angry face) and a neutral stimulus at different locations on the screen. The images are then typically replaced by a single dot at the location of one of the images and participants quickly indicate (usually via button press) the location of the dot. Faster reaction times when the dot replaces the emotive stimulus indicate greater attention towards it, and a faster reaction to the neutral stimulus indicates attention away from the emotive stimulus. Research findings from emotional dot probe studies indicate that children and adolescents, aged 8 to 18 years, experience an automatic attentional bias towards, and interference during conscious processing from, threatening stimuli (Wolters et al., 2012). A greater bias towards threatening stimuli for typically developing children compared with adolescents is evident, and in particular for children with higher levels of anxiety (Reinholdt-Dunne et al., 2012; Wolters et al., 2012), and those with lower levels of effortful control (Lonigan & Vasey, 2009). This suggests that a bias towards emotional stimuli reduces over time in typically developing populations, and that it is positively correlated with levels of anxiety and effortful control.

2.3.3 Attentional bias towards emotional stimuli in adults with BPD.

Cognitive formulations of BPD posit that those with the disorder are unconsciously hypervigilant to threat, and have trouble consciously controlling attention allocation (Arntz, 2014; Beck, Davis, & Freeman, 2014; Linehan, 1993).

Supraliminal emotional stroop studies (see Table 2.1 for details) have generally found that, compared with healthy controls, adult patients with BPD experience greater interference for generally negative words (Arntz, Appels, & Sieswerda, 2000; Sieswerda, Arntz, & Kindt, 2007; Wingenfeld, Rullkoetter, et al., 2009), for schema or autobiographically specific words (Sieswerda et al., 2007; Sieswerda, Arntz, Mertens, & Vertommen, 2006; Wingenfeld, Mensebach, et al., 2009), and for positive words (Sieswerda et al., 2006), but not for neutral words (Arntz et al., 2000; Sieswerda et al., 2007; Sieswerda et al., 2006; Wingenfeld, Mensebach, et al., 2009; Wingenfeld, Rullkoetter, et al., 2009). These studies, along with a recent meta-analysis (Kaiser et al., 2016), concluded that attentional biases for generally negative, BPD schema specific, as well as personally relevant words, were present in BPD.

Functional magnetic resonance imaging (fMRI) during the administration of the emotional stroop task indicates dysfunction in adult patients with BPD compared with healthy control participants. Specifically, brain regions associated with the regulation of stress and emotions (anterior cingulate cortex and frontal brain regions) show greater activation in healthy controls compared with adult BPD patients (Wingenfeld, Rullkoetter, et al., 2009). Neuroimaging (fMRI) studies also show that adult patients with BPD allocate increased attention towards emotive stimuli (greater activation in occipital areas across all valences) and attempt to regulate positive emotions to a greater degree (greater activation in superior temporal gyrus, dorsolateral and dorsomedial prefrontal cortex and anterior cingulate cortex in response to positive stimuli) compared with healthy controls (Winter et al., 2015).

In contrast, other studies (Table 2.1) have found greater interference for both neutral and negative words for adult patients with BPD, compared with healthy controls (Domes et al., 2006), no difference between adult BPD patients and healthy controls (Sprock, Rader, Kendall, & Yoder, 2000), and greater interference specifically for adult BPD patients who underwent a dissociation induction procedure but not for those who did not (Winter et al., 2015). However, participant related factors (such as strict exclusion criteria, including the exclusion of participants with comorbid mental state disorders, which reduces the representativeness of the sample), words that were insufficiently emotive, age differences between groups, and lack of statistical power to reliably detect differences might have variously influenced these contrasting findings (see Table 2.1 for details).

Two studies also assessed preconscious attentional processes in adult patients with BPD by including a subliminal emotional stroop component (Arntz et al., 2000; Sieswerda et al., 2007) (Table 2.1). Another study used the emotional dot-probe paradigm with presentation times being a combination of 200 and 500 ms[6] (which is on the cusp of the unconscious/conscious attentional processing window) (Brüne et al., 2013) (Table 2.2). Shorter presentation times are considered to more accurately assess automatic/unconscious attentional processes such as an attentional bias[7] (Harvey et al., 2004). Subliminal emotional stroop studies did not show an attentional bias for adult patients with BPD when they were compared with healthy controls and adults with cluster C personality disorder (Arntz et al., 2000; Sieswerda et al., 2007). But compared with healthy controls, adult BPD patients demonstrated a ‘bias’ away from, perhaps better interpreted as actively disengaging or avoiding, angry (threatening) faces during the emotional dot-probe task (Brüne et al., 2013). However, the emotional stroop and the emotional dot-probe tasks are qualitatively different and

[6] Trials of emotion faces were either 200 ms or 500 ms. Because no difference in response pattern was evident for the shorter vs the longer presentation time, the data was pooled across presentation times.
[7] Longer presentation times (approximately > 500 ms) arguably access conscious processing and therefore are more reflective of interference or trouble disengaging rather than an attentional bias per se (de Ruiter & Brosschot, 1994; Harvey, Watkins, Mansell, & Shafran, 2004; Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006; Posner & Petersen, 1990).

therefore difficult to compare. For example, the emotional dot-probe task (in this instance) used faces for stimuli, whereas the emotional stroop tasks used emotion words. It might be that faces are more ecologically valid (e.g., socially threatening) than single emotive words, and are thus more likely to elicit an avoidant response.

Thus, emotional stroop and emotional dot-probe studies focused on adults with BPD indicate that, as observed by Baer et al. (2012), they experience an 'attentional bias' *towards* emotive stimuli only during supraliminal (conscious) stimuli presentations but not during subliminal (preconscious) presentations. This suggests that the 'bias' might be a controlled attentional process, better described as difficulty disengaging, relating to attention allocation/shifting rather than an automatic one relating to hypervigilance.

2.3.4 Attentional bias towards emotional stimuli in young people with BPD.

To date, there are no published studies of young people with BPD that have explored attentional bias or allocation using the emotional stroop task. There are, however, three studies that have investigated attentional bias to emotion faces using the emotional dot-probe task. Jovev et al. (2012) found that, compared with healthy controls, youth with first presentation BPD had a specific unconscious attentional bias towards threatening emotion faces, which was not generalised to all emotions. This could lead to difficulties managing threat related arousal and regulating associated anxiety, and could result in transient paranoia, and poor psychosocial and interpersonal functioning (Jovev et al., 2012). In addition, during conscious processing, young people with BPD (and those with mixed psychiatric diagnoses) had greater difficulty than healthy controls disengaging from fearful as well as angry, disgusted, anxious, sad, and neutral facial expressions (Jovev et al., 2012; von

Ceumern-Lindenstjerna et al., 2010b). Such difficulty disengaging could increase internalising symptoms, such as rumination and heightened stress.

When emotion faces were presented for an extended period of 1500 ms, group differences dissipated (von Ceumern-Lindenstjerna et al., 2010a), suggesting that adolescents (aged 13-19) with BPD, and those with mixed psychiatric conditions and healthy controls were equally able to direct attention away and disengage from emotional stimuli. However, when adolescents with BPD were in a negative mood they allocated greater attention to negative emotion faces, and when they were in a positive mood they avoided negative emotional stimuli (von Ceumern-Lindenstjerna et al., 2010a). The reverse pattern was found for both control groups. That is, they disengaged from negative stimuli when they were in a negative mood, and allocated more attention towards negative stimuli when they were in a positive mood (von Ceumern-Lindenstjerna et al., 2010a). This suggests that adolescents with BPD do not have a general difficulty disengaging from negative emotional stimuli, but rather that it is their negative mood which leads to difficulty disengaging. This interaction might further perpetuate their negative mood, and lead to difficulties controlling attention allocation and the regulation of emotions.

2.3.5 Developmental patterns, implications, and future directions.

2.3.5.1 Summary and implications of research to date.

In typically developing populations, attentional bias towards emotive stimuli (and in particular, towards threat) reduces over time, and conscious attention allocation ability (e.g., ability to consciously shift attention away, disengaging from threat) improves (Reinholdt-Dunne et al., 2012; Wolters et al., 2012). Adults with BPD do not appear to have attained the capacity to disengage from emotive words, as they tend to allocate greater attention to general and BPD relevant negative words (as evidenced by both fMRI and behavioural emotional stroop data) compared with their healthy counterparts (Arntz et al., 2000; Sieswerda et al., 2007; Wingenfeld, Mensebach, et al., 2009; Wingenfeld, Rullkoetter, et al., 2009). But subliminal emotional stroop data does not indicate an unconscious bias (hypervigilance) towards emotive words (Arntz et al., 2000; Sieswerda et al., 2007) as might be expected (Arntz, 2014; Linehan, 1993). Suggesting that, at least for negative emotive words, the difficulty for adults with BPD arises at the conscious level. That is, they are not troubled by hypervigilance towards negative stimuli (negative words) in the environment, but once in their conscious awareness, difficulty disengaging might perpetuate rumination and heighten stress.

Emotional dot-probe studies focused on young people with BPD do show an unconscious bias, relative to healthy young people, towards threat specifically, but not towards negative emotions generally (Jovev et al., 2012). Moreover, trouble disengaging at a conscious level is generalised, and applies to various negative emotional expressions, as well as neutral faces, and not just those associated with threat, for young people with BPD (Jovev et al., 2012; von Ceumern-Lindenstjerna et al., 2010b). A negative mood might further perpetuate the impact of this difficulty, as young people with BPD have trouble disengaging from, and turn their attention *towards,* negative faces when they are in a negative mood. This contrast with their healthy counterparts, and young people with other psychiatric disorders, who instead shift their attention *away* from negative stimuli when they are in a negative mood (von Ceumern-Lindenstjerna et al., 2010a). It also contrasts with adults with BPD, who can shift attention away from negative faces, although the extent of disengagement appears to be abnormal and is greater than that demonstrated by healthy adults (Brüne et al., 2013). These findings suggest nuanced, rather than generalised, impairments in attentional bias (unconscious vigilance) and attention allocation (the ability to shift attention towards or away from) in individuals with BPD, and the extent of attentional bias and ability to allocate/shift attention appears to be dependent on developmental stage, stage of illness, stimuli valence, and mood.

2.3.5.2 Gaps, challenges and future directions.

A challenge of reviewing studies in this area was the lack of clarity regarding what was being assessed. The interpretation of the subliminal and supraliminal emotional stroop paradigms seem to be confounded and combined in the adult BPD literature to both reflect attentional bias (e.g., Kaiser et al., 2016). However, supraliminal presentations, rather than demonstrating an attentional bias, are more likely to represent interference, and disruption of goal-directed attention, such as trouble disengaging (de Ruiter & Brosschot, 1994; Harvey et al., 2004). Therefore, future research should clarify whether unconscious attentional bias/hypervigilance, or conscious attention allocation/shifting (e.g., trouble disengaging or avoidance) are being assessed.

A further challenge is that the emotional stroop task has only been used with adults, and the emotional dot-probe task has primarily (except for one adult BPD study) been used with young people. The methodological differences between the tasks (emotion words versus emotion faces; varying ability to differentiate between unconscious and conscious attentional processes inherent to the tasks) make it difficult to consider functioning in young people alongside that of adults with BPD. In addition, stage of disorder is not clearly identified in most studies, making it difficult to comment on any overlap between developmental stage and stage of illness. Further research is needed, with young people and adult BPD populations, and across different stages of BPD, that distinguishes unconscious attentional biases/hypervigilance towards emotional stimuli, in particular threatening stimuli, from conscious attention allocation processes (i.e., trouble disengaging and avoidance). Given the flexibility of the emotional dot-probe task in allowing the differentiation between conscious and unconscious attentional processes[8] (Harvey et al., 2004; Koster et al., 2004), it is recommended that further research comparing adults with BPD with healthy adults using this paradigm be carried out. This will provide a more complete picture of the development of these processes from adolescence through adulthood in the BPD population.

It would also be useful to undertake emotional stroop studies with young people in order to provide comparable data regarding how well young people with BPD disengage from emotional words. However, the normative developmental literature suggests that the emotional stroop paradigm might not be sufficiently behaviourally sensitive to detect developmental changes, though fMRI during the emotional stroop paradigm has been able to detect developmental changes in brain function (Hwang et al., 2014; Sebastian, Roiser, et al., 2010; Veroude et al., 2013). Alternative paradigms such as neuroimaging and eye tracking might be promising avenues to further explore the developmental trajectory of attentional bias to emotive stimuli in BPD. For example, eye tracking developmental studies with healthy younger children provide important insights regarding normal development and suggest that attention to different parts of the face (e.g., lack of attention to the mouth) are associated with emotion recognition later on (Birmingham et al., 2013). Future research should also continue to consider the varying impact of stimuli valence and participant mood given that these appear to affect attentional bias in BPD.

[8] The emotional dot-probe task is generally considered to better assess attentional bias to emotion stimuli, because it allows for differentiation between trouble disengaging (which requires conscious processing) and vigilance (attentional bias; an unconscious process) (Harvey et al., 2004; Koster, Crombez, Verschuere, & De Houwer, 2004).

Ultimately, an improved understanding of attentional bias and allocation might assist in the development of targeted interventions, including early intervention. For example, oxytocin has been found to diminish attentional bias towards socially threatening cues for adults with BPD, as assessed using eye tracking, fMRI, and behavioural dot-probe outcomes (Bertsch et al., 2013; Brüne et al., 2013). More broadly, studies with clinically anxious individuals suggest that anxiety symptoms can be attenuated by specifically targeting attentional biases in treatments for adults (Hakamata et al., 2010) and children (Bar-Haim, 2010; Bar-Haim, Morag, & Glickman, 2011). Therefore, understanding the development of attentional bias and allocation in BPD will play an important role in the planning and design of interventions that might specifically target these in treatment.

Table 2.1.

Summary of Attentional Bias Towards Emotional Stimuli in BPD Studies: Emotional Stroop Task

	Participant Characteristics						Results: RT[a]/Interference[b]: > (slower RT/greater inference), < (faster RT/less interference), = (comparable)[c]	
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Emotional Stroop word categories	Subliminal (presentation time)	Supraliminal (presentation time)
					BPD adult- clinical			
Arntz (2000)	 BPD (16) CPD (12) HC (15)	20-55 29.8 (n/a) 32.5 (n/a) 35 (n/a)	100	Netherlands Out-pt; SCID-II Out-pt; min 1 CPD; ≤ 2 BPD c Ad	All: intoxication, psychotic dx, IQ < 80, vision problems. HC: axis I or PD dx; any BPD c	 Neutral BPD related Generally negative	(10-34 ms[d] + mask) RT: BPD = CPD = HC Int: BPD = CPD = HC Int: BPD = CPD = HC	(no time limit) RT: BPD = CPD = HC Int: BPD > HC; BPD = CPD Int: BPD > HC; BPD = CPD
Domes (2006)	 BPD (28) HC (30)	Range n/a 24.93 (5.85) 23.90 (5.88)	100	Germany In-pt; IPDE; no meds ≥ 4 weeks Bulletin board; uni & vocational students; uni staff.	BPD: lifetime schizophrenia, MDD, bipolar, panic dx, agoraphobia, social phobia, GAD, PTSD, ADHD, current/past 6mo AOD abuse; head trauma, neurological disease, IQ < 85. HC: lifetime psychiatric dx, axis II dx or impulsive behaviour (IPDE); ≥ 1 BPD c	 Neutral Negative	n/a	(no time limit) RT: BPD > HC Int: BPD = HC
Sieswerda (2006)	 BPD (16) CPD (18) Axis I (16) HC (16)	18-60 27 (6.8) 29 (9.2) 30 (9.6) 26 (5.4)	 94 89 75 88	Netherlands & Belgium In-pt & Out-pt; SCID-II In-pt & Out-pt; 1/more CPD In-pt & Out-pt; 1/more anxiety dx Same region Ad	All: bipolar, psychotic dx, MR, visual impairment, intoxication, Dutch not native All controls: > 2 BPD c HC: axis II dx or anxiety dx	 Negative schema Positive (opposite of negative)[e] SCHEMA[f] negative SCHEMA[f] positive	(8-30 ms[d] + mask) Int: BPD = All controls Int: BPD = All controls Int: BPD > All controls Int: BPD = All controls	(max 2 s) Int: BPD > All controls Int: BPD > All controls Int: BPD > All controls Int: BPD = All controls

Table 2.1 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Emotional Stroop word categories	Results: RT[a]/Interference[b]: > (slower RT/greater inference), < (faster RT/less interference), = (comparable)[c] Subliminal (presentation time)	Supraliminal (presentation time)
					BPD adult- clinical			
Sieswerda		18-60		Netherlands	All: intoxication, IQ < 80		(14 ms, + mask)	(max 2 s)
(2007)	BPD (24)	29.6 (7.2)	88	CMH, starting tx; SCID-II; BPDSI	BPD: psycho-organic dx,	Neutral	n/a	n/a
				≥ 20	ADHD, addiction, bipolar,	BPD schema related	Int: BPD = HC	Int: BPD > HC
	HC (23)	34 (11)	91	Ad (setting n/a)	psychotic dx, DID, APD.	Generally negative	Int: BPD = HC	Int: BPD > HC
					HC: axis I/II dx; ≥ 1 BPD c;			
					BPD-47 ≥ 80; > 1 remitted			
					axis I dx; vision problems,			
					Dutch not native			
Sprock		18-45	100	USA	All: AOD use; psychotic,		n/a	(no time limit reported)
(2000)	BPD (18)	37.6 (5.3)[g]		In-pt/out-pt; AutoSCID-II	neurological, sensory, and	Neutral		RT: BPD > HC;
	MDD (17)	32.7 (9.7)		In-pt/out-pt; MiniSCID; no PD dx	motor dx			MDD > HC; BPD = MDD
	HC (16)	30.3 (5.9)		Ad (setting n/a)	HC: hx axis I or II dx	Anger		Int: BPD = MDD = HC
						Sadness		Int: BPD = MDD = HC
Wingenfeld		Range n/a		Germany	All: pregnancy, significant		n/a	(no time limit reported)
(2009a)	BPD (31)	28.2 (11.1)	68	In-pt; SCID-II	medical condition	Neutral		RT: BPD = HC
	HC (49)	32.4 (11.8)	61	Local Ad	BPD: AN, SCZ,	Generally negative		Int: BPD = HC
					schizoaffective dx, bipolar,	Personal & relevant negative		Int: BPD > HC
					MDD with psychotic sx;	Personal & not relevant negative		Int: BPD = HC
					AOD dependence during			
					previous 6 months			
					HC: Hx psychiatric dx			
Wingenfeld		Range n/a	70	Germany	All: pregnancy, significant		n/a	(1.5 s)
(2009b)	BPD (20)	29.75 (13.2)		In-pt; SCID-II	medical condition	Neutral		n/a
	HC (20)	29.45 (12.4)		Local Ad	BPD: AN, SCZ,	Generally negative		Int: BPD = HC
					schizoaffective dx, MDD	Individually relevant negative		Int: BPD = HC
					with psychotic sx; AOD			
					dependence during previous			
					6 months			
					HC: hx psychiatric dx			

Table 2.1 Continued

First Author (year)	Participant Characteristics: Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Emotional Stroop word categories	Results: RT[a]/Interference[b]: > (slower RT/greater inference), < (faster RT/less interference), = (comparable)[c] Subliminal (presentation time)	Supraliminal (presentation time)
					BPD adult- clinical			
Winter (2015)		18-45	100	Germany	All: somatic illness, TBI, current/lifetime psychotic/bipolar dx, psychotropic meds during previous 4 weeks, dev disorders, AOD dependence past year, AOD abuse past 2 months. HC: lifetime mental dx		n/a	(1500 ms)
	BPD (19)	28.05 (7.82)		Setting n/a; IPDE		Neutral		n/a
	BPDd (18)	27.61 (5.95)		+ stress-related dissociation		Negative		RT: BPD = HC; BPDd > HC, BPD
	HC (19)	28.74 (80.7)		Setting n/a		Positive		RT: BPD = HC, BPDd BPDd > HC

Note. (abbreviations are listed in alphabetical order) Ad = advertising; ADHD = attention deficit hyperactivity disorder; AN = anorexia nervosa; AOD = alcohol and other drug; APD = antisocial personality disorder; BPD = borderline personality disorder; BPDd: BPD participants randomly assigned to dissociation induction; BPD-47 = BPD Symptom Checklist 47; c = criteria; CMH = community mental health; CPD = cluster C personality disorder; dev = developmental; DID = dissociative identity disorder; dx = disorder/diagnosis; F = female; GAD = generalised anxiety disorder; HC = healthy control; In-pt = inpatient; Int = interference score; IPDE-BPD = International Personality Disorders Examination - Borderline Personality Disorder Section; IQ = intelligence quotient; MDD = major depressive disorder; meds = medications; min = minimum; MR = mental retardation; n/a = not available/not reported; Out-pt = out-patient; PD = personality disorder; PTSD = post-traumatic stress disorder; RT = reaction time; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; sx = symptoms; TBI = traumatic brain injury; tx = treatment; uni = university.

[a]RT: Reaction time: The raw reaction time to words; the slower the reaction time, the greater the bias towards emotive words. Some studies report findings in terms of raw reaction time.
[b]Interference: Calculated by subtracting the reaction time for neutral words from the reaction time for the target emotional words. Greater interference indicates slower responses to target words, which indicates greater bias. Some studies report findings in terms of interference scores.
[c]'Slower' (<) refers to slower reaction time (caused by greater interference), and therefore a greater bias towards negative words; 'Faster' (>) refers to faster reaction time, indicating a greater bias away from negative words; 'Comparable' (=) refers to no difference in reaction time.
[d]Presentation times were individually calibrated in this study.
[e]Positive words consisted of the positive opposite to the schema-related negative words. For example, powerless and powerful.
[f]SCHEMA: The study calculated a mean interference score. This was done by subtracting the mean interference score for the schema-unrelated stimuli from the mean interference score for schema-related stimuli.
[g]Significant age difference between BPD and HC groups; age was included as a covariate.

Table 2.2.

Summary of Attentional Bias Towards Emotional Stimuli in BPD Studies: Emotional Dot-Probe Task

	Participant Characteristics						Results: Attentional Bias[a]: > (greater), < (reduced), = (comparable)[b]	
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Emotional dot-probe emotion face stimuli	Supraliminal (presentation time)	Subliminal (presentation time)
BPD adult clinical								
Brüne (2013)	 BPD (13) HC (13)	Range n/a 28.6 (7.22) 25.7 (6.76)	 62 77	Germany In-pt; MINI Ad (setting n/a)	All: excessive smokers, participated in another study in last 30 days, hx AOD dependence, pregnant, breast feeding, intending to become pregnant within 30 days, prolactin level > 200ng/ml, electrocardiogram abnormalities, acute/serious/unstable medical dx; females not taking oral contraceptives	 Happy Angry Neutral	(200 & 500 ms pooled)[c] BPD = HC BPD < HC BPD = HC	n/a
BPD young people- clinical								
Jovev (2012)	 BPD (21) HC (20)	15-24 18.90 (3.10) 20.40 (2.72)	 86 65	Australia Out-pt, ≥ 3 BPD DIPD c Ad local area	All: visual impairment, ID, SCZ/psychotic dx, AOD intoxication, head injury, significant medical illness (e.g., epilepsy, meningitis, thyroid disorder), loss of consciousness ≥ 10 mins. HC: any BPD/APD features; hx psychiatric problems	 Neutral Angry Fearful Happy	(500 ms) BPD > HC BPD > HC BPD > HC BPD > HC	(30 ms) BPD = HC BPD = HC BPD > HC BPD = HC
von Ceumern- Lindenstjerna (2010a)	 BPD (30) Mixed (29) HC (30)	13-19 16.13 (1.48) 15.31 (1.11) 15.73 (0.46)	100	Germany In-pt & out-pt; SCID-II In- & out-pt Ad public schools	BPD & Mixed: psychosis, PDD, AOD abuse, neurological disease, impaired vision, IQ < 85 Mixed: cluster B PD, BPD c HC: current/lifetime axis I/II dx, lifetime psychiatric/ psychological treatment or psychotropic medication.	 Happy Negative	(500 ms) BPD = Mixed = HC BPD = Mixed; BPD & Mixed > HC	 n/a

Table 2.2 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Emotional dot-probe emotion face stimuli	Results: Attentional Bias[a]: Supraliminal (presentation time) > (difficulty disengaging), < (avoidance), = (comparable)[b]	Results: Attentional Bias[a]: Subliminal (presentation time) > (bias towards/ hypervigilance), < (bias away), = (comparable)[b]
					BPD young people- clinical			
von Ceumern-Lindenstjerna (2010b)	BPD (30) Mixed (29) HC (30)	13-19 16.13 (1.48) 15.31 (1.11) 15.73 (1.46)	100	Germany In-pt & out-pt; SCID-II In-pt & out-pt; Ad public schools	All: psychosis, PDD, AOD dependence, neurological disease, impaired vision, IQ < 85 Mixed: cluster B PD/BPD c HC: current/lifetime axis I/II dx, lifetime psychiatric/ psychological treatment or psychotropic medication.	*Mood not considered*	(1500ms)	n/a
						Happy	BPD = Mixed = HC	
						Negative[d]	BPD = Mixed = HC	
						Negative mood		
						Happy	BPD = Mixed = HC	
						Negative[d,e]	BPD > Mixed	
						Neutral mood		
						Happy	BPD = Mixed = HC	
						Negative[d]	BPD > Mixed, BPD > HC	
						Positive mood		
						Happy	BPD = Mixed = HC	
						Negative[d]	BPD < Mixed, BPD < HC	

Note. (abbreviations are listed in alphabetical order) Ad = advertising; AOD = alcohol and other drug; APD = antisocial personality disorder; BPD = borderline personality disorder; c = criteria; DIPD = Diagnostic Interview for DSM-IV Personality Disorder; dx = disorder/diagnosis; F = female; HC= healthy control; hx = history; ID = intellectual disability; In-pt = inpatient; IQ = intelligence quotient; MINI = Mini International Neuropsychiatric Interview; Mixed = mixed psychiatric diagnoses; n/a = not available/not reported; Out-pt = out-patient; PD = personality disorder; PDD = pervasive developmental disorder; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia.

[a]Attentional Bias score: To calculate an attentional bias score, studies subtract reaction time obtained for trials when probe appeared in the same position as the emotional face (congruent trials) from trials when probes appeared in opposite position of emotional face (incongruent trials). Positive attention bias score indicates hypervigilance for emotional stimulus.
[b]Greater (>) refers to greater attention towards the emotional stimuli. Reduced (<) refers to reduced attention given to the emotional stimulus; Comparable (=) refers to no difference in the amount of attention towards the emotional stimulus. During supraliminal trials a ‘bias towards’ is better considered as difficulty disengaging, whereas during subliminal trials, a ‘bias towards’ suggests hypervigilance.
[c]Two separate presentation times were used in this study, however these were pooled in that study for analyses due to no main effect of time being found.
[d]Negative = angry, anxious, sad, disgusted.
[e]All HC had either positive or neutral mood and could therefore not be compared for negative mood in that study.

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2.4 Facial Emotion Recognition

2.4.1 Purpose of facial emotion recognition.

The ability to accurately recognise facial emotional expressions is a key component of social cognition (Hugenberg & Wilson, 2013). It is involved in complex interpersonal processes such as empathy and trust, and facilitates prosocial behaviour (Dadds, Cauchi, Wimalaweera, Hawes, & Brennan, 2012; Marsh, Kozak, & Ambady, 2007). Impairments in emotion recognition have been associated with schizophrenia (Catalan et al., 2016; Edwards, Jackson, & Pattison, 2002), mood (Bourke, Douglas, & Porter, 2010; Derntl, Seidel, Kryspin-Exner, Hasmann, & Dobmeier, 2009), and anxiety disorders (Kessler, Roth, von Wietersheim, Deighton, & Traue, 2007), are implicated in the development of various mental disorders (Collin, Bindra, Raju, Gillberg, & Minnis, 2013), including autism (Harms, Martin, & Wallace, 2010), and psychopathy (Dawel, O'Kearney, McKone, & Palermo, 2012), and are thought to be associated with secondary problems in interpersonal functioning (Dadds et al., 2012).

2.4.2 Typical development of facial emotion recognition from adolescence through adulthood.

Facial emotion recognition ability generally continues to develop through adolescence, tends to plateau in early adulthood, and the greatest levels of accuracy are evident between 20-49 years of age (Tousignant, Sirois, Achim, Massicotte, & Jackson, 2017; L. M. Williams et al., 2008). Younger children categorise emotions into broad, 'feels good' versus 'feels bad' categories, while typical adults tend to understand emotions in more discrete categories (Widen, 2013). Facial emotional expressions associated early in children's development with reward or punishment (Magai, 1999), such as happiness, anger and sadness, are recognised with greater accuracy earlier on (K. Lawrence, Campbell, & Skuse, 2015; Widen, 2013). For example, accurate recognition of happiness is attained earliest (by age 5-6 years) (K. Lawrence et al., 2015; L. M. Williams et al., 2008), and recognition of sadness, anger and surprise improve steeply into mid and late childhood (K. Lawrence et al., 2015; Mancini, Agnoli, Baldaro, Ricci Bitti, & Surcinelli, 2013).

By contrast, more socially complex emotions, such as fear, surprise and disgust, become more differentiated later, particularly during the period between adolescence and adulthood (Garcia & Scherf, 2015; Widen, 2013). This is when the social world of the young person expands from primarily involving interactions with family or within semi-familiar environments, such as school, to a broader and expanding social network. For example, recognition of fear and disgust improve more gradually through to mid adolescence (K. Lawrence et al., 2015). Therefore, emotion recognition does not develop at the same rate, nor does it reach the same ultimate levels of accuracy for all emotions in healthy populations (K. Lawrence et al., 2015; Mancini et al., 2013; L. M. Williams et al., 2008).

2.4.3 Facial emotion recognition in adults with BPD.

Various studies have explored emotion recognition in BPD (see Table 2.3 for study details), and two recent meta-analyses have synthesised findings (Daros et al., 2013; Mitchell et al., 2014). Daros et al. (2013) concluded that individuals with BPD experience consistent difficulties recognizing disgust and anger, but do not show consistent deficits in the recognition of sadness, fear, or surprise. In contrast, however, Mitchell et al. (2014) did not find significant facial emotion recognition differences between healthy controls and BPD participants for any of the four negative emotions (anger, disgust, fear, sadness), although they did note that some individual studies did indicate enhanced sensitivity (sensitivity to facial expressions of emotions is discussed in detail in Section 2.5) of people with BPD to fearful expressions, and impairments in the recognition of disgust. A limitation of both reviews, from a developmental perspective, is that both included studies of adolescents with BPD (aged 15-19; discussed in Section 2.4.4) along with studies focused on adults aged 18-60 years. Pooling all studies across developmental periods and illness stages ignores the fact that facial emotion recognition continues to improve throughout adolescence and early adulthood (see Section 2.4.2), and that as a result, facial emotion recognition might differ for young people and adults with BPD.

The inconsistent findings across the two reviews might also reflect the fact that the criteria for study inclusion differed between reviews. The Daros et al. (2013) meta-analysis included 11 studies that only assessed facial emotion recognition at 100 per cent intensity, while the Mitchell et al. (2014) meta-analysis included 16 studies, which assessed facial emotion recognition at 100 per cent intensity, as well as studies that assessed sensitivity to emotion faces at different intensities, and during dynamic morphing paradigms (to be discussed in Section 2.5, sensitivity to facial expressions of emotions). According Daros et al. (2013), this is a critical distinction because viewing lower intensity emotions might enhance arousal just enough to improve emotion recognition in BPD, while viewing intense emotions might induce hyperarousal that interferes with cognitive processing and in turn lead to poorer recognition of emotions. This hyperarousal is particularly likely when emotions that are associated with threat and rejection (anger and disgust, respectively) are presented at full intensity. Thus, by including studies that presented facial emotional expressions at different intensities, the Mitchell et al. (2014) review might have been less likely to show differences in facial emotion recognition between BPD and healthy control participants. Morphing paradigms also differ in that the prime focus is on detection rather than on recognition. Nevertheless, both reviews did concur that a negative response bias is present in BPD when individuals are presented with neutral or ambiguous faces. That is, they tend to misattribute emotions to faces that depict neutral expressions, and to attribute negative emotions to ambiguous or neutral faces.

Since these reviews, another study assessed facial emotion recognition of faces presented at 100 per cent intensity in adults with BPD (Catalan et al., 2016). Consistent with Mitchell et al. (2014), but not Daros et al. (2013), it found no difference between adult BPD patients and healthy control participants in the recognition of fear, happiness, and anger. Also, consistent with both reviews, neutral expressions were perceived less accurately than by healthy controls and were misperceived as negative emotions by adults with BPD. In addition, other studies have since assessed the recognition of facial expressions of emotions at intensities other than 100 per cent, as well as ambiguous expressions (e.g., facial emotional expressions combining 50 per cent angry and 50 per cent fearful expressions), and faces with degraded/reduced picture quality (see Table 2.3 for details) (Daros, Uliaszek, & Ruocco, 2014; Fenske et al., 2015; Mier et al., 2013; Thome et al., 2016; van Dijke, van‘t Wout, Ford, & Aleman, 2016). When facial expressions were less clear, adults with BPD had greater difficulty than healthy controls accurately labelling neutral expressions (Daros et al., 2014; Fenske et al., 2015; van Dijke et al., 2016), and ambiguous facial expressions of happiness (Fenske et al., 2015; Thome et al., 2016), and sadness (Daros et al., 2014). However, no difficulties, compared with healthy controls, were evident with regards to the identification of ambiguous angry or fearful faces (Fenske et al., 2015; Mier et al., 2013; Thome et al., 2016; van Dijke et al., 2016). That there were no difficulties identifying ambiguous, less intense negative emotions is consistent with the Daros et al. (2013) hyperarousal hypothesis, suggesting that difficulties recognising emotions associated with threat and rejection are more likely to be evident when expressed emotions are intense.

When findings from studies with adults with BPD are considered separately from studies with young people with BPD (see Table 2.3 for details of studies and see Section 2.4.4 for studies with young people with BPD), and when studies using intense stimuli are considered separately from those that used less intense/ambiguous stimuli, it does appear that adults with BPD have greater difficulty accurately recognising a broad range of facial expressions when they are expressed at 100 per cent intensity (see Table 2.3). When expressions are ambiguous, however, they tend to have more specific difficulties recognising neutral, happy and sad faces, but not angry or fearful faces.

2.4.4 Facial emotion recognition in young people with BPD.

Studies that have specifically focused on adolescents with BPD (see Table 2.3) have shown that young female in- and out-patients appear to be developing similarly compared with their healthy peers with regards to facial emotion recognition. They were able to accurately recognise happiness, fear, anger, disgust, and sadness (Robin et al., 2012; von Ceumern-Lindenstjerna et al., 2007). Thus, facial emotion recognition deficits do not seem to be apparent in adolescents early in the disorder's trajectory. In addition, von Ceumern-Lindenstjerna et al. (2007) found that adolescent patients with BPD rated happy emotions as more negative, less intense and less pleasant than their healthy peers. This more negative appraisal of happy emotional expressions in others is similar to findings in adults with BPD indicating happy faces are rated as less intense (Catalan et al., 2016; Thome et al., 2016), and is similar to the quite consistent findings showing a negative bias in the perception of emotions (particularly neutral and ambiguous) found in adults with BPD (Daros et al., 2013;

Mitchell et al., 2014). Therefore, while adolescents with BPD do not appear to show facial emotion recognition deficits, a negative bias might be evident early in the disorder's trajectory. Such a negative bias might place adolescents with BPD at increased risk of judging social stimuli as threatening, leading to greater feelings of defensiveness. Over time this negative bias might serve to influence, and perpetuate, deterioration in their ability to recognise facial emotional expressions accurately in adulthood.

2.4.5 Developmental patterns, implications, and future directions.

2.4.5.1 Summary and implications of research to date.

When research focused on adolescents with BPD is considered alongside, rather than combined with, research focused on adults, a pattern of facial emotion recognition deterioration in BPD between adolescence and adulthood is apparent. This pattern contrasts with the normative developmental pattern of facial emotion recognition in non-patient populations for whom emotion recognition improves over time. This suggests that facial emotion recognition deficits might not be a hallmark of the disorder but instead might develop throughout its course, diverging from normative development sometime during late adolescence and early adulthood. However, like adults with BPD, adolescents also show a negative bias, whereby positive emotions are perceived as less positive. This bias might be an early factor underlying the development of later facial emotion recognition deficits.

2.4.5.2 Gaps, challenges and future directions.

A number of gaps remain to be addressed in order to fully describe the developmental trajectory of facial emotion recognition impairments in BPD. Future research should aim to replicate the findings of the only two studies focused on adolescents with BPD. In addition, cross-sectional and longitudinal studies that include the late adolescent and young adult periods are needed. These could explore mechanisms that might be involved in what appears to be a deterioration of facial emotion recognition sometime between adolescence and adulthood. It is also recommended that future reviews and meta-analyses take developmental age and illness stage into account. This need is illustrated by the two existing meta-analyses (Daros et al., 2013; Mitchell et al., 2014), where the null findings of studies in youth with BPD (aged 15-19) were combined with studies focused on adults (aged 18-60). These might have affected the overall results, likely reducing the overall differences between healthy controls and BPD groups. Future meta-analyses could therefore run analyses with and without adolescent samples to assess the impact of null findings in adolescence.

Future research could also explore the effects of emotion recognition training for adults with BPD. Such training could also be considered in late adolescence and early adulthood as a form of early intervention in order to maintain what appears to be intact emotion recognition in adolescents with BPD. There is promising research evaluating the benefits of explicit training in facial emotion recognition in children with anxiety disorders (Russo-Ponsaran, Evans-Smith, Johnson, Russo, & McKown, 2016), young adults with depressive symptoms (Penton-Voak, Bate, Lewis, & Munafò, 2012), and adults with schizophrenia (Frommann, Streit, & Wölwer, 2003; Wölwer & Frommann, 2011). Benefits of such training include increased accuracy and speed of facial emotion recognition in themselves and others (Russo-Ponsaran et al., 2016), and increased positive mood (Penton-Voak et al., 2012). Such training also improves social cognition more generally, as well as social functioning and social skills (Frommann et al., 2003; Wölwer & Frommann, 2011).

Table 2.3.

Summary of Facial Emotion Recognition in BPD Studies

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	Results: FER accuracy (response time limit) < (impaired), > (enhanced), = (comparable)
				Participant Characteristics			
BPD adults- clinical & 1 non-clinical study (stimuli presented at 100% intensity[a])							
Bland (2004)	 BPD (35) HC (35)	18-48 32.3 (8.5) (overall M & SD reported; gps matched)	100	USA In-pt; SCID-II Com	BPD: SCZ, schizoaffective dx; bipolar, AOD abuse, MR HC: Hx psychiatric tx; axis I/II dx	POFA; forced choice paper-pencil to label emotion. Total Anger Sadness Fear Disgust Surprise Happiness	(no time limit reported) BPD < HC BPD < HC BPD < HC BPD = HC BPD < HC BPD = HC BPD = HC
Catalan (2016)	 BPD (37) FEP (64) HC (137)	18-60 36.8 (10.3) 35.5 (12.9) 33.1 (11.4)	 66.7[b] 35.9 43.8	Spain Out-pt; DSM-IV-TR c (measure n/a) In-pt, DSM-IV-TR c (measure n/a) Local population	All: lifetime dx neurological disorder; hx severe head injury; severe medical condition; drug dependence BPD: Psychosis FEP: anti-psychotic med > 1yr	DFAR; forced choice, button press to label emotion. Anger Fear Happiness Neutral	(no time limit reported) BPD = HC, BPD = FEP, FEP < HC BPD = HC, BPD = FEP, FEP = HC BPD = HC, BPD = FEP, FEP = HC BPD < HC, BPD = FEP, FEP < HC
Dyck (2009)	 BPD (19) HC (19)	Range n/a 28.26 (9.37) 28.05 (9.86)	 89 89	Germany In- & out-pt; SCID-II Ad	BPD: MDD, life-time bipolar, psychotic dx, AOD dependence, ADHD, neurological disorder HC: axis-I or II dx	FAN; forced choice, button press to discriminate valence. Neutral Negative[c]	(2 s) BPD < HC BPD = HC
						ER Test; forced choice, button press to label emotion. Anger Sadness Fear Happiness Neutral	(no time limit) BPD = HC BPD = HC BPD = HC BPD = HC BPD = HC

Table 2.3 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	Results: FER accuracy (response time limit) < (impaired), > (enhanced), = (comparable)
BPD adults- clinical & 1 non-clinical study (stimuli presented at 100% intensity[a])							
Guitart-Masip		Range n/a	50	Spain	BPD: SCZ, drug-induced psychosis, organic	POFA; Forced choice, button	(700ms)
(2009)	BPD (10)	31.3 (9.47)		Out-pt; SCID-II & DIB-R	brain syndrome, AOD dependence, bipolar,	press to discriminate neutral/	
	HC (10)	31.2 (9.05)			MR, MDD	emotional face pairs	
					HC: BPD	Figures	BPD = HC
						Anger	BPD = HC
						Fear	BPD = HC (trend for BPD < HC)
						Disgust	BPD < HC
						Happiness	BPD = HC
Levine		23-56		Canada		POFA; forced choice, paper-	(no time limit reported)
(1997)	BPD (30)	37.55 (7.81)	67	Out-pt SCID-II	BPD: none reported	pencil to label emotion.	
	HC (30)	(overall M &	50	Ad in general hospital	HC: SCID-II BPD c met	Total	BPD < HC
		SD reported;				Anger	BPD < HC
		gps matched)				Fear	BPD < HC
						Disgust	BPD < HC
Lowyck		18-48	77	Belgium		POFA[d]; forced choice, button	(no time limit reported)
(2015)	BPD (22)	25.91 (8.27)		In-pt, SCID-II	HC: PD dx	press to label emotion	
	HC (22)	25.95 (8.48)		Com, hospital, university		Total	BPD < HC
						Anger	BPD = HC
						Disgust	BPD = HC
						Sadness	BPD < HC
						Fear	BPD = HC
						Surprise	BPD = HC
						Happiness	BPD = HC
Lynch		Range n/a	85	USA	All: current mania or hx of psychosis	POFA[d]; forced choice, button	(no time limit reported)
(2006)	BPD (20)	35.5 (11.2)		Com; SCID-II	HC: more than minimal sx of MDD as	press to label emotion	
	HC (20)	34.7 (11.2)		Com	defined by HAM-D, PD, BPD	Total	BPD = HC
						Anger	BPD = HC
						Sadness	BPD = HC
						Fear	BPD = HC
						Disgust	BPD = HC
						Surprise	BPD > HC
						Happiness	BPD = HC

Table 2.3 Continued

	Participant Characteristics						Results: FER accuracy
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	(response time limit) < (impaired), > (enhanced), = (comparable)
BPD adults- clinical & 1 non-clinical study (stimuli presented at 100% intensity[a])							
Merkl (2010)			100	Germany	All: SCZ, MDD, AOD abuse & neurological disorder last 6 months, psychopharmacologic med during past two weeks	POFA; forced-choice of two options to label valence	("respond as quickly as possible")
	BPD (13)	20-38 26.2 (5.2)		In-pt; first week 12-week DBT program; SCID-II		Total	BPD < HC
	HC (11)	25-41 30.3 (5.6)		Ad	HC: hx neurological or current/past psychiatric dx	Anger	BPD = HC
						Sadness	BPD = HC
						Fear	BPD > HC
						Disgust	BPD = HC
						Surprise	BPD = HC
						Happiness	BPD = HC
						Neutral	BPD = HC
Minzenberg (2006)		18-60		USA	All: neurological disease, SCZ, schizo-affective disorder, bipolar dx, PTSD, MDD, AOD dependence, visual/auditory impairments	POFA; forced choice verbal response to label emotion	("as quickly as possible")
	BPD (43)	35 (13)	88	Out-pt; SCID-II	BPD: Dissociative or psychotic sx	Total	BPD = HC
	HC (36)	34 (9)	89	Community	HC: Axis I/II disorder; > 1 BPD c, lifetime psychiatric dx/tx; hospitalisation in past mo	Anger	BPD = HC
						Sadness	BPD = HC
						Fear	BPD = HC
						Disgust	BPD = HC
						Surprise	BPD = HC
						Happiness	BPD = HC
						Neutral	BPD = HC
						BLERT; intensity n/a; audio-visual vignettes; forced choice label emotion	Overall: BPD < HC
Unoka (2011)		Range n/a	100	Hungary	All: SCZ, schizoaffective disorder, organic mental syndrome, AOD withdrawal syndrome, CNS neurological disease, unable to complete self-report	POFA; forced choice, button press label emotion	(no time limit reported)
	BPD (33)	30 (9.3)		In-pt, following tx of AOD withdrawal syndrome & 4-week cognitive psychotherapy program; SCID-II		Total	BPD < HC
	HC (32)	29.8 (7.5)		Acquaintances/relatives of uni students	HC: psychiatric dx	Anger	BPD < HC
						Sadness	BPD < HC
						Fear	BPD < HC
						Disgust	BPD < HC
						Surprise	BPD > HC
						Happiness	BPD = HC

Table 2.3 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	Results: FER accuracy (response time limit) < (impaired), > (enhanced), = (comparable)
				Participant Characteristics			
BPD adults- clinical & 1 non-clinical study (stimuli presented at 100% intensity[a])							
Wagner		18-45	100	USA	All: Visual impairment, SCZ or other	JACFEE & JACNeuF;	(no time limit reported)
(1999)	BPD (21)	29.7 (5.9)[e]		In-pt/out-pt; SCID-II & hx childhood	psychotic dx, AOD abuse	free response label emotion	
				sexual abuse	HC: Hx sexual abuse, use of psychotropic	Anger	BPD = CSC = HC
	CSA (21)	35.3 (7.4)		Uni & medical centre; out-pt clinics; hx	med, BPD sx/dx	Sadness	BPD = CSC = HC
				childhood sexual abuse		Fear	BPD > CSA, BPD > HC
	HC (20)	31.6 (7.1)		Uni & medical centre notices; out-pt		Disgust	BPD = CSC = HC
				clinics		Surprise	BPD = CSC = HC
						Happiness	BPD < CSA, BPD = HC
						Neutral	BPD < HC, CSA < HC
BPD adults- clinical (stimuli presented at varying intensities[f])							
Daros			100	Canada	All: IQ < 80, neurological illness, serious	PEAT; forced choice, rate	(no time limit reported)
(2014)	BPD (31)	18-52		Out-pt & online postings; SIDP-IV	physical illness, developmental disorder	intensity[g]	
		30.7 (10.5)			BPD: Current/lifetime psychosis/bipolar I,	Overall	BPD < HC
	HC (28)	18-59		Com	lifetime ED requiring hospitalisation,	Neutral	BPD < HC
		27.5 (10.6)			current/extensive hx of AOD dx, significant	Mildly sad	BPD < HC
					head trauma, significant	Moderately sad	BPD = HC
					manual/auditory/hearing impairment	Very sad	BPD = HC
						Mildly happy	BPD = HC
						Moderately happy	BPD = HC
						Very happy	BPD = HC
Fenske		Range n/a	100	Germany	BPD: SCZ, bipolar, addiction <3 yrs	Nim Stim: 60%; forced	(3s)
(2015)	BPD (32)	30.35 (8.22)		In-pt/out-pt, IPDE	HC: Current/lifetime psychiatric dx,	choice, button press, rate	
	HC (31)	29.84 (7.70)		Existing database	neurological disorder	valence (+ve/neutral/-ve)	
						Neutral	BPD < HC
						Happy	BPD < HC
						Angry	BPD = HC

Table 2.3 Continued

	Participant Characteristics						Results: FER accuracy
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	(response time limit) < (impaired), > (enhanced), = (comparable)
BPD adults- clinical (stimuli presented at varying intensities[f])							
Thome (2016)	BPD (36) HC (36)	Range n/a 26.6 (5.4) 26.8 (5.2)	100	Germany Research database, Ad; IPDE Research database, Ad	All: lifetime psychotic dx/bipolar I, current AOD addiction, pregnancy, hx brain disease, skull/brain damage, severe neurological illness, current psychotropic medication, positive screen illicit drugs HC: lifetime/current psychiatric dx	Nim Stim: 40% and 50%[h]; forced choice rate anger and happiness intensity[i]	(no time-limit)
						Neutral/emotion blend, rate anger intensity:	
						Happy	BPD = HC
						Angry	BPD = HC
						Neutral/emotion blend, rate happiness intensity:	
						Happy	BPD < HC
						Angry	BPD = HC
						Emotion/emotion blend, rate anger & rate happiness:	
						60/40 happy/angry 50/50 happy/angry 40/60 happy/angry	BPD = HC for all conditions
van Dijke (2016)	BPD (30) SCZ (57) SoD (25) HC (41)	Range n/a 30 (8.9) 32.4 (9.2) 37.0 (10.2)[j] 30.9 (8.5)		Netherlands In-pt, 3-week intensive; BPDSI In- Out-pt; CASH In-pt, 3-week intensive; CIDI Ad	All: neurological conditions, hx head injury, recent hx AOD abuse, MR BPD & SoD: brain damage, high doses of psychotropic medication impacting executive function, psychotic dx, bipolar, MDD with suicidality, ED, ASD, ADHD BPD: SCZ or SoD SCZ: BPD or SoD SoD: BPD or SCZ HC: mental disorder	Degraded facial affect recognition task: 100% and 75 %[k]; degraded by 30%[l]; forced choice; button press	(no time limit reported)
						Angry	BPD = HC
						Fearful	BPD = HC
						Happy	BPD = HC
						Neutral	BPD < HC

Table 2.3 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Facial Emotion Recognition (FER) stimuli & task details	Results: FER accuracy (response time limit) < (impaired), > (enhanced), = (comparable)
BPD young people- clinical (stimuli presented at 100% intensity[a])							
Robin		15-19	100	France, Belgium, Switzerland		POFA[d]; forced choice, button press label emotion	(no time limit reported)
(2012)	BPD (22)	16.9 (1.1)		In-pt & out-pt; SIDP-IV	BPD: SCZ, severe medical illness		
	HC (22)	16.2 (0.6)		Schools	HC: PD	Total	BPD = HC
						Anger	BPD = HC
						Sadness	BPD = HC
						Fear	BPD = HC
						Disgust	BPD = HC
						Surprise	BPD = HC
						Happiness	BPD = HC
von Ceumern-		13-19	100	Germany	All: IQ ≤ 85, brain damage, impaired/uncorrected vision, addiction, acute psychotic sx.	POFA; forced choice label emotion	(no time limit reported)
Lindenstjerna	BPD (30)	16.13 (1.48)		In-pt & out-pt; SCID-II			
(2007)	CC (29)	15.31 (1.11)		In-pt & out-pt; Axis I dx, K-SADS		Negative[m]	BPD = HC
	HC (30)	15.73 (1.46)		Schools & hospital staff network	CC: cluster B PD; ≥ 1 BPD c	Happiness	BPD = HC
					HC: previous psychological or psychiatric tx	Neutral	BPD = HC

Note. (abbreviations are listed in alphabetical order) Ad = advertising; ADHD = attention deficit hyperactivity disorder; AOD = alcohol and other drug; ASD = autism spectrum disorder; BLERT = Bell-Lysaker Emotion Recognition Test; BPD = borderline personality disorder; c = criteria; CASH = Comprehensive Assessment Symptoms and History; CC = clinical control; CIDI = Composite International Diagnostic Interview; CNS = central nervous system; Com = community; DBT = dialectical behaviour therapy; DFAR = Degraded Facial Affect Recognition Task; DIB-R = Revised Diagnostic Interview for Borderlines; DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders- Fourth Edition – Text Revision; dx = disorder/diagnosis; ED = eating disorder; F = female; FAN = Fear Anger Neutral Test; FEP = first episode psychosis; FER = facial emotion recognition; gps = groups; HAM-D = Hamilton Depression Rating Scale; HC = healthy control; hx = history; IPDE = International Personality Disorders Examination; In-pt = inpatient; JACFEE = Japanese and Caucasian, Facial Expressions of Emotion; JACNeuF = Japanese and Caucasian Neutral Faces; K-SADS = Kaufman Schedule for Affective Disorders and Schizophrenia for School Aged Children; MDD = major depressive disorder; meds = medications; mo = month; MR = mental retardation; n/a = not available/not reported; Nim Stim = Nim Stim Set of Facial Expressions; Out-pt = out-patient; PD = personality disorder; PEAT = Penn Emotional Acuity Test; POFA = Pictures of Facial Affect; PTSD = post-traumatic stress disorder; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; SIDP-IV = Structured Interview for DSM-IV Personality Disorders; SoD = somatoform disorder; sx = symptoms; tx = treatment.

[a]100 % indicates the intensity of the emotional facial expression presented to participants.
[b]Analysis was adjusted for sex in this study, which differed significantly between groups.
[c]Negative: fearful and angry.
[d]POFA stimuli were used in this study as part of the Multimorph Facial Affect Recognition Task or Face Morph task where intensity of facial expression changes dynamically; results reported here are only for recognition at 100% intensity.
[e]Age differed significantly between groups and was included in analysis.
[f]Intensity indicated for each study in stimuli column as either percentage of facial emotional expression intensity or as a fraction, depending on what each study reported.

[g]This study reported that participants rated intensity of expression on a 7-point Likert scale (very sad, moderately sad, mildly sad, neutral, mildly happy, moderately happy, very happy); no further information was provided regarding the % intensity of faces.
[h] Facial emotional expressions were presented as neutral/emotion (anger or happiness) blends (60/40 per cent and 50/50 intensity ratio), and emotion/emotion blends (60/40 per cent and 50/50 intensity ratio).
[i]Rate intensity of anger or happiness on 6-pt scale from 1 (not at all) to 6 (very strong).
[j]Age differed significantly between groups. There was no correlation between age and task performance and therefore age was not included as covariate.
[k]Responses to 75 per cent and 100 per cent were combined for analyses.
[l]Degradation refers to the resolution of the image, whereby visual contrast was degraded electronically through a filter.
[m]Anger, Sadness, Fear, Disgust.

2.5 Sensitivity to Facial Expressions of Emotions

2.5.1 Purpose of sensitivity to facial expressions of emotions.

Emotion sensitivity refers to an individual's threshold for the detection of emotional stimuli. Greater sensitivity implies a lower threshold, and reduced sensitivity refers to a higher threshold (Blair, Colledge, Murray, & Mitchell, 2001). Sensitivity to subtle facial expressions of emotions is a crucial sociocognitive skill that can facilitate or hamper the ability to detect emotions in others. Optimal levels of emotion sensitivity are associated with empathic ability (Chikovani, Babuadze, Iashvili, Gvalia, & Surguladze, 2015; Dinsdale & Crespi, 2013) and regulation capacity (van Zutphen, Siep, Jacob, Goebel, & Arntz, 2015), which are both essential for social functioning (Eisenberg & Miller, 1987). On the other hand, both excessive and insufficient sensitivity to emotional faces can lead to social impairments. For example, lack of sensitivity to facial expressions of fear and sadness is associated with callous, unemotional and psychopathic traits in children and adults (Blair et al., 2001; Blair et al., 2004). Heightened sensitivity to facial expressions of fear and sadness is associated with a heightened stress response (Chikovani et al., 2015; Engert, Plessow, Miller, Kirschbaum, & Singer, 2014).

2.5.2 Typical development of sensitivity to facial expressions of emotions from adolescence through adulthood.

Sensitivity to subtle expressions of the different emotions develops at varying rates in typical populations. Sensitivity to anger and disgust, for example, develops steeply during adolescence (Rodger, Vizioli, Ouyang, & Caldara, 2015). The development of sensitivity to facial expressions of fear is more gradual, and reaches adult levels around the early to mid-twenties (Rodger et al., 2015; Thomas, De Bellis, Graham, & LaBar, 2007). This development of sensitivity to facial expressions that convey the threat of potential social harm coincides with normative increases in the need for inclusion and acceptance from peers (Burklund, Eisenberger, & Lieberman, 2007; DeWall, Maner, & Rouby, 2009; Kawamoto, Nittono, & Ura, 2014; Masten et al., 2009). A lack of peer inclusion can result in poor psychosocial and mental health outcomes (Masten et al., 2009; Silk et al., 2014), therefore increased sensitivity to expressions that convey potential social harm makes sense within a developmental context.

2.5.3 Sensitivity to facial expressions of emotions in adults with BPD.

The biosocial model of BPD posits that a biologically based, heightened baseline level of sensitivity to emotions in others is at the core of the disorder and contributes to the maintenance of the extreme emotional lability characteristic of BPD (Crowell et al., 2009; Linehan, 1993). This biological vulnerability, together with poor impulse control, is thought to transact with the environment and activate emotional, behavioural, and cognitive dysregulation. Three studies explored sensitivity to facial expressions of emotions in adult patients with BPD, and one in an adult community sample that met BPD criteria, using dynamically changing facial expressions as stimuli (i.e., gradually morphing from neutral 0 per cent intensity (neutral), to 100 per cent emotional intensity) (see Table 2.4 for study details) (Domes et al., 2008; Domes, Grabe, Czieschnek, Heinrichs, & Herpertz, 2011; Lowyck et al., 2015; Lynch et al., 2006). Another study used a novel paradigm, where emotional stimuli were to be detected while a rapid, continuous stream of non-facial and facial (neutral and emotional) stimuli were presented (Schulze, Domes, Köppen, & Herpertz, 2013). Three of the studies found no difference in emotion sensitivity between adult patients with BPD and healthy control participants (Domes et al., 2008; Domes et al., 2011; Lowyck et al., 2015), suggesting that adult patients with BPD experience neither heightened sensitivity, nor a deficit, in processing dynamic subtle facial emotional expressions. However, analysis of errors in affect attribution during sensitivity paradigms indicated that adults with BPD made more errors overall (Domes et al., 2011), particularly for fearful and surprised expressions (Domes et al., 2008; Domes et al., 2011), and were more likely to mislabel ambiguous emotion blends as anger (e.g., 50 per cent anger/50 per cent sadness blend; 40 per cent anger/60 per cent happiness blend) (Domes et al., 2008).

In contrast to these studies, two studies did find heightened sensitivity in adults with BPD compared with healthy controls. This was specifically for faces expressing anger (Lynch et al., 2006; Schulze et al., 2013) and disgust (Lynch et al., 2006), with trends in the same direction for sadness and fear, but no difference between groups for surprise or happiness (Lynch et al., 2006) (see Table 2.4 for details). However, methodological differences might have led to contrasting findings. The Lynch et al. (2006) study allowed participants to change their responses (as the expression morphed to reach 100 per cent intensity), allowing greater opportunities for guessing and increased practice, whereas the first response was final in the other studies. Sample age also differed between studies, with much older BPD participants taking part in the Lynch et al. (2006) study (M = 35.5 years, SD = 11.2), compared with participants in the other studies (mean age across studies ranged from 25.91-26.5 years) (Domes et al., 2008; Domes et al., 2011; Lowyck et al., 2015). The greater sensitivity evident in older individuals with BPD might be a consequence of the various factors related to longer duration of illness, such as iatrogenic harm and chronic exposure to stressful life events associated with BPD (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes et al., 2015; Pagano et al., 2004; Wingenfeld et al., 2011). The Schulze et al. (2013) study implemented a novel paradigm in which participants were not required to indicate the specific valence of expressions, in contrast to other studies. This makes it difficult to compare findings from this study with the others, but suggests that pure detection, without consideration of emotional valence, might result in greater sensitivity for adults with BPD.

Combined, these findings suggest that while younger adults (in their late 20’s) with BPD might not have impaired or heightened sensitivity, greater sensitivity might develop in later adulthood (30’s), although a negative bias towards perceiving ambiguous faces as negative is apparent even in younger adults with BPD. It seems likely, therefore, that a negative bias precedes sensitivity to facial expressions of emotions in BPD.

2.5.4 Sensitivity to facial expressions of emotions in young people with BPD.

Emotion sensitivity has been assessed using the face morph task in two studies of young people with BPD (Jovev et al., 2011; Robin et al., 2012) (see Table 2.4 for study details). In contrast to the normal or heightened sensitivity evident in adult samples, out-patient youth with first presentation BPD pathology displayed reduced sensitivity to facial expressions of fear and disgust (Jovev et al., 2011). Similarly, female in- and out-patient adolescents with BPD also demonstrated reduced sensitivity to facial expressions of anger and happiness, compared with healthy controls (Robin et al., 2012). Taken together, emotion sensitivity studies with younger BPD samples do not support the notion that heightened sensitivity is apparent early in the disorder’s trajectory (as proposed by Crowell et al., 2009). Instead, these studies reveal reduced emotion sensitivity in young people with BPD to the emotions of fear, disgust (Jovev et al., 2011), and anger (Robin et al., 2012), which convey the threat of potential social harm, such as exclusion and disapproval (Burklund et al., 2007; DeWall et al., 2009; Kawamoto et al., 2014).

2.5.5 Developmental patterns, implications and future directions.

2.5.5.1 Summary and implications of research to date.

In sum, there appears to be a shift from reduced emotion sensitivity early in the course of BPD, relative to healthy populations, to relatively increased emotion sensitivity, compared with healthy adults, later in the course of BPD. The atypically reduced sensitivity in young people with BPD therefore might place them at risk for missing important social cues. Since social interactions are reciprocal in nature (Gergely & Watson, 2010; Sameroff, 2009; Zahavi & Rochat, 2015), it is possible that if young people with BPD are less sensitive to emotional expressions of social threat (i.e., anger, disgust and fear), their interaction partners (e.g., parent, friend or romantic partner) might respond by heightening the intensity of their own emotional expressions to communicate the desired message. This type of interaction could rapidly intensify and become a vicious cycle of escalation over time and contribute to some of the interpersonal difficulties typical of those with the disorder, such as aggressive behaviour and outbursts.

Reduced sensitivity to happiness in adolescents with BPD (Robin et al., 2012) also contrasts with the typical developmental pattern seen in healthy populations. The normative literature suggests that a facial expression of happiness is typically accurately detected by age five with only a minimal degree of the emotion needed in order to be clearly detectable (Rodger et al., 2015). Reduced sensitivity to happy facial expressions would place a young person with BPD at additional risk of concurrently missing pro-social cues that might otherwise help to de-escalate a negative interpersonal interaction.

2.5.5.2 Gaps, challenges and future directions.

Further research involving young people and adults with BPD is needed to test the proposal that sensitivity to facial expressions is reduced in adolescence but heightened in older adults. Further, the proposal that reduced sensitivity in young people might trigger social interactions that lead to heightened sensitivity to negative expressions as the disorder progresses could be tested longitudinally. Also, if reduced sensitivity to facial emotional expressions in young people with BPD is a precursor evident in earlier stages of the disorder, prevention research could test whether it is amenable to change, and whether early intervention reduces heightened sensitivity as the disorder progresses. Administration of intranasal oxytocin, for example, has been found to increase sensitivity to subtle emotions in people with low baseline levels of sensitivity (Leknes et al., 2013), and could thus be considered as a potential treatment in young people with BPD. As a first step however, the neurobiology associated with emotion sensitivity, or lack thereof, in young people with BPD needs to be understood. Using fMRI, studies focused on adults with BPD have consistently shown increased amygdala responses to emotional stimuli (facial emotional expressions and emotional scenes) in adult BPD patients compared with healthy controls (see review by van Zutphen et al., 2015), but no such studies have been carried out with young people. Therefore, future research should first focus on clarifying the trajectory of emotion sensitivity in BPD at a behavioural and neurobiological level. Research on targeted treatment options should follow.

Table 2.4.

Summary of Sensitivity to Facial Expressions of Emotions in BPD Studies

First Author (year)	Participant Characteristics: Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Task details	Results: Sensitivity[a] < (reduced), > (enhanced), = (comparable)	Error rate[b] < (lower), > (higher), = (comparable)
BPD adults- clinical & 1 non-clinical: dynamic stimuli								
Domes (2008)	BPD (25) HC (25)	Range n/a 26 (7.21) 25.96 (4.51)	100	Germany In-pt, IPDE Setting n/a	All: somatic illness, neurological signs and AOD abuse < 6 mo. BPD: SCZ, MDD, panic disorder, GAD, social phobia HC: > 1 BPD criteria	Dynamic face morph task[c]; POFA, 0-100% intensity, 5% increments; button press indicate emotion recognition; forced choice label emotion	Overall: BPD = HC (anger, disgust, sadness, fear, surprise, happiness)	Anger: BPD = HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD = HC Surprise: BPD > HC Happiness: BPD = HC
						Mixed emotions forced-choice task; POFA dynamic change from anger or fear to other emotions, 10% increments; button press forced choice label emotion		Error Type[d]: BPD more likely than HC to label anger/disgust (50/50) & anger/happy (40/60) blends as anger
Domes (2011)	BPD (19) HC (25)	Range n/a 26.5 (8.1) 26 (4.5)	100	Germany In-pt, IPDE On-campus Ad	BPD: n/a HC: any physical or mental illness	Dynamic face morph task: POFA 0-100% intensity, 5% increments; button press indicate recognition; forced choice label emotion	Overall: BPD = HC Anger: BPD = HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD = HC Surprise: BPD = HC Happiness: BPD = HC	BPD > HC Anger: BPD = HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD > HC Surprise: BPD > HC Happiness: BPD = HC
Lowyck (2015)	BPD (22) HC (22)	18-48 25.91 (8.27) 25.95 (8.48)	77	Belgium In-pt, SCID-II Com, hospital, uni Ad	BPD: n/a HC: PD dx	Dynamic face morph task: Nim Stim; 0-100% intensity, 2% increments; button press indicate recognition; forced choice label emotion	Overall: BPD = HC (fear, sadness, disgust, happiness, anger, surprise)	Overall: BPD = HC (fear, sadness, disgust, happiness, anger, surprise)

Table 2.4 Continued

First Author (year)	Participant Characteristics: Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Task details	Results: Sensitivity[a] < (reduced), > (enhanced), = (comparable)	Error rate[b] < (lower), > (higher), = (comparable)
BPD adults- clinical & 1 non-clinical: dynamic stimuli								
Lynch (2006)	BPD (20) HC (20)	Range n/a 35.5 (11.2) 34.7 (11.2)	85	USA Com; SCID-II Com	All: current mania or hx of psychosis; illiteracy HC: HAM-D score > 6; PD; > 4 BPD sx;	Dynamic Face Morph Task; POFA; 0-100% intensity, 39 stages; button press label emotion	Overall: BPD > HC Anger: BPD > HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD = HC Surprise: BPD = HC Happiness: BPD > HC	Overall: BPD = HC (anger, disgust, sadness, fear, surprise, happiness)
BPD adults- clinical: static stimuli								
Schulze (2013)	BPD (20) HC (25)	Range n/a 24 (6) 26 (6)	100	Germany In-pt (non-acute); IPDE Ad	BPD: psychosis, bipolar, neurological dx, psychotropic medication < 2 wk HC: current/lifetime mental illness/neurological dx, psychotropic medication	Detection task; Karolinska faces; Rapid, continuous static neutral faces; flower/mushroom image with randomly inserted angry/happy face. *Single- task trials*: participants report presence of emotion face *Dual-task trials:* participants report presence of emotion face & flower/mushroom	Single-task trial: Angry: BPD > HC Happy: BPD = HC Dual-task trial: Overall BPD > HC	n/a
BPD young people- clinical: dynamic stimuli								
Jovev (2011)	BPD (21) HC (20)	16-24 18.9 (3.10) 20.4 (2.72)	86 65	Australia Out-pt; ≥3 DIPD c Local Ad	All: visual impairment, ID, SCZ, psychotic dx, alcohol/drug intoxication, hx head injury, epilepsy, meningitis, encephalitis, brain infection, loss of consciousness > 10min, seizures, thyroid disorder, significant medical illness HC: ≥ 1 BPD or APD sx, hx of psychiatric problems	Dynamic face morph task; POFA; 0-100% intensity, 5% intervals; button press indicate recognition, forced-choice label emotion	Earliest correct[e] Anger: BPD = HC Disgust: BPD < HC Sadness: BPD = HC Fear: BPD < HC Surprise: BPD = HC Happiness: BPD = HC	Earliest incorrect[f] Anger: BPD = HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD = HC Surprise: BPD = HC Happiness: BPD > HC

Table 2.4 Continued

	Participant Characteristics						Results	
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Task details	Sensitivity[a] < (reduced), > (enhanced), = (comparable)	Error rate[b] < (lower), > (higher), = (comparable)
BPD young people- clinical: dynamic stimuli								
Robin (2012)	BPD (22) ComC (22)	15-19 16.9 (1.1) 16.2 (0.6)	100	France, Belgium, Switzerland In- & out-pt, SIDP-IV Schools	All: SCZ, chronic/life-threatening medical illness ComC: PD dx	Dynamic face morph task; POFA; 0-100% intensity, 2.5% stages; forced choice identify emotion; able to change response until 100% intensity reached	All: BPD < HC Anger: BPD < HC Disgust: BPD = HC Sadness: BPD = HC Fear: BPD = HC Surprise: BPD = HC Happiness: BPD < HC	n/a[g]

Note. (abbreviations are listed alphabetically) Ad = advertising; AOD = alcohol and other drug; APD = antisocial personality disorder; BPD = borderline personality disorder; c = criteria; Com = community; ComC = community control group; DIPD = Diagnostic Interview for DSM-IV Personality Disorder; dx = disorder/diagnosis; F = female; GAD = generalised anxiety disorder; HAM-D = Hamilton Depression Rating Scale; HC = healthy control; hx = history; ID = intellectual disability; In-pt = inpatient; IPDE = International Personality Disorders Examination; MDD = major depressive disorder; mo = month; n/a = not available/not reported; Nim Stim = Nim Stim Set of Facial Expressions; Out-pt = out-patient; PD = personality disorder; POFA = Pictures of Facial Affect; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; sx = symptoms; uni = university; wks = weeks.

[a]Sensitivity: refers to the intensity of expressed emotion required for recognition of the emotion.
[b]Error rate: refers to the number of recognition errors made when labelling the emotions.
[c]Dynamically changing facial expressions gradually morph from neutral 0% intensity to 100% emotional intensity. The increment of gradual increase in intensity varied across experiments.
[d]Errors: Only the Domes 2008 study reported types of errors made.
[e]Earliest correct response- sensitivity in this study was defined as the ability to recognise emotions at lower intensities.
[f]Earliest incorrect response- impulsivity was examined by analysing the earliest incorrect responses.
[g]Sensitivity and accuracy were not separated therefore results for accuracy are the same as for sensitivity.

2.6 Rejection Sensitivity

2.6.1 Purpose of rejection sensitivity.

Rejection sensitivity refers to the tendency to anxiously expect and perceive rejection from others (Downey & Feldman, 1996). The detection and perception of social rejection is an adaptive response to social threat (Baumeister & Leary, 1995). It signals pain and triggers a range of cognitive, affective, and behavioural responses that serve to ensure the fundamental need to belong is met (K. D. Williams, 2009). Children and young people who overestimate rejection from their peers are as at risk for internalising and externalising mental health issues as young people whose peers actually highly reject them (Sandstrom, Cillessen, & Eisenhower, 2003; B. A. White & Kistner, 2011). Those who underestimate their rejection, such as children with an inflated perception of competence or poor self-awareness of their personal social deficits, might continue to perpetuate their social shortcomings (e.g., interpersonal aggression) and form less close relationships with others (Prasad-Gaur, Hughes, & Cavell, 2001; Zimmer-Gembeck et al., 2013). Thus, clinical attention is warranted for those who overestimate as well as underestimate social rejection.

2.6.2 Typical development of rejection sensitivity from adolescence through adulthood.

2.6.2.1. Typical development of trait rejection sensitivity.

Trait rejection sensitivity is typically assessed via self-report questionnaires (primarily the Rejection Sensitivity Questionnaire; Downey & Feldman, 1996). In normative samples, trait rejection sensitivity predicts greater negative affect, and impairs affect regulation in response to social stimuli, to a greater degree in younger but not older individuals (age range from 10-23 years) (Silvers et al., 2012). In 16-18 year olds, trait rejection sensitivity is associated with increased depressive and anxiety symptoms, and decreased peer-reports of social competence (Marston, Hare, & Allen, 2010). Males also report greater rejection sensitivity than females at age 16-17 years (Marston et al., 2010).

2.6.2.2. Typical development of state rejection sensitivity.

State rejection sensitivity is typically explored by assessing self-reported affect following rejection inducing paradigms, commonly Cyberball (a virtual ball-tossing game; K. D. Williams, Cheung, & Choi, 2000), although other novel paradigms, such as the Chatroom task, have also been used to assess sensitivity to peer rejection (Guyer, Silk, & Nelson, 2016). In typical healthy populations, the mood of adolescents is affected to a greater degree by social rejection compared with the mood of adults (Pharo, Gross, Richardson, & Hayne, 2011; Sebastian, Viding, Williams, & Blakemore, 2010), suggesting that they find social rejection more distressing. For example, in response to social rejection, young people from 11 through to about 22 years, experience greater anxiety, anger, hurt, and reduced positive emotions compared with adults aged 22 and over (Pharo et al., 2011; Sebastian, Viding, et al., 2010). In addition, perceived threats to social needs appear to be affected to a greater degree in female normative samples (Pharo et al., 2011; Sebastian, Viding, et al., 2010). Gender and age appear to affect the degree to which social inclusion improves mood, particularly in older adolescent females (Guyer, Caouette, Lee, & Ruiz, 2014; Kloep, 1999). Further, different social needs appear to take precedence at different ages. Following ostracism, threats to self-esteem are greater for 8-9 year olds compared with older groups, threats to belonging are greater for 13-14 year olds compared with 8-9 year olds and young adults (mean age of 20 years), and threats to meaningful existence are greater for young adults compared with the younger groups

(Abrams, Weick, Thomas, Colbe, & Franklin, 2011). Brain imaging indicates that brain regions associated with affect regulation (i.e., ventrolateral prefrontal cortex) are engaged to a greater degree in adults compared with young people in response to rejection cues, suggesting continued development (in terms of structure and functional connectivity) in these regions between adolescence and adulthood (Sebastian, Roiser, et al., 2010).

2.6.3 Rejection sensitivity in adults with BPD.

A developmental attachment framework suggests that individuals with BPD are biologically predisposed to experience hypersensitivity to interpersonal distress (Gunderson, 2007). This biological predisposition is thought to interact with the environment, in particular maladaptive parenting, and leads to a heightened susceptibility to perceive abandonment and rejection, which presents symptomatically in BPD as proximity seeking and avoidance of abandonment (Gunderson, 2007; Gunderson & Lyons-Ruth, 2008). The BPD literature has generally explored both trait and state rejection sensitivity, therefore findings of both aspects are presented here.

2.6.3.1 Trait rejection sensitivity in adults with BPD.

Trait rejection sensitivity has been associated with BPD features in non-clinical samples of university students[9] (Ayduk et al., 2008; Berenson et al., 2009; Boldero et al., 2009; De Panfilis, Meehan, Cain, & Clarkin, 2016; Gardner, Qualter, Stylianou, & Robinson, 2010; J. Goodman, Fertuck, Chesin, Lichenstein, & Stanley, 2014; Miano, Fertuck, Arntz, & Stanley, 2013; Peters, Smart, & Baer, 2015; Rosenbach & Renneberg, 2014; Selby, Ward, & Joiner, 2010; Tragesser, Lippman, Trull, & Barrett,

[9] University samples varied widely in age (from 17-63 years, mean age approximately 21.18; though not all studies reported mean age or age range) and could therefore not be said to be representative of young people specifically. These findings are therefore reported in this section and taken to be representative of adults.

2008; Zielinski & Veilleux, 2014) and in adults recruited from the community (Ayduk et al., 2008; Meyer, Ajchenbrenner, & Bowles, 2005). Adults with a BPD diagnosis report the highest levels of trait rejection sensitivity when compared with healthy controls (Berenson, Downey, Rafaeli, Coifman, & Leventhal Paquin, 2011; Berenson et al., 2016; Jobst et al., 2014; Staebler, Helbing, Rosenbach, & Renneberg, 2011), or with a mixed clinical sample of patients with anxiety and mood disorders or combined social phobia/avoidant personality disorder (individuals with these diagnoses were combined in that study) (Chesin, Fertuck, Goodman, Lichenstein, & Stanley, 2015; Staebler, Helbing, et al., 2011) (see Table 2.5 for study details). However, adults with BPD report similar levels of trait rejection sensitivity compared with adults with avoidant personality disorder (Beeney, Levy, Gatzke-Kopp, & Hallquist, 2014; Berenson et al., 2016), suggesting that while trait rejection sensitivity is high in adults with BPD, it might not be disorder specific.

2.6.3.2. State rejection sensitivity in adults with BPD.

Following social ostracism induction via the Cyberball task, adults with BPD typically experience higher levels of overall negative affect and anxiety compared with healthy controls (Beeney et al., 2014; De Panfilis, Riva, Preti, Cabrino, & Marchesi, 2015; Jobst et al., 2014; Renneberg et al., 2012) (see Table 2.6 for study details). There are exceptions, however, where negative affect following rejection did not differ between groups (Dixon-Gordon, Gratz, Breetz, & Tull, 2013; Domsalla et al., 2014).

Like trait rejection sensitivity, state rejection sensitivity does not appear to be specific to BPD. Adults with BPD and major depressive disorder (MDD) reported comparable levels of negative affect following Cyberball (Beeney et al., 2014). Combined, these studies indicate greater rejection sensitivity for adults with BPD (i.e., higher negative affect following ostracism) than healthy controls, suggesting that they are likely to respond with a more negative response if feeling rejected, ostracised, or excluded.

In addition to negative affect following Cyberball, adults with BPD reported greater likelihood of responding with aggression than individuals with MDD (Beeney et al., 2014). Similarly, adults with BPD responded with rage (Berenson et al., 2011; Renneberg et al., 2012), and reported greater anger and contempt focused on others following rejection (studies included Cyberball or other rejection priming paradigms, see Table 2.6) compared with healthy controls (Jobst et al., 2014; Staebler, Renneberg, et al., 2011). Following social exclusion, BPD participants also perceived greater threat to the basic social needs of perceived control, belonging, self-esteem, and meaningful existence, compared with healthy controls (Dixon-Gordon et al., 2013; Jobst et al., 2014). Even following inclusion, adults with BPD continued to feel more excluded than healthy controls (Domsalla et al., 2014; Staebler, Renneberg, et al., 2011). Overt over-inclusion reduced the negative emotional experience for adults with BPD, but they still perceived explicit over-inclusion as rejecting, suggesting that adults with BPD are not only sensitive to interpersonal rejection but also have a need for extreme idealised inclusion (De Panfilis et al., 2015). Interestingly, two studies found that, regardless of the experimental condition (i.e., inclusion, exclusion, over-inclusion), adults with BPD experienced a decrease in sadness and an increase in happiness immediately after Cyberball (De Panfilis et al., 2015; Renneberg et al., 2012). This suggests a generally positive impact of social participation, but the impact was only short-lived as it dissipated within 20 minutes (De Panfilis et al., 2015).

Adults with BPD also reported higher levels of negative emotions even before Cyberball (Renneberg et al., 2012; Staebler, Renneberg, et al., 2011), a factor that could impact on the level of negative affect at later time-points during the Cyberball game, and the magnitude of change seen over time, when compared with healthy controls. Nevertheless, research to date indicates that adults with BPD are more sensitive to social rejection than the average adult and are more likely to respond with anxiety and anger towards others in situations of social exclusion.

2.6.4 Rejection sensitivity in young people with BPD.

2.6.4.1. Trait rejection sensitivity in young people with BPD.

No studies have specifically assessed trait rejection sensitivity in clinical samples of adolescents or youth with BPD. However, one recent study assessed trait rejection sensitivity reported by in- and out-patient young adults with BPD (mean age, 23.6, SD = 4.1, range not reported) (R. C. Brown et al., 2017) (see Table 2.5 for study details). The study also included adolescents (mean age, 15.5, SD = 2) with non-suicidal self-injury (NSSI; as defined by DSM-5 proposed criteria for NSSI), and age matched healthy controls for each clinical group. Young adults with BPD reported greater trait rejection sensitivity compared with healthy controls and adolescents with NSSI, and adolescents with NSSI reported greater rejection sensitivity than their healthy counterparts. The older and younger control groups did not differ. These findings are particularly interesting given the developmental theme of the current review, because, while NSSI occurs independently of BPD, it is also a core feature of BPD, and sensitivity to social exclusion might be common to both (R. C. Brown et al., 2017). The authors of that paper argue that if NSSI and BPD represent a developmental continuum, these findings then suggest increasing rejection sensitivity between adolescents in the early, subsyndromal stages of BPD, through to later full threshold BPD in young adulthood (R. C. Brown et al., 2017).

2.6.4.2. State rejection sensitivity in young people with BPD.

Only one study has explored state rejection sensitivity in a clinical BPD youth sample (see Table 2.6 for study details). Using the Cyberball paradigm, K. A. Lawrence, Chanen, and Allen (2011) found that youth with first presentation BPD reported that their state affect changed to the same extent as it did for healthy controls over the course of Cyberball. They were also able to spontaneously (without explicit instruction) regulate (return to baseline) their self-reported affect to the same extent as healthy controls. This suggests that youth with first presentation BPD are no more reactive than and can regulate their emotions in response to ostracism to the same extent as, their healthy counterparts. However, it is also of note that the BPD participants reported their affect (anger, disgust, fear, joy, sadness, surprise, rejection, shame, emptiness, suicidality, dissociation (spaced-out), suspicion, and guilt) as more intense (on a visual analogue scale, rated from 'not at all' to 'extremely') than healthy controls at all time points, including at baseline.

The recent R. C. Brown et al. (2017) study (reported in Section 2.6.4.1) also assessed perceived social rejection following Cyberball (as assessed by the Needs Threat Scale). Results showed that young adults with BPD felt more excluded than adolescents with NSSI, and healthy age matched controls, following Cyberball. Adolescents with NSSI did not feel more excluded than their aged-matched healthy peers, and the older and younger control groups did not differ in terms of felt social exclusion. The authors of that study suggest that, from a developmental perspective (if adolescents with NSSI are considered to be earlier along the BPD continuum) then the impact of their greater trait rejection sensitivity, relative to their healthy peers (discussed in Section 2.6.4.1) might be generalised and result in greater sensitivity to social rejection as the disorder progresses to later stages of disorder. They propose that the greater social rejection experienced by the young adults with BPD following Cyberball, relative to adolescents with NSSI, bears this out.

2.6.5 Developmental patterns, implications and future directions.

2.6.5.1 Summary and implications of research to date.

Findings to date indicate consistently greater trait rejection sensitivity in adults and young adults with BPD compared with their healthy peers (Berenson et al., 2011; Berenson et al., 2016; R. C. Brown et al., 2017; Jobst et al., 2014; Staebler, Helbing, et al., 2011). However, no studies have specifically assessed trait rejection sensitivity in clinical samples of adolescents or youth with BPD, therefore it is difficult at this stage to describe the developmental trajectory of state rejection sensitivity in BPD from adolescence through adulthood. However, the novel study by R. C. Brown et al. (2017) suggests that heightened rejection sensitivity in adolescents with NSSI could represent heightened rejection sensitivity in earlier stages of BPD.

Regarding state rejection sensitivity, research to date indicates a pattern of increasing state rejection sensitivity during the period between adolescence and adulthood for individuals with BPD (Beeney et al., 2014; De Panfilis et al., 2015; Jobst et al., 2014; K. A. Lawrence et al., 2011; Renneberg et al., 2012). This observation appears to be supported by a recent and novel developmental study (R. C. Brown et al., 2017). This is the reverse of what occurs in healthy populations. In typical healthy populations, adolescent mood is affected to a greater degree by social rejection, compared with adults (Pharo et al., 2011; Sebastian, Viding, et al., 2010), suggesting that healthy adults, unlike adults with BPD, develop the ability to better regulate affective responses to rejection. Therefore, the developmental trajectory of rejection sensitivity might substantially diverge from a normative path for BPD sometime during late adolescence/early adulthood, when rejection sensitivity appears to become particularly problematic for adults with the disorder.

2.6.5.2 Gaps, challenges and future directions.

Future studies focused on young people should replicate methodologies that have already been used with adults so that findings across the development of the disorder can be considered side by side and a developmental picture might begin to emerge. Longitudinal or cross-sectional research would also assist to shed light on the developmental trajectory of rejection sensitivity in BPD.

It is also recommended that paradigms other than Cyberball be used to assess rejection sensitivity in BPD. Cyberball was designed to induce ostracism, and not rejection specifically, yet Cyberball is the only paradigm that has been used in studies assessing rejection sensitivity in adults with BPD. While ostracism and rejection are related, they are not identical. It has been suggested, for example, that ostracism is a form of rejection (Leary, 2005), with ostracism referring to "ignoring and excluding individuals", whereas rejection requires the "explicit declaration that an individual or group is not wanted" (K. D. Williams, 2007, p. 427). Therefore, future research into rejection sensitivity could expand on previous research by implementing alternative established paradigms (for example, see Leary, 2005; K. D. Williams, 2007), as well as novel paradigms, such as the Chatroom task (Guyer et al., 2016), which facilitate the assessment of rejection sensitivity more specifically.

Table 2.5.

Summary of Trait Rejection Sensitivity in BPD Studies

First Author (year)	Participant Characteristics: Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Questionnaire/Measure	Results: Trait RS < (reduced), > (greater/increased), = (comparable)
					BPD adults- clinical		
Beeney (2014)	 BPD (23) MDD (13) HC (21)	18-60 31.84 (9.10) 32.12 (8.80) 27.78 (11.74)	100	USA Out-pt; IPDE Out-pt; SCID-I Com	All: left-handed, significant medical illness; lifetime psychotic dx, bipolar I, delirium, dementia, brain injury, MR BPD: MDE <6 mo MDD: > 2 cluster B PD HC: current/past axis I/II dx; ≥ 2 cluster B features	Adult Rejection Sensitivity Questionnaire (ARSQ)[a]	BPD > HC BPD = MDD MDD > HC
Chesin (2015)	 M/BPD (60) MoodD (25)	18-62 30.4 (10.6) 35.7 (11.2)	 81.7 56	USA Patients; Mood dx + BPD, SCID-I/II Patents; Mood dx only, SCID-I	MoodD: BPD dx	ARSQ	BPD > MoodD
Jobst (2014)	 BPD (22) HC (21)	Not reported[b]	100	Germany Setting n/a; SCID-II Setting n/a	n/a	Rejection Sensitivity Questionnaire (RSQ)	BPD > HC
Staebler (2011b)	 BPD In-pt (26) BPD Out-pt (20) MoodD[c] (22) ANX[d] (38) SP/AVPD[e] (23) HC (76)	Range n/a 27.27 (7.69) 28.45 (4.09) 43.68 (10.12) 38.95 (10.54) 34.65 (11.06) 29.33 (9.47)	 100 80 50 68.4 52.2 92.1	Germany In-pt ≤ 3wk DBT tx; SCID-II BPD Out-pt tx; SCID-II BPD Out-pt tx; SCID-I Mood dx Out-pt tx; SCID-I Anxiety dx Out-pt tx; SCID-I & II SP/AVPD Uni students	All: acute psychotic sx, organic brain disease BPD In-pt: hx bipolar	RSQ	All BPD > HC, MoodD, ANX, SP/AVPD HC < all groups BPD In-pt = BPD Out-pt
					BPD adults – non-clinical		
Berenson (2011)	 BPD (45) HC (40)	Range n/a 33.5 (10.2) (M & SD reported for overall sample)	76.5	USA Com; SIDP-IV Com	All: psychosis, AOD intoxication/withdrawal, cognitive impairment; reading, language or visual impairments HC: current/partially remitted axis I disorder past year; < 2 BPD c; < 3 c for any single PD; < 10 PD c in total; psychotropic meds, ≤ 80 GAF score	ARSQ	BPD > HC

Table 2.5 Continued

First Author (year)	Participant Characteristics: Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Questionnaire/Measure	Results: Trait RS < (reduced), > (greater/increased), = (comparable)
				BPD adults – non-clinical			
Berenson (2016)		18-64		USA	All: psychotic dx, AOD intoxication /withdrawal, cognitive impairment, illiteracy	ARSQ	BPD > HC
	BPD (35)	30.69 (9.63)	86	Com; SID-P-IV BPD c	AVPD: ≥ 1 cluster B PD dx		BPD = AVPD
	AVPD (24)	(M & SD reported for overall sample)	54	Com; SID-P-IV AVPD c	HC: > 2 c for any PD, or > 10 PD c in total; no psychiatric dx, psychotropic meds past year, ≤ 80 GAF score		
	HC (45)		69	Com			
				BPD adults & young people -clinical			
Brown (2017)		Range n/a		Germany	All: medical dx, epilepsy, AOD dx, psychotic dx; antipsychotic meds	Hurt Feelings Scale (measures sensitivity to social exclusion)	BPD > HCYA
	BPD (14)	23.6 (4.1)	100	In-/out-pt DSM-5 BPD c SCID-I[f]			BPD > NSSI
	HCYA (17)	23.2 (4.4)	76.9	Medical centre (unclear) SCID-I	NSSI: BPD		NSSI > HCA
	NSSI (13)	15.5(2.0)	100	In-/out-pt DSM-5 NSSI c, K-SADS	HCYA & HCA: Axis I dx (no other exclusions stated)		HCYA > HCA
	HCA (15)	14.5 (1.7)	80.0	Medical centre (unclear), K-SADS			

Note: (abbreviations are listed alphabetically) ANX = anxiety disorder; AOD = alcohol and other drug; ARSQ = Adult Rejection Sensitivity Questionnaire; AVPD = avoidant personality disorder; BPD = borderline personality disorder; BPD In-pt = borderline personality disorder inpatient; BPD Out-pt = borderline personality disorder outpatient; c = criteria; Com = community; DBT = dialectical behaviour therapy; DSM-5 = Diagnostic and Statistical Manual - 5 (5th Edition); dx = disorder/diagnosis; F = female; GAF = Global Assessment of Functioning; HC = healthy control; HCA = healthy control adolescents; HCYA = healthy control young adults; hx = history; In-pt = inpatient; IPDE = International Personality Disorders Examination; K-SADS = Kaufman Schedule for Affective Disorders and Schizophrenia for School Aged Children; M/BPD = mood disorder with comorbid borderline personality disorder; MDD = major depressive disorder; MDE = major depressive episode; mo = month; MoodD = mood disorder without comorbid borderline personality disorder; MR = mental retardation; MRI = magnetic resonance imaging; n/a = not available/not reported; NSSI = non-suicidal self-injury adolescents; Out-pt = out-patient; PD = personality disorder; RS = rejection sensitivity; RSQ = Rejection Sensitivity Questionnaire; SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SIDP-IV = Structured Interview for DSM-IV Personality Disorders; SP/AVPD = social phobia and avoidant personality disorder; sx = symptoms.

[a]ARSQ = adapted from RSQ, which was developed to assess trait rejection sensitivity in university samples. Includes nine hypothetical interpersonal situations involving acceptance or rejection by important others. Participants rate their anxiety/concern for each situation, as well as the likelihood that the other person would respond with rejection. To score the ARSQ first the concern score is multiplied with the likelihood of rejection score for each situation, then an average trait rejection sensitivity score is derived.
[b]Mean age, range and SD were not reported. However, the study stated 'women' were recruited therefore it could be assumed that the women were adults over 18 years of age.
[c]Mood disorder: included major depressive disorder, dysthymic disorder, bipolar disorder.
[d]Anxiety disorders included: generalised anxiety disorder, obsessive-compulsive disorder, panic disorder with or without agoraphobia, post-traumatic stress disorder, specific phobia.
[e]Social phobia and avoidant personality disorders were grouped together.
[f]Measure used to assess BPD not stated, but SCID-I was listed as measure used to assess axis I disorders in adults.

Table 2.6.

Summary of State Rejection Sensitivity in BPD Studies

	Participant Characteristics						Results State Rejection Sensitivity
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Rejection task Measures & timepoints	< (reduced), > (greater/increased), = (comparable)
					BPD adults- clinical		
Beeney (2014)	BPD (23) MDD (13) HC (21)	18-60 31.84 (9.10) 32.12 (8.80) 27.78 (11.74)	100	USA Out-pt; IPDE Out-pt; SCID-I Com	All: left-handed, significant medical illness; lifetime psychotic dx, bipolar I, delirium, dementia, brain injury, MR BPD: MDE < 6 mo MDD: > 2 cluster B PD HC: current/past axis I/II dx; ≥ 2 cluster B features	Cyberball (ostracism induction) PANAS baseline (t1) & post (t2)	PANAS-NA All groups t1 < t2 BPD & MDD > at all timepoints PANAS-PA BPD = HC = MDD t1 & t2 All groups t1 > t2
De Panfilis (2015)	BPD (61) HC (61)	18-65 40.2 (11) 37.6 (12)	77 70.5	Italy Out-pt; SCID-II Ad; ≤ 4 BPD c	BPD: SCZ, psychotic disorder, bipolar, AOD dependence HC: > 4 BPD c; above GSI clinical cut-off	Cyberball (Ostracism, inclusion & overinclusion conditions) Assessed self-reported rejection related emotions of anger, anxiety, sadness, hurt, rejection, happiness on 10-point scale, at baseline (t1), post induction (t2), and after 20 min recovery period (t3); Assessed feelings of social connectedness	Negative emotions: Ostracism & inclusion: BPD > HC Overinclusion: BPD = HC Sadness stable over time for HC; for BPD sadness t1 > t2, t2 < t3 Happiness: BPD & HC t1 < t2 For HC but not BPD t2 < t3 Social connectedness: BPD < HC all timepoints & conditions
Domsalla (2014)	BPD (20) HC (20)	29.2 (7.5) 28.7 (7.8)	100	Germany Out-pt; IPDE Ads	All: lifetime hx psychotic/ bipolar dx; current MDD, AOD abuse/addiction, pregnancy; hx organic brain disease, skull/brain damage, severe neurological illness; metal implants, left-handed, claustrophobia BPD: psychotropic med <2 wk HC: lifetime/current psychiatric dx	Cyberball (exclusion, inclusion, control condition[a]) Self-reported sense of exclusion, inner tension, sense of inclusion	Sense of exclusion: BPD > HC (inclusion & control conditions) BPD = HC (exclusion condition) Inner tension: BPD > HC all conditions Sense of inclusion: BPD < HC (inclusion & control conditions) BPD = HC (exclusion condition)

Table 2.6 Continued

First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Rejection task Measures & timepoints	Results State Rejection Sensitivity < (reduced), > (greater/increased), = (comparable)
				BPD adults- clinical			
Jobst (2014)	BPD (22) HC (21)	n/a[b]	100	Germany Setting n/a; SCID-II Setting n/a	n/a	Cyberball (ostracism induction) pre-post outcome measures: Aversive inner tension[c], threat to social needs, negative mood[d] (overall), anger, contempt	Inner tension: BPD = HC Threat to social needs: BPD > HC Negative mood: BPD > HC Anger: BPD > HC Contempt: BPD > HC
Renneberg (2012)	BPD (30) HC (30)	Range n/a 28.8 (7.6) 29.03 (7.1)	 86.7 86.7	Germany In-pt, non-acute; SCID-II Ads	BPD: acute psychotic sx, bipolar hx, AOD abuse/ dependence, MR, < 18 yrs HC: Axis I/II dx; ≥ 2 BPD sx	Cyberball: random assignment inclusion or ostracism conditions Self-report (pre (t1) & post (t2)): negative emotions, Anger, Sadness; Perception of exclusion based on ball-tosses received perception, feeling ignored, feeling excluded t2	Negative emotions: BPD > HC both conditions For HC t1 < t2 For BPD t1 = t2 Anger for both groups t1 < t2 Sadness: For HC t1 < t2 For BPD t1 > t2 (though sadness t1 BPD > HC) Perception of exclusion t2: BPD > HC Feeling ignored t2: BPD = HC Feeling excluded t2: BPD = HC
Staebler (2011a)	BPD-Inc (18) BPD-Ex (17) HC-Inc (17) HC-Ex (16)	Age >18 yrs 32.11 (9.00) 27.88 (8.31) 31.59 (9.66) 27.88 (8.63)	100	Germany In-pt, non-acute; SCID-II In-pt, non-acute; SCID-II Ad Ad	BPD: acute psychotic sx, hx bipolar, current AOD abuse/dependence, MR HC: psychotropic medication, hx mental illness, > 1 GSI	Cyberball: Exclusion (Ex) and inclusion conditions (Inc) conditions. Assessed pre (t1), post (t2), & change pre to post (t1-t2): Self-focused negative emotions[e]; Other-focused negative emotions[e]; Facial expressions (negative, positive, mixed)[f]	Self-focused negative emotions: T1: BPD > HC, for both Inc & Ex T2: BPD > HC, for both Inc & Ex T1-t2: BPD = HC, for both Inc &Ex Other-focused negative emotions: Pre-post increase for BPD but not for HC after Ex Facial expressions: Negative: BPD > HC, for both Inc & Ex Positive: BPD < HC for both Inc & Ex Mixed: BPD > HC for Ex; BPD = HC for Inc

Table 2.6 Continued

	Participant Characteristics						Results State Rejection Sensitivity
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Rejection task Measures & timepoints	< (reduced), > (greater/increased), = (comparable)
					BPD adults- non-clinical		
Berenson (2011)	BPD (45) HC (40)	Range n/a 33.5 (10.2) (M & SD reported for overall sample)	76.5	USA Com; SID-P-IV Com	All: psychosis, AOD intoxication/withdrawal, cognitive impairment; reading, language or visual impairments HC: current/partially remitted axis I disorder past year; < 2 BPD c; < 3 c for any single PD; < 10 PD c in total; psychotropic meds, ≤ 80 GAF score	Priming-pronunciation task: Assessed association between rejection and rage; shorter latency for rage words primed by rejection words indicated greater rage in response to rejection Experience-sampling: Assessed rejection-contingent rage; Questions over 21 days regarding perceived rejection & rage	Rage in response to rejection BPD > HC Rejection & rage over 21 days BPD > HC The same level of rejection predicted greater rage in BPD than HC
Chapman (2014)	H-BPD (30) L-BPD (44)	Range n/a 22.08 (6.68)	70	Canada Uni; PAI-BOR ≥ 38 Uni; PAI-BOR < 23	n/a	Random assignment to negative mood induction conditions: Academic or Rejection[g] PANAS-NA baseline (t1) & post (t2)	t1 PANAS-NA & hostility = across conditions for both groups Greater shame at t1 for H-BPD than L-BPD in academic vs rejection H-BPD: PANAS-NA t1 < t2 rejection only Irritability t1 < t2 in rejection only Hostility t1 < t2 in both conditions Shame t1 < t2 rejection only L-BPD: PANAS-NA t1< t2 academic only Irritability t1 = t2 Shame t1< t2 academic only

Table 2.6 Continued

	Participant Characteristics						Results State Rejection Sensitivity
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Rejection task Measures & timepoints	< (reduced), > (greater/increased), = (comparable)
					BPD adults- non-clinical		
Chapman (2015)	H-BPD (23) L-BPD (33)	20.70 (3.85) 20.69 (2.28)	87 81.8	Canada Uni; PAI-BOR ≥ 38 Uni; PAI-BOR < 23	n/a	Random assignment to negative mood induction conditions: Rejection (same rejection induction as Chapman 2014) or frustration induction (PASAT-C, a frustrating arithmetic task) PANAS & SSGS shame scale at baseline (t1), post induction (t2) & post 5 min recovery period (t3)	H-BPD: PANAS-NA t1 < t2 both conditions Shame: t1 < t2 frustration condition only Anger: t1 < t2 rejection only. L-BPD: PANAS-NA t1 < t2 frustration condition only Shame: t1 < t2 rejection only PANAS-NA: H-BPD = L-BPD at t2 and t3 Anger: H-BPD > L-BPD at t2 rejection condition only PANAS-PA: t1 > t2 both conditions L-BPD only
Dixon-Gordon (2013)	BPD (53) N-BPD (34)	18-60 26 (10.9) 23 (9.9)	72 50	USA Com; DIP-D-IV Com; DIP-D-IV	All: current manic, hypomanic, depressive mood episodes, AOD dependence, psychosis N-BPD: > 3 BPD c;	Cyberball (ostracism) PANAS-NA: pre (t1) & post (t2); Nonspecific distress pre (t1) & post (t2)[h]; Threat to social needs[i] (t2)	PANAS-NA (t1 to t2 change controlling for baseline levels) BPD = N-BPD Nonspecific distress (t1 to t2 change controlling for baseline levels): BPD > N-BPD Threat to social needs t2: BPD > N-BPD
					BPD adults & young people- clinical		
Brown (2017)	BPD (14) HCYA (17) NSSI (13) HCA (15)	Range n/a 23.6 (4.1) 23.2 (4.4) 15.5(2.0) 14.5 (1.7)	100 76.9 100 80.0	Germany In-/out-pt DSM-5 BPD c SCID-I[j] Medical centre (unclear) SCID-I In-/out-pt DSM-5 NSSI c, K-SADS Medical centre (unclear), K-SADS	All: medical dx, epilepsy, AOD dx, psychotic dx; antipsychotic meds NSSI: BPD HCYA & HCA: Axis I dx (no other exclusions stated)	Cyberball inclusion and exclusion conditions. Assessed threats to social needs using the needs threat scale post Cyberball	Threats to social needs: BPD > NSSI BPD > HCYA NSSI = HCA

Table 2.6 Continued

	Participant Characteristics						Results State Rejection Sensitivity
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Rejection task Measures & timepoints	< (reduced), > (greater/increased), = (comparable)
					BPD young people- clinical		
Lawrence (2011)	BPD (30) HC (22)	15-24 18.95 (2.49) 19.25 (2.27)	90 86	Australia Out-pt; ≥ 4 SCID-II Com	All: MR, psychotic dx, psychiatric dx due to general medical condition HC: axis-I disorder, any DSM-IV BPD or APD features	Cyberball Self-reported mood pre (t1), post (t2) and 15 min post (t3) Cyberball Visual analogue scale for: negative emotions (anger, disgust, fear, sadness, rejection, shame, emptiness, suicidality, dissociation, suspicion, and guilt) and positive emotions (joy, surprise)	Negative emotions: BPD > HC overall at all timepoints Positive emotions: BPD < HC overall at all timepoints No group by time interactions for any mood state

Notes. (abbreviations are listed alphabetically) Ad = advertising; AOD = alcohol and other drug; APD = antisocial personality disorder; BPD = borderline personality disorder; c = criteria; Com = community; DIPD-IV = Diagnostic Interview for DSM-IV Personality Disorder; DSM-5 = Diagnostic and Statistical Manual - 5 (5th Edition); dx = disorder/diagnosis; Ex = exclusion; F = female; GAF = Global Assessment of Functioning; GSI = Global Severity Index; H-BPD = group with high number of BPD criteria; HC = healthy control; HCA = healthy control adolescents; HCYA = healthy control young adults; hx = history; Inc = inclusion; In-pt = inpatient; IPDE-BPD = International Personality Disorders Examination - Borderline Personality Disorder Section; K-SADS = Kaufman Schedule for Affective Disorders and Schizophrenia for School Aged Children; L-BPD = group with low number of BPD criteria; MDD = major depressive disorder; MDE = major depressive episode; mo = month; MR = mental retardation; n/a = not available/not reported; N-BPD = Non borderline personality disorder; NSSI = non-suicidal self-injury adolescents; Out-pt = out-patient; PAI-BOR = Personality Assessment Inventory - Borderline Subscale; PANAS = positive and negative affect schedule; PANAS-NA = positive and negative affect schedule- negative affect; PANAS-PA = positive and negative affect schedule- positive affect; PASAT-C = Paced Auditory Serial Addition Task – Computerized; PD = personality disorder; SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; SIDP-IV = Structured Interview for DSM-IV Personality Disorders; SSGS = State Shame and Guilt Scale; sx = symptoms; uni = university; Wks = weeks; yr/yrs = year/years.

[a]Control condition: Set up so that other players' actions could not be attributed to their intention, but rather were pre-determined by the rules of the game.
[b]Mean age, range and SD were not reported. However, the study stated 'women' were recruited therefore it could be assumed that the women were adults over 18 years of age.
[c]Participants were asked to assess aversive inner tension as a percentage of maximal tension.
[d]Assessed via a 14-item scale.
[e]Current emotional state assessed via the Emotion Scale, a 14-item self-report scale.
[f]Facial expression as assessed using the Emotional Facial Action Coding System.
[g]All participants received the same negative feedback regarding a short essay (Academic condition: "This was one of the worst essays I have ever read!") and regarding a short description of themselves (Rejection condition: feedback indicated that the other 'participant' did not wish to "waste their time" meeting them and that they were not very interesting).
[h]Nonspecific distress- comprised of 'distressed' and 'upset' PANAS items.
[i]Needs threat questionnaire assessed threats to 4 social needs (post-Cyberball): belonging, feeling in control, self-esteem, meaningful existence.
[j]Measure used to assess BPD not stated, but SCID-I was listed as measure used to assess axis I disorders in adults.

2.7 Empathy

Empathy involves the vicarious sharing of other people's internal states, as well as the ability to appreciate, reflect and understand other's thoughts, feelings, beliefs and intentions (Decety & Meyer, 2008; Singer & Lamm, 2009; Zaki & Ochsner, 2012). Respectively, these empathic processes have been referred to as affective and cognitive empathy. While affective and cognitive empathy can be defined separately, and can engage different brain regions (e.g., frontal and parietal premotor systems, and areas of the medial prefrontal cortex, such as the precuneus and superior temporal sulcus, respectively), they are not mutually exclusive and act in concert (see Nummenmaa, Hirvonen, Parkkola, & Hietanen, 2008; Ochsner, 2013; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009; Zaki & Ochsner, 2012). Empathy is associated with prosocial behaviour (Eisenberg & Miller, 1987; McMahon, Wernsman, & Parnes, 2006; A. Williams, O'Driscoll, & Moore, 2014) and various aspects of social functioning (Baron-Cohen & Wheelwright, 2004; Davis, 1983; Hatfield, Cacioppo, & Rapson, 1993), and is therefore key to understanding adaptive and maladaptive aspects of interpersonal functioning.

Despite the severe interpersonal difficulties experienced by individuals with BPD, enhanced, rather than deficient, empathy is theorised to contribute to the disorder (Franzen et al., 2011; Krohn, 1974). It has also been proposed that there might be a paradoxical presentation of empathy in people with BPD. That is, deficits in cognitive empathy, but intact (or perhaps even superior/heightened) affective empathy (Dinsdale & Crespi, 2013; Harari, Shamay-Tsoory, Ravid, & Levkovitz, 2010). This proposed dissociation might partially account for the interpersonal dysfunction and emotional over-reactivity seen in BPD, such that heightened affective empathy results in excessive personal distress, while impaired cognitive empathy fails to effectively modulate such a heightened response (Harari et al., 2010; Jeung & Herpertz, 2014; New et al., 2012). Below, cognitive and affective empathy findings are reviewed separately, followed by a summary and discussion of implications and recommendations.

2.7.1 Cognitive empathy.

2.7.1.1 Purpose of cognitive empathy.

Cognitive empathy involves inferring others' mental states, including thoughts, beliefs and emotions (Blair, 2005; Frith & Frith, 2003; Perner, 1991). Across different fields (e.g., neurobiological, developmental, psychological), *cognitive empathy* is often used interchangeably with the terms *theory of mind* (TOM), *mentalisation*, and *perspective taking* (e.g., Blair, 2005; Preston & Hofelich, 2012; Rueda, Fernández-Berrocal, & Baron-Cohen, 2015; Sharp et al., 2011; Tousignant et al., 2017; Zaki & Ochsner, 2012). Thus, the terms are used interchangeably here, and generally reflect the terminology used by the respective researchers. Complex concepts, including the understanding that others can hold false beliefs, tell white lies, be ironic, and make social *faux pas*, are encompassed by the construct of cognitive empathy (Dziobek et al., 2006; Valle, Massaro, Castelli, & Marchetti, 2015). In addition, inferring emotional states is considered a 'hot' component of cognitive empathy, while inferring thoughts and beliefs is considered a 'cold' component (Shamay-Tsoory, Harari, Aharon-Peretz, & Levkovitz, 2010; Vetter, Weigelt, Döhnel, Smolka, & Kliegel, 2014). These are often referred to as affective TOM and cognitive TOM[10], respectively. The capacity to attribute mental states to others, and consider the

[10] The developmental literature also tends to subdivide cognitive TOM, and associated tasks, into increasingly complex first-, second-, and third- order false beliefs (Dziobek et al., 2006; Valle et al., 2015), but discussion at this level of detail is beyond the scope of this review because the bulk of the BPD research literature has not explored cognitive TOM in this level of detail.

thoughts and intentions of those minds, separate from one's own, facilitates social interactions with individuals and groups. It enables the understanding and prediction of others' behaviours, as well as their moral evaluation, thus informing, for example, judgements of who should be trusted or avoided (Young & Waytz, 2013).

2.7.1.2 Typical development of cognitive empathy from adolescence through adulthood.

The neurocognitive maturation that occurs during adolescence and stabilises into the early twenties, including structural maturation of the prefrontal cortex and parallel development of executive functions, enables greater metalizing capacity (Andersen, 2016; Mills, Lalonde, Clasen, Giedd, & Blakemore, 2014; Pfeifer & Blakemore, 2012; Yurgelun-Todd, 2007). Perspective taking capacity continues to develop throughout adolescence and plateaus by young adulthood (as indexed by the Perspective Taking subscale of the Interpersonal Reactivity Index (IRI), which asks about placing oneself in the other person's shoes in real life scenarios; see Appendix A for task details). When tested experimentally, mentalising regarding emotions and actions has been shown to improve linearly between 13 and 19 years of age (Keulers, Evers, Stiers, & Jolles, 2010), affective theory of mind continues to develop between adolescence and adulthood (with mean ages of 14.18 (range 11-16) and 28.88 (range 24-40) years, respectively) (Sebastian et al., 2012), although adolescents (mean age 14.77, range 12-17 years) have also demonstrated mentalizing capacity as mature as that of young adults (mean age 19.59, range 18-21) and older adults (mean age 24.30, range 22-30) (Tousignant et al., 2017). These contrasting findings could be due to differences in the definition and measurement of constructs, to differences in the ages of cohorts, and to ceiling effects, which can be difficult to overcome in mentalising tasks (Blakemore, 2011).

In vulnerable populations, bidirectional interactions between normative maturation (i.e., increased capacity for complex mentalisation) and risk factors (e.g., biological, environmental) can interact and reinforce increasingly negative perceptions and interpretations of social interactions over time (Haller, Cohen Kadosh, & Lau, 2014). Various researchers have therefore proposed that, given the increased neural plasticity during adolescence and early adulthood, this period might be an optimal time for prevention and early intervention that target cognitive empathy (Andersen, 2016; Kilford, Garrett, & Blakemore, 2016).

2.7.1.3 Cognitive empathy in adults with BPD.

Self-reported cognitive empathy is typically assessed using the Perspective Taking and Fantasy scales of the Interpersonal Reactivity Index[11] (IRI; see Appendix A for task details) (Davis, 1980, 1983). When results of these sub-scales are combined, adult BPD patients' cognitive empathy appears to be impaired, compared with healthy controls (Harari et al., 2010) (see Table 2.7 for study details). However, when separated, results from the Fantasy scale suggest similar BPD and healthy controls functioning (Dziobek et al., 2011; Guttman & Laporte, 2000; New et al., 2012; Petersen, Brakoulias, & Langdon, 2016) (see Table 2.7 for study details). Only the Perspective Taking scale consistently indicates adult BPD patient impairment, compared with healthy controls (Dziobek et al., 2011; New et al., 2012; Petersen et al., 2016; Ritter et al., 2011), except for one study where BPD and healthy control groups reported similar levels of cognitive empathy (Guttman & Laporte, 2000) (see Table 2.7 for study details). However, the age range in that study spanned adolescence

[11] The Perspective Taking scale assesses the ability to 'put oneself in another's shoes' during a real-life situation (e.g., "Before criticizing somebody, I try to imagine how I would feel if I were in their place"), and the Fantasy scale asks individuals about their ability to imagine themselves in fictional situations such as a book (e.g., "When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me") (Davis, 1980).

through adulthood (16-45) and the BPD group was an average of 10 years older than the women in the healthy control group. Age likely affected the results, given that perspective taking ability continues to develop and increases over the late adolescent period in typical healthy populations (Davis & Franzoi, 1991). Thus, adults with BPD appear to struggle taking another person's perspective when presented with real life scenarios, but not fictional situations. In addition, the Perspective Taking scale, but not the Fantasy scale, is strongly associated with social functioning (Davis, 1983), suggesting that a perspective taking deficit might contribute to the interpersonal difficulties evident in adults with BPD.

Evaluation of cognitive empathy using experimental tasks also results in variable findings. Assessment of cognitive empathy using 'hot' tasks (i.e., the Movie for the Assessment of Social Cognition (MASC) and the Multifaceted Empathy Test; see Appendix A for task details) and complex 'cold' tasks (i.e., Faux Pas Task and Joke-Appreciation Task; see Appendix A for task details) have indicated difficulty with cognitive empathy (Baez et al., 2014; Dziobek et al., 2011; Harari et al., 2010; Petersen et al., 2016; Preiβler, Dziobek, Ritter, Heekeren, & Roepke, 2010; Ritter et al., 2011) and overmentalising (attributing overly complex/exaggerated mental states) (Andreou et al., 2015; Vaskinn et al., 2015) in adult patients with BPD, compared with healthy controls (see Table 2.7 for study details). These findings generally hold true even when stricter BPD characterisation excludes comorbid Axis-I disorders (Harari et al., 2010) or substance use disorder (Harari et al., 2010; Ritter et al., 2011). However, one recent study using the Multifaceted Empathy Test, found no differences in cognitive empathy between adult patients with BPD and healthy controls during either a control or active stress condition[12] (Wingenfeld et al., 2018). In the absence of

[12] Stress was induced in this experiment using the Trier Social Stress Test, and a placebo version of the task was used for the control condition (Wingenfeld et al., 2018).

a further control condition without a preceding stressful or placebo stress condition, it is difficult to compare the findings from this study to previous findings where the preceding context was otherwise innocuous.

Assessment of cognitive empathy using less complex 'cold' tasks indicates comparable cognitive empathy for adult patients with BPD and healthy controls (Ghiassi, Dimaggio, & Brüne, 2010; Petersen et al., 2016) (see Table 2.7 for study details). Therefore, rather than there being a broad cognitive empathy deficit, as is implied by theories suggesting a dissociation between affective and cognitive empathy (Dinsdale & Crespi, 2013; Harari et al., 2010), findings from studies of adults with BPD support Petersen et al.'s (2016) view that deficits in cognitive empathy are only evident in individuals with BPD when more complex tasks are applied. They also appear to have difficulty with 'hot' tasks, which require individuals to infer the emotional states of others.

However, there are some exceptions to these findings. Arntz, Bernstein, Oorschot, and Schobre (2009) used the Advanced Theory of Mind Test, a 'cold' yet complex TOM task (see Appendix A for task details) and found comparable or enhanced (trend for enhanced performance when corrected for IQ and WAIS picture arrangement test) BPD performance, compared with healthy controls (see Table 2.7 for study details). However, with only 16 participants in the BPD group, the study might have been underpowered to reliably detect group differences, though effect sizes were medium. Future research using the Advanced Theory of Mind Test is therefore recommended. Another, much earlier study, found that relative to schizophrenic and neurotic patients, adult BPD patients were better able to predict the self-reported feelings (suggesting measurement of affective theory of mind) of other members of their group (Ladisich & Feil, 1988). However, it is difficult to compare findings from that study to more recent studies, as the paradigm and diagnostic criteria used differed noticeably from the various other studies reported here.

Another exception involves findings from studies using the Reading the Mind in the Eyes Test (RMET; see Appendix A for task details), which is considered a 'hot', emotionally charged, cognitive empathy task (affective TOM). It involves discriminating subtle and complex affective mental states from photographs of the eye region. The bulk of RMET findings suggest comparable cognitive empathy for adult patients with BPD and healthy controls (see Table 2.7 for study details). This was the case for total RMET score (Baez et al., 2014; Preiβler et al., 2010; Schilling et al., 2012), and scores for negative expressions (Fertuck et al., 2009; Petersen et al., 2016; Schilling et al., 2012), positive expressions (Schilling et al., 2012), and neutral expressions (Frick et al., 2012; Schilling et al., 2012). However, results in two of these studies predominantly indicated enhanced cognitive empathy as reflected by total RMET score, negative expressions, positive expressions, and neutral expressions (Fertuck et al., 2009; Frick et al., 2012) (see Table 2.7 for study details). One study also indicated reduced cognitive empathy in response to positive expressions (Petersen et al., 2016).

It should be noted that the RMET stimuli, static photographs of the eye region, differ from the complex vignettes or social films used by other cognitive empathy tasks. In addition to assessing TOM, the RMET has also been found to assesses emotion recognition (Rueda et al., 2015), and is associated with measures of emotion perception (Henry et al., 2009; Petroni et al., 2011). It is not a homogenous measure of TOM, and has poor internal consistency (Olderbak et al., 2015). It also does not correlate with the MASC in autism spectrum disorders or normative samples (Dziobek et al., 2006). The MASC, contrary to findings using the RMET, indicates impaired cognitive empathy (hypermentalisation) in BPD compared with healthy controls (Andreou et al., 2015; Vaskinn et al., 2015). Therefore, the RMET might be assessing aspects of cognitive empathy, specific to the processing of eye gaze, that are not tapped by the various other tasks that have been used with the adult BPD population.

2.7.1.4 Cognitive empathy in young people with BPD.

There are only a handful of studies focused on young people with BPD, and all have compared BPD to a psychiatric control group but not to healthy controls (see Table 2.7 for study details). Two studies looked at early stage BPD, and compared them to youth with MDD (Jennings, Hulbert, Jackson, & Chanen, 2012; Tay, Hulbert, Jackson, & Chanen, 2017). Social perspective taking (indexed by the Interpersonal Negotiation Strategies Interview; see Appendix A for task details) was less sophisticated and more egocentric for the BPD compared with the MDD group (Jennings et al., 2012). Affective TOM (indexed by the RMET) was found to be impaired in the BPD group, compared with MDD, but cognitive TOM (indexed by Happé's Cartoon Task; see Appendix A for task details) was unimpaired (Tay et al., 2017).

Sharp and colleagues (Sharp et al., 2013; Sharp et al., 2011) used the MASC (see Appendix A for task details) to compare adolescent patients with later stage BPD to adolescent patients who met diagnostic criteria for various other psychiatric diagnoses. Like the studies with adult BPD patients, these studies found that adolescent patients with later stage BPD group were more likely to hypermentalise (over interpretive mental state reasoning), compared with the psychiatric control group. In contrast to these studies, Kalpakci, Vanwoerden, Elhai, and Sharp (2016) recently found no difference in cognitive empathy between BPD youth and a mixed psychiatric control group using the Basic Empathy Scale (a self-report scale; see Appendix A for task details). Given that the more ecologically valid tasks generally indicate that cognitive empathy impairments are present in young people with BPD, compared with psychiatric controls, and in particular with regards to 'hot' aspects/affective TOM, it could be expected that such deficits are also present when compared with healthy peers. However, to understand the direction of the deficit, and to be able to form a developmental picture of the trajectory of cognitive empathy in BPD, comparison studies with typically developing peers are necessary.

It should be noted that there are three group comparison studies involving non-clinical young people with BPD features (see Table 2.7 for study details). Two of those explored affective TOM using the RMET. One found that high-school students with high BPD features demonstrated poorer affective TOM, compared with those with low BPD features (Fossati, Feeney, Maffei, & Borroni, 2014). They were less accurate overall for negative stimuli, but not for neutral or positive stimuli. In contrast, in a sample of young adults enrolled in an introductory psychology university class, those with high BPD features were more accurate at identifying negative mental states, compared with low BPD trait students, but there were no differences between groups for neutral or positive stimuli (Scott, Levy, Adams, & Stevenson, 2011). Like the RMET studies with adult BPD patients, the results of these studies are inconsistent. Differences could be due to demographic differences between cohorts, such as age, setting, and the tools used to assess BPD features.

In the third study, which used a novel task, where undergraduate students inferred the mental state of their interaction partner, participants with higher BPD features appeared to demonstrate enhanced cognitive empathy, relative to their interaction partners (Flury, Ickes, & Schweinle, 2008) (see Table 2.7 for study details). However, the authors concluded that, relative to their low BPD trait counterparts, students with high BPD features were simply harder to *read* (i.e., their mental state was harder to interpret based on their behaviour, such as facial expressions), which meant that they accurately interpret their partner's mental state but their partners couldn't interpret theirs (Flury et al., 2008). Thus, it is unclear what this study suggests regarding cognitive empathy specifically.

2.7.2 Affective empathy.

2.7.2.1 Purpose of affective empathy.

Affective (emotional) empathy is defined as the sharing of another person's emotional state (Singer, 2006; Zaki & Ochsner, 2012). Developmental models of affective empathy differentiate between primitive forms of empathy involving unconscious simulation processes (e.g., rapid mirroring of emotional facial expressions in others), emotional contagion (the tendency to 'catch' other people's emotions/affective states; in which the primary focus is on the self), and the mature recognition that the affective state one has 'caught' belongs to the other (e.g., empathic concern for the other; in which the primary focus is on the 'other') (Blair, 2005; Eisenberg & Miller, 1987; Gonzalez-Liencres, Shamay-Tsoory, & Brüne, 2013; Singer & Lamm, 2009; Zhou, Valiente, & Eisenberg, 2003). These three processes overlap and transact. They allow people to experience a corresponding, congruent emotional response (via mimicry and contagion processes), and to continuously receive feedback about how their interaction partner feels, thereby facilitating moment-to-moment emotional attunement among individuals in a social interaction (Hatfield et al., 1993). Thus, for a complete picture of affective empathy, automatic/unconscious simulation processes, emotional contagion, and the more advanced capacity for empathic concern for the other, need to be understood.

2.7.2.2 Typical development of affective empathy from adolescence through adulthood.

Unconscious simulation processes.

Rapid mirroring of facial emotional expressions, within one second, is reliably observed in children and adults, and occurs even when individuals are instructed not to react and when facial expressions are presented subliminally (P. E. Bailey, Henry, & Nangle, 2009; Beall, Moody, McIntosh, Hepburn, & Reed, 2008; Dimberg, 1990; Dimberg, Thunberg, & Elmehed, 2000; Dimberg, Thunberg, & Grunedal, 2002; Moody, McIntosh, Mann, & Weisser, 2007). It is also observable and associated with healthy attachment in infants (Datyner, Henry, & Richmond, 2017; Isomura & Nakano, 2016; Meltzoff & Moore, 1977), and with prosocial behaviour, as well as with state and trait empathy, in healthy adolescents (Balconi & Canavesio, 2013; Van der Graaff et al., 2016). Rapid, involuntary, facial mimicry is considered a bottom-up, low-level affective empathy mechanism (Decety & Jackson, 2004; Oberman & Ramachandran, 2007; Singer & Lamm, 2009), and is thought to facilitate appropriate empathic responses in the observer (Adolphs, 2002; Decety & Meyer, 2008).

Emotional contagion.

In adults, greater emotional contagion is thought to be due to sensitivity to emotions and lack of control, and is associated with difficulties in distinguishing one’s own and other’s emotions (Carré, Stefaniak, D'Ambrosio, Bensalah, & Besche-Richard, 2013). Its typical trajectory from adolescence through adulthood is not well understood and is difficult to discern from studies that often use self-report scales that do not differentiate between the different aspects of affective empathy. Nevertheless, emotional contagion (indexed by the Personal Distress scale of the IRI), appears to be relatively stable by 17 years of age (Taylor, Barker, Heavey, & McHale, 2015), and seems to decline between adolescence and adulthood (Davis & Franzoi, 1991).

Empathic concern.

Empathic concern follows an inverse *u-shape* trajectory over the life-course in typically developing populations. That is, it generally increases with age from childhood, through adolescence, peaks in middle adulthood, and reduces again into old age (Davis & Franzoi, 1991; Endresen & Olweus, 2001; O'Brien, Konrath, Grühn, & Hagen, 2013). Higher levels of empathic concern in typically developing adolescents are associated with decreases in relational aggression (Batanova & Loukas, 2011). Reduced empathic concern is associated with increased incidence of antisocial behaviour, including bullying behaviours, and particularly in adolescent males (Espelage, Mebane, & Adams, 2004; Jolliffe & Farrington, 2006b, 2011).

2.7.2.3 Affective empathy in adults with BPD.

Unconscious simulation processes.

Unconscious simulation processes have not been assessed in BPD to date. However, a recent study assessed facial reactions in response to facial expressions in female adult patients with BPD over a 10 second period (Matzke, Herpertz, Berger, Fleischer, & Domes, 2014). During longer presentation periods, of more than 1000 milliseconds, it is increasingly difficult to distinguish between automatic motor mimicry and conscious emotional responding. Therefore, studies that focus on presentation times of under 1000 milliseconds, and studies that use masks, are needed in order to begin to understand automatic motor mimicry processes in BPD.

The Matzke et al. (2014) study assessed facial reactions to dynamically changing facial expressions (via facial electromyography, EMG) to differentiate between empathic responding and a negative bias. Matching facial reactions to congruent facial expressions indicated an empathic response, whereas a pattern of increased facial reactions to negative faces and reduced facial reactions to positive faces indicated a negatively biased pattern of responding. BPD patients had a greater corrugator supercilii (frowning) response, when viewing angry, sad, and disgusted facial expressions, compared with healthy controls. They also had a comparatively reduced levator labii superioris response when viewing happy and surprised faces, which is associated with disgust (Rozin, Lowery, & Ebert, 1994; Vrana, 1993; Whitton, Henry, & Grisham, 2015; Whitton, Henry, Rendell, & Grisham, 2014). There were no differences in zygomaticus muscle activity, which is associated with smiling and feelings of happiness (Cacioppo, Petty, Losch, & Kim, 1986; Dimberg, 1990; Dimberg et al., 2002; Tassinary, Cacioppo, & Vanman, 2007), between the groups. Therefore, the results of this study provide partial support for the hypothesis that a negative bias occurs in people with BPD, demonstrated by greater frowning than among healthy controls when viewing angry, sad, and disgusted facial expressions, but a similar (rather than reduced) zygomaticus major (smiling) response when viewing happy faces.

Although the Matzke et al. (2014) study did not assess rapid facial mimicry, it was the first to assess facial reactions in response to facial expressions in BPD using EMG. Due to the challenges of capturing unconscious mimetic responses, methodologies such as facial electromyography might prove useful in future research. *Rapid facial mimicry*, during which individuals unconsciously and rapidly (< 1000 ms) match their own facial expression to that of another, is an important component of affective empathy (Dimberg et al., 2000; Singer & Lamm, 2009).

Emotional contagion.

Emotional contagion refers to the tendency to catch other people's emotional states. It results in a focus on the self, and one's own distress, and has been assessed via questionnaires as well as self-reported affect. The Personal Distress scale of the IRI (see Appendix A for task details), which assesses for emotional contagion, has generally indicated greater self-reported personal distress in adult patients with BPD, compared with healthy controls (Dziobek et al., 2011; New et al., 2012; Petersen et al., 2016). This was except for one study where personal distress was comparable for BPD and healthy control groups (Guttman & Laporte, 2000) (see Table 2.7 for study details). However, the significant age difference between groups (BPD group was an average of 10 years older than controls) in the latter study was not sufficiently accounted for and could have affected the results.

Neuroimaging studies (fMRI) also suggests greater emotional contagion for adult patients with BPD, compared with controls. Dziobek et al. (2011) measured brain activity while participants viewed photographs depicting people in emotionally charged situations and found greater brain activity in the right insular cortex (involved in arousal). This activity was associated with greater skin conductance response for BPD participants, suggesting greater emotional contagion. Results of a study using the emotional contagion component of the Multifaceted Empathy Test, however, indicated reduced contagion for adult patients with BPD compared with healthy controls (Ritter et al., 2011).

Empathic concern.

The more mature capacity to feel concern for the 'other' has also been assessed in adult patients with BPD. The Empathic Concern sub-scale of the Interpersonal Reactivity Index (see Appendix A for task details) has yielded inconsistent results and suggests either reduced (Dziobek et al., 2011; Ritter et al., 2011), or comparable self-reported empathic concern in adult patients with BPD, compared with healthy controls (New et al., 2012; Petersen et al., 2016) (see Table 2.7 for study details). More ecologically valid tasks, such as the empathic concern component of the Multifaceted Empathy Test, and the affective empathy component of the *Faux Pas* task (see Appendix A for task details), have consistently indicated reduced empathic concern in adult patients with BPD, compared with healthy controls (Baez et al., 2014; Dziobek et al., 2011; Petersen et al., 2016; Ritter et al., 2011) (see Table 2.7 for study details). One additional study that used the affective empathy component of the *Faux Pas* task indicated no difference between BPD and healthy control groups (Harari et al., 2010). However, when the difference between affective and cognitive empathy was calculated and compared between groups, the BPD group demonstrated greater affective empathy compared with the healthy control group, whereas the healthy control group displayed the opposite pattern (Harari et al., 2010).

2.7.2.4 Affective empathy in young people with BPD.

Unconscious simulation processes.

To date, there are no studies comparing unconscious simulation processes in young people with BPD with healthy young people.

Emotional contagion.

Only one study has explored the emotional contagion component of affective empathy in adolescent patients with BPD (Kalpakci et al., 2016). This study used the affective empathy subscale of the Basic Empathy Scale (a self-report questionnaire; see Appendix A for task details) to assess for affective empathy in adolescent inpatients with BPD, compared with a healthy control group, aged 12-17 years.

Participants rated how strongly they agreed with statements such as “I don’t become sad when I see other people crying” (a reverse coded item) on a 5-point Likert-scale. Higher scores indicated greater empathy. Adolescent patients with BPD reported greater affective empathy compared with the healthy control group. Based on the items, it appears that the Basic Empathy Scale, like the Personal Distress subscale of the Interpersonal Reactivity Index, assesses for contagion aspects of affective empathy, thus suggesting greater emotional contagion in adolescents with BPD compared with their typically developing peers.

Empathic concern.

There are no published studies comparing the empathic concern component of affective empathy in young people with BPD with that of healthy young people.

2.7.3 Developmental patterns, implications and future directions.

2.7.3.1 Summary and implications of research to date.

Adults with BPD do not appear to experience a gross cognitive empathy deficit (Richman & Unoka, 2015). Instead, they appear to demonstrate specific deficits in emotionally charged (often referred to as affective TOM), as well as complex aspects of, cognitive empathy. Less complex aspects of cognitive empathy appear to be unimpaired. No studies to date have compared cognitive empathy in young people with BPD with that of their typically developing peers, though studies comparing them with psychiatric controls, and studies with non-clinical samples, suggest that impairments occur. Without studies comparing cognitive empathy in young people with BPD with healthy controls, however, it is difficult to speculate about the developmental trajectory of this function for individuals with BPD.

Regarding affective empathy, the emotional contagion aspect appears to be heightened in young people and adults with BPD. That is, individuals with BPD 'catch' emotions from others more readily than healthy controls. This suggests that heightened emotional contagion might develop early in the course of BPD and persist into adulthood. This pattern of greater emotional contagion in young people and adults with BPD contrasts with the typical pattern of development in healthy samples, reflecting either stable or reduced contagion between adolescence and adulthood. In contrast, empathic concern appears to be reduced in adults with BPD, but no studies have assessed empathic concern in young people with BPD. No studies have assessed unconscious simulation processes in adults or young people with BPD. These gaps in the literature make it difficult to speculate about the developmental trajectory of unconscious simulation processes and empathic concern in BPD.

Although it is not the goal of this review to make conclusions regarding the 'borderline empathy paradox' theory, which suggests a dissociation between cognitive and affective empathy (Dinsdale & Crespi, 2013; Harari et al., 2010), research across cognitive and affective empathy (predominantly in adults) to date appears to provide only partial support. That is, impairments in cognitive empathy are not all-encompassing, but appear to be specific to complex and emotionally charged aspects, and heightened affective empathy is only evident with regards to the contagion component, but not for empathic concern.

2.7.3.2 Gaps, challenges and future directions.

Various aspects of empathy in BPD, across developmental periods, remain to be understood. Overall, cognitive empathy has received greater attention than affective empathy in BPD. However, the different aspects of cognitive empathy (i.e., simple and complex; 'hot' and 'cold') need to be better differentiated in future research given that individuals with BPD appear to have difficulties with some, but not all, aspects of cognitive empathy. In addition, there are no studies that compare young people with BPD with healthy young people. Such studies are needed in order to begin to understand the developmental trajectory of cognitive empathy in the disorder.

Affective empathy has received much less attention. Like cognitive empathy, the different components of affective empathy (i.e., unconscious simulation processes, emotional contagion, empathic concern) appear to be affected differently. Future research should pay greater attention to these different components. Specifically, no studies have explored unconscious simulation processes in either young people or adults with BPD. In addition, no studies have assessed empathic concern in young people with BPD. Such research is needed in order to develop a better understanding of all of the different components of affective empathy and its function in BPD.

In addition to research that takes into consideration the different components of cognitive and affective empathy in BPD, future research needs to take into account developmental age and stage of illness. Understanding the developmental trajectory of empathy in BPD is especially important because it continues to develop during the adolescent period (Haller et al., 2014; Pfeifer & Blakemore, 2012), plays an important role in adolescent prosocial behaviour, interpersonal function, and emotion regulation (Eisenberg & Miller, 1987; Pfeifer & Blakemore, 2012), and predicts social competence in adulthood (Allemand, Steiger, & Fend, 2015). Understanding the trajectory of empathy over the course of the disorder will assist us to identify early risk factors that might be able to be targeted in treatments early on, before impairments become entrenched.

Table 2.7.

Summary of Cognitive and Affective Empathy in BPD Studies

First Author (year)	Participant Characteristics: Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Results: Cognitive Empathy < (Reduced), > (Greater), = (Comparable)	Results: Affective Empathy
				BPD Adults- Clinical				
Andreou (2015)	 BPD (44) SCZ (36) HC (38)	Range n/a 29 (8.9) 32.34 (11.44) 32.92 (12.6)	 86 44 58	Germany In-pt/Out-pt; SCID-II In-pt/Out-pt; MINI Ad/wom	All: current > mild MDD; neurological/ dev dx; hx AOD dependence; AOD abuse < 6 mo; hearing/vision problems SCZ: cluster B PD; BPD: bipolar, SCZ HC: family hx psychotic dx; hx psychiatric dx/tx	MASC (overmentalising[b]) MASC (undermentalising[b])	BPD > HC SCZ = BPD & HC BPD = HC SCZ > BPD & HC (> here indicates greater undermentalising)	n/a
Arntz (2009)	 BPD (16) CPD (16) HC (28)	18-45 30.5 (8.1) 29.5 (8.6) 29 (9.5)	100	Belgium Patients[c]; SCID-II Patients[c]; SCID-II ≥ CPD dx Volunteers, setting n/a	CPD: 1 ≥ BPD c CPD & BPD: psychotic dx, bipolar, organic dx, DID, MR HC: any axis-I or axis-II dx, 1 ≥ BPD c, MR	Advanced TOM test	BPD = HC BPD < CPD BPD/CPD comparison n/a	n/a
Baez (2014)	 BPD (15) HC (15)	Range n/a 38.4 (12.2) 36.5 (14.3)	80 87	Argentina Out-pt: SCID-II	All: other axis II dx, bipolar I, SCZ, psychosis, hx AOD abuse/dependency, MR, neurological dx, condition affecting cognition	RMET (total) Faux Pas (cognitive) Faux Pas (affective)	BPD = HC BPD < HC	 BPD < HC
Dziobek (2011)	 BPD (21) HC (21)	Range n/a 31.7 (9.1) 33.2 (10.6)	100	Germany Patients[c]; MINI/SCID-II Setting n/a	All: neurological dx, medical dx HC: specific HC exclusions n/a. Demographics information suggests any axis I or II was an exclusion	IRI (PT) IRI (FS) MET (cognitive empathy) IRI (EC) IRI (PD) MET (emotional empathy)	BPD = HC BPD = HC BPD < HC	 BPD = HC BPD > HC BPD < HC
Fertuck (2009)	 BPD (30) HC (25)	18-55 29.8 (8.5) 26.4 (12)	87 60	USA Patients[c]; SCID-II Ad & uni	BPD: bipolar I, SCZ, psychotic dx, MR, hx severe head trauma, cognitive impairment, neurological disease. HC: hx axis I/II dx, hx substance use dx	RMET (total) RMET (neutral) RMET (positive) RMET (negative)	BPD > HC BPD > HC BPD > HC BPD = HC	n/a

Table 2.7 Continued

First Author (year)	Participant Characteristics: Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Results: Cognitive Empathy < (Reduced), > (Greater), = (Comparable)	Results: Affective Empathy
BPD Adults- Clinical								
Frick (2012)	BPD (21) HC (20)	Range n/a 27.14 (7.48) 24.80 (5.23)	100	Germany Patients[c]; trauma & SCID-II Ad	BPD: hx SCZ-spectrum psychosis, bipolar I, affective dx, AOD abuse previous 6mo HC: h axis I/II dx	RMET (total) RMET (neutral) RMET (positive) RMET (negative)	BPD > HC BPD = HC BPD > HC BPD > HC	n/a
Ghiassi (2010)	BPD (50) HC (20)	22-41 26.18 (6.63) 26.00 (4.15)	92[d] 65	Germany In-pt DBT tx Uni	All: hx TBI, ID, addiction, severe somatic dx HC: axis I/II dx;	MSAT-S MSAT-Q	BPD = HC BPD = HC	n/a
Guttman (2000)	BPD (27) AN (28) HC (27)	16-40 (M & SD n/a BPD M age > AN & HC)	100	Canada Patients[c]; DIB-R ≥8 Out-pt; SCID-I, restricting AN Ad; SC 90-R & BSI normal	BPD & AN: organic condition, psychotic dx BPD: AN dx AN: BPD dx HC: psychiatric hx	IRI (PT) IRI (FS) IRI (EC) IRI (PD)	BPD = HC = AN[e] BPD = HC[e]	 BPD > HC[e] BPD > HC/AN; AN = HC
Harari (2010)	BPD (20) HC (22)	Range n/a 32.10 (10.70) overall	90	Israel In/out-pt; DIB-R Volunteers	BPD: current axis I dx, AOD abuse HC: any psychiatric dx	IRI (PT + FS) Faux Pas (recognition) Faux Pas (cognitive) IRI (EC + PD) Faux Pas (affective)	BPD < HC BPD < HC BPD < HC	 BPD = HC BPD = HC
Ladisich (1988)	BPD (20) Neur (20) Psy (19)	Range n/a 28.7 (n/a) 35.5 (n/a) 28.7 (n/a)	n/a	n/a (Austria/Germany- unclear) In-pt gp therapy; various ax[f] In-pt gp therapy; ICD[g] In-pt gp therapy; hx psychosis/schizo-affective dx ICD	n/a	Novel task, overall empathy score[h]	BPD > Neur & Psy Neur = Psy	n/a
New (2012)	BPD (79) AVPD (39) HC (76)	18-65 33.8 (11.6) 32.3 (11.4) 30.4 (9.4)	67 384 63	USA Out-pt; SIDP-IV Out-pt; SIDP-IV Com Ad	All: hx serious head injury/neurological ds; AOD abuse/dependence past 6 mo; SCZ or psychotic dx; bipolar I; MDE; current psychiatric medication BPD: AVPD dx; AVPD: BPD dx; HC: hx axis I/II dx	IRI (PT) IRI (PT) IRI (PD) IRI (EC	BPD < HC BPD = HC	 BPD > HC BPD = HC

Table 2.7 Continued

First Author (year)	Participant Characteristics: Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Results: Cognitive Empathy	Results: Affective Empathy
							< (Reduced), > (Greater), = (Comparable)	
BPD Adults- Clinical								
Niedtfeld (2017)	BPD (34) HC (32)	Range n/a 28.26 (8.11) 31.16 (8.47)	100	Germany Patients[c]; SCID-II Ad	BPD: current AOD abuse, bipolar, SCZ, current severe MDE HC: any axis I/II dx	Novel task[i]:		
						Emotion recognition	BPD = HC	
						'Congruent'		BPD < HC
						'Neutral content'		BPD > HC
						'Neutral face'		BPD = HC
						'Neutral prosody'		BPD = HC
Petersen (2016)	BPD (19) HC (20)	18-65 32.5 (13.57) 33 (14.27)	95	Australia CMH & NGOs; SCID-II Uni Ad	All: hx head injury, neurological disease, AOD dependence, SCZ dx, non-English speaking, IQ < 80	IRI (PT)	BPD < HC	
						IRI (FS)	BPD = HC	
						False-belief task	BPD = HC	
						RMET (positive valence)	BPD < HC	
						RMET (negative valence)	BPD = HC	
						Joke-appreciation task	BPD < HC	
						Faux Pas (cognitive)	BPD < HC	
						Expression attribution test (affective TOM)	BPD = HC	
						IRI (PD)		BPD > HC
						IRI (EC)		BPD = HC
						Faux Pas (affective)		BPD < HC
Preißler (2010)	BPD (64) HC (38)	Range n/a 29.2 (8.9) 31.7 (10.3)	100	Germany In-pt (non-acute); SCID-II Ad	BPD: mental retardation, SCZ, aged < 18 years HC: Axis I/II dx	RMET	BPD = HC	n/a
						MASC (inference total)[j]	BPD < HC	
						(inference feelings)	BPD < HC	
						(inference thoughts)	BPD < HC	
						(inference intentions)	BPD < HC	

Table 2.7 Continued

First Author (year)	Participant Characteristics: Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Results: Cognitive Empathy	Results: Affective Empathy
							< (Reduced), > (Greater), = (Comparable)	
BPD Adults- Clinical								
Ritter (2011)	BPD (27) NPD (22) HC (53)	Range n/a 30 (8.3) 34.4 (8.3) 33.2 (10.7)	92.6[d] 36.4 54.7	Germany In-pt, non-acute; SCID II In-pt; SCID II Ad	All: hx psychotic dx, bipolar I/II, manic/hypomanic episode, AOD dx BPD: NPD dx	IRI (PT)	BPD, NPD < HC BPD = NPD	
						MET (emotion recognition)	BPD, NPD = HC BPD < NPD	
						MASC (overall)	BPD < HC; NPD = BPD, HC (post hoc only BPD < HC for inferring intentions)	
						IRI (EC)		BPD < HC NPD = BPD, HC
						MET (empathic concern)		BPD, NPD < HC; BPD= NPD
						MET (mirroring emotions)		BPD, NPD < HC BPD = NPD
Schilling (2012)	BPD (31) HC (27)	n/a range, M or SD; groups matched	n/a BPD > HC[d]	Germany Uni med centre; SCID-II Existing pool/wom	BPD: current/lifetime SCZ, AOD dependence last 6 mo; bipolar, schizoaffective dx, MDD with psychotic sx, AN, cognitive impairments HC: mental disorder	Accuracy:		n/a
						RMET (total)	BPD = HC	
						RMET (neutral)	BPD = HC	
						RMET (positive)	BPD = HC	
						RMET (negative)	BPD = HC	
						Confidence (in responses):		
						Correct items	BPD > HC	
						Incorrect items	BPD > HC	
Vaskinn (2015)	BPD (25) SCZ (25) HC (25)	Range n/a 30.7 (5.9) 30.8 (10) 30.6 (8.6)	100	Norway Patients[c]; SCID-II Pre-existing study; SCID-I Pre-existing study, same area	HC: mental dx, neurological dx, somatic dx All: lived in Norway < 10 yrs/poor Norwegian	MASC (total)	BPD = HC; SCZ < BPD, HC	n/a
						MASC (overmentalising)[k]	BPD, SCZ > HC; BPD =SCZ	
						MASC (reduced TOM)[k]	BPD < HC (lower reduced TOM for BPD gp) SCZ > HC, BPD (greater reduced TOM for SCZ gp)	
						MASC (no TOM)[k]	BPD = HC SCZ > HC, BPD (greater no TOM for SCZ gp)	

Table 2.7 Continued

First Author (year)	Participant Characteristics: Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Results: Cognitive Empathy	Results: Affective Empathy
							< (Reduced), > (Greater), = (Comparable)	
BPD young people- clinical								
Jennings		15-24		Australia	All: ID, LD, psychotic dx	INSI (assessed social	BPD < MDD	n/a
(2012)	BPD (30)	19.42 (2.55)	80	Out-pt; ≥ 3 SCID-II	MDD: ≥ 1 BPD c; met criteria for other	perspective taking)		
	MDD (30)	19.88 (2.84)	73.3	Out-pt; SCID-I	PD			
Kalpakci		12-17	100	USA	All: severe aggression, psychosis, IQ < 70;	BES (cognitive empathy)	BPD = PC	
(2016)	BPD (107)	15.11 (1.51)		In-pt, CI-BPD	unstable	BES (affective empathy)		BPD > PC
	PC (145)	15.35 (1.40)		In-pt, C-DISC	PC: BPD dx			
Sharp		12-17	56	USA	All: SCZ, psychotic dx, mental retardation	MASC (hypermentalising)	BPD > PC	n/a
(2011)	BPD (28)	15.5 (1.44)		In-pt, FTR previous tx; CI-BPD				
	PC (79)	15.5 (1.44)		In-pt, FTR previous tx; admission[l]				
Sharp		12-17		USA	All: psychosis, IQ< 70, ASD	MASC (hypermentalising)	BPD > PC	n/a
(2013)	BPD (68)	15.93 (1.5)	67.6	In-pt, FTR previous tx; CI-BPD				
	PC (96)	16.1 (1.29)	56.8	In-pt, FTR previous tx; admission[l]				
Tay		15-25	100	Australia	All: psychotic dx, psychiatric condition	Advanced TOM Test	BPD = MDD	n/a
(2017)	BPD (41)	18.44 (2.71)		Out-pt; SCID-II	due to medical condition	(cognitive TOM)		
	MDD (37)	18.59 (2.58)		Out-pt; SCID-I/P < 12 mo	MDD: ≥ 3 BPD c, any antisocial PD c, other PD dx	RMET (affective TOM)	BPD < MDD	
BPD- non-clinical								
Flury			61	USA	n/a	Infer state of partner in	H-BPD > L-BPD[n]	n/a
(2008)	H-BPD (38)	Age range,		Uni; BSI score 46-85		dyadic interactions[m]		
	L-BPD (38)	M, SD n/a		Uni; BSI score 24-29				
Fossati		Range n/a		Italy	n/a	RMET	Overall: H-BPD < L-BPD	n/a
(2014)	H-BPD (29)	16.54 (1.57)	55.2	High school; BPI score ≥ 129			Negative: H-BPD < L-BPD	
	A-BPD (31)	16.81 (1.70)	35.5	High school; BPI score 85-88			Positive: H-BPD = L-BPD	
	L-BPD (31)	16.68 (1.83)	35.5	High school; BPI score ≤ 57			Neutral: H-BPD = L-BPD	

Table 2.7 Continued

First Author (year)	Group (n)	Age Range Mean (SD)	% F	Location Setting; Inclusion Criteria	Exclusion Criteria	Empathy Measure/Paradigm[a]	Cognitive Empathy	Affective Empathy
	Participant Characteristics						Results: < (Reduced), > (Greater), = (Comparable)	
BPD (non-clinical)								
Scott (2011)		Range n/a		USA	n/a	RMET	Negative: H-BPD > L-BPD	n/a
	H-BPD (38)	19.63 (2.82)	66	Uni; MSI-BPD > 1SD above M			Positive: H-BPD = L-BPD	
	L-BPD (46)	18.85 (1.26)	67	Uni; MSI-BPD < 1SD below M			Neutral: H-BPD = L-BPD	

Note. (abbreviations are listed alphabetically) Ad = advertising; AN = anorexia nervosa; AOD = alcohol and other drug; AVPD = avoidant personality disorder; BLERT = Bell-Lysaker Emotion Recognition Test; BPD-47 = BPD Symptom Checklist 47; BPD = borderline personality disorder; BPI = Borderline Personality Inventory; BSI = Borderline Syndrome Index; c = criteria; CI-BPD = Child Interview for the Diagnostic and Statistical Manual-IV, Borderline Personality Disorder; CMH = community mental health; Com = community; CPD = cluster C personality disorder; DBT = dialectical behaviour therapy; dev = developmental; DIB-R = Revised Diagnostic Interview for Borderlines; DID = dissociative identity disorder; dx = disorder/diagnosis; F = female; FTR = failure to respond; gp/gps = group/groups; H-BPD = group with high number of BPD criteria; HC = healthy control; hx = history; ICD = International Classification of Diseases; ID = intellectual disability; Inc = inclusion; In-pt = inpatient; INSI = Interpersonal Negotiation Strategies Interview; IQ = intelligence quotient; IRI = Interpersonal Reactivity Index; IRI (EC) = Interpersonal Reactivity Index – Empathic Concern Scale; IRI (FS) = Interpersonal Reactivity Index – Fantasy Scale; IRI (PD) = Interpersonal Reactivity Index – Personal Distress Scale; IRI (PT) = Interpersonal Reactivity Index – Perspective Taking Scale; L-BPD = group with low number of BPD criteria; LD = learning difficulty; MASC = Movie for the Assessment of Social Cognition; MDE = major depressive episode; MET = Multifaceted Empathy Test; MINI = Mini International Neuropsychiatric Interview; mo = month; MR = mental retardation; MSAT-Q = Mental States Attribution Task – Questions; MSAT-S = Mental States Attribution Task – Scenarios; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; n/a = not available/not reported; Neur = 'neurotics'; NGOs = non-government organisations supporting people with mental health problems living in the community; Out-pt = out-patient; PASAT-C = Paced Auditory Serial Addition Task – Computerized; PC = mixed psychiatric control group; PD = personality disorder; Psy = 'psychotics'; RMET = Reading the Mind in the Eyes Test; SC-90-R = Symptom Checklist 90-Revised; SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; SIDP-IV = Structured Interview for DSM-IV Personality Disorders; TBI = traumatic brain injury; TOM = theory of mind; tx = treatment; uni = university; wom = word-of-mouth.

[a]Details of measures/paradigms provided in Appendix A.
[b]This study used two MASC subscales: 'overmentalising' and 'undermentalising'; 'overmentalising' referred to responses reflecting overly complex mental state reasoning; 'undermentalising' comprised responses that reflected reduced (overly simplistic) theory of mind, or no theory of mind (lack of mental state concept).
[c]The paper states BPD and CPD participants were hospital patients but does not state whether they were in- or out-patients.
[d]Sex difference between groups, controlled for in analyses.
[e]Not all post-hoc comparisons were reported in paper. Only those reported in paper, or those which could be reasonably extrapolated, are reported here.
[f]BPD assessed based on Hoch & Polatin (1949), Kernberg (1967) & Gunderson & Singer (1975).
[g]ICD criteria for 'hysterical neurotics', 'neurotic depressives' and 'obsessive compulsive neurotics'.
[h]Participants rated themselves on the Gieben Test (GT), a 40-item test based on psychoanalytic theory which describes an individual's 'inner dispositions' (e.g., hypomanic vs depressive mood) as well as 'social attitudes' (e.g., dominance vs submissiveness). In addition, participants rated three other (randomly selected) participants from their psychotherapy group on the GT according to how they thought those participants rated themselves. The same rating procedure of self and other was repeated for the Unpleasant Person Hierarchy Test (UPHT), a 21-item describing personality features (e.g. 'people who always contradict others'). An empathy score was arrived at by calculating the difference between the prediction of how others would rate themselves and the self-rating of others. Difference scores of GT and UPHT were added, and the final empathy score for each individual was the mean value from all ratings.
[i]Participants were shown short video clips showing a person telling a self-relevant story with different emotional valence (disgust, fear, joy, sadness, neutral). Videos were either 'congruent' (in the self-relevant story the communication channels of speech content, facial expression and prosody were congruent), or one of the communication channels was neutral (i.e., neutral content, neutral face, or neutral prosody).
[j]Total refers to the inference of feelings thoughts and intentions combined.

[k]Overmentalising referred to ‘excessively attributing intentions or personal meaning; Reduced TOM referred to incorrect mentalising; no TOM referred to lack of mentalising ability.
[l]All participants were consecutive admissions to the hospital and were deemed eligible for the clinic via “a comprehensive evaluation at intake”. Various clinical measures (e.g., the Youth Self-Report) were used to describe the sample but it is not clear which were used to determine inclusion in the PC group.
[m]The task was adapted from (Ickes, Stinson, Bissonnette, & Garcia, 1990). Dyads consisted of one H-BPD and one L-BPD individual of the same sex. They participated in a semi-structured ‘getting acquainted’ interaction session. Following the interaction, each participant viewed a video of the interaction, identified the instances they felt or thought something during the interaction, and completed a semi-structured self-report coding form identifying the thoughts and feelings they experienced during the actual interaction at the points they identified. Each participant then completed a similar procedure to infer the content of the specific thoughts or feelings of their interaction partners at the actual points identified by the interaction partner. Independent judges then scored inferences of the interaction partner’s thoughts and feelings by comparing inferences to what the interaction partner had reported they actually thought and felt at the time. Inferences were scored on a 3-point scale: 0 = essentially different content, 1 = somewhat similar but not the same content, 2 = essentially the same content. These scores were translated into a single score on a 0-100 scale reflecting overall empathic accuracy.
[n]While the results base on the empathy scores indicated that individuals with H-BPD features had greater empathic accuracy, the inclusion of ‘readability’ (which was rated by independent raters who viewed the dyadic video interactions and rated the ease with which they could infer/’read’ each individual’s thoughts and feelings) in the analysis as a control variable resulted in no empathic differences between groups. The authors concluded that individuals with BPD do not have greater empathic capacity but are harder to ‘read’ in social situations.

2.8 Summary and Implications

2.8.1. Summary of key observations regarding social cognition in young people and adults with BPD.

The aim of this review was to draw together the current research literature focused on social cognition in BPD and to consider it from a developmental perspective. Previous reviews have pooled together studies of young people and adults, and early and late stage disorder, whereas the current review looked separately at social cognition within these developmental periods and considered findings in the context of normative development.

Regarding attentional bias to emotional stimuli, most studies indicate that adults with BPD have difficulty consciously disengaging from emotive words (Arntz et al., 2000; Baer et al., 2012; Kaiser et al., 2016; Sieswerda et al., 2007; Sieswerda et al., 2006; Wingenfeld, Rullkoetter, et al., 2009), but avoid threatening (angry) faces (Brüne et al., 2013), relative to their healthy counterparts. They do not, however, demonstrate an unconscious attentional bias/hypervigilance towards emotive words (Arntz et al., 2000; Sieswerda et al., 2007), contradicting theoretical predictions of unconscious hypervigilance to threat (Arntz, 2014; Beck et al., 2014; Linehan, 1993).

Adolescents with BPD demonstrate both a specific unconscious attentional bias towards threatening facial expressions (Jovev et al., 2012), and difficulty consciously disengaging from neutral and negative expressions more generally (Jovev et al., 2012; von Ceumern-Lindenstjerna et al., 2010b), particularly when in a negative mood (von Ceumern-Lindenstjerna et al., 2010a). The developmental trajectory of attentional bias in BPD, however, cannot be described at this stage. This is because, although there are several studies of attentional bias in BPD, the emotional stroop task has only been used to assess attentional bias in adults with BPD, and the emotional dot probe task has primarily (except for one study) been used to assess attentional bias in young people with BPD. The stimuli, and the nature of the tasks, means that studies with adults with BPD and studies with young people with BPD cannot be directly compared.

Future research should use paradigms that enable the differentiation of hypervigilance towards (threatening) stimuli from difficulty disengaging from (threatening) stimuli, because each of the processes relating to attention to emotional stimuli has different implications for functioning. Hypervigilance implies heightened threat detection, is associated with greater anxiety and paranoia, and is mediated by the amygdala (Fox et al., 2010; Kimble et al., 2014; Van Bockstaele et al., 2014). In contrast, difficulty disengaging implies slower top-down cognitive processing, mediated by the prefrontal cortex, and is associated with heightened stress (Cisler & Koster, 2010; Salum et al., 2013). The emotional dot-probe paradigm is a more robust and flexible measure of both unconscious and conscious attentional processes, and appears to elicit measurable behavioural responses across developmental stages more consistently than the emotional stroop (Harvey et al., 2004; Koster et al., 2004; Reinholdt-Dunne et al., 2012).

With regards to facial emotion recognition, deficits in the recognition of disgust and anger are apparent in adults with BPD (Daros et al., 2013) but not in young people (Robin et al., 2012; von Ceumern-Lindenstjerna et al., 2007). It should be noted that the Daros et al. (2013) meta-analysis included studies with young people. Had these been exclude, the meta-analysis might have found more global negative emotion recognition deficits in adults with BPD. It appears, therefore, that facial emotion recognition ability deteriorates between adolescence and adulthood for individuals with BPD. These deficits might be associated with the negative bias which is evident early in the disorder's trajectory and continues into adulthood (Daros et al., 2013; Mitchell et al., 2014; von Ceumern-Lindenstjerna et al., 2007).

Research exploring sensitivity to facial expressions of emotions indicates reduced sensitivity to fear, disgust and anger (indicating social threat) in young people with BPD (Jovev et al., 2011; Robin et al., 2012), no difference in emotion sensitivity between adults with BPD and healthy control participants aged in their mid to late twenties (Domes et al., 2008; Domes et al., 2011; Lowyck et al., 2015), but heightened sensitivity in older adults (in their mid-thirties) (Lynch et al., 2006). It is speculated that this developmental pattern might be related to greater exposure to various factors associated with longer duration of illness, such as iatrogenic harm and greater comorbidity (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes et al., 2015; Pagano et al., 2004; Wingenfeld et al., 2011). It could also be the result of maladaptive reciprocal social interactions (Gergely & Watson, 2010; Sameroff, 2009; Zahavi & Rochat, 2015), whereby the interaction partner needs to heighten their emotional expression in order for the young person with BPD to perceive it. This might in turn lead to later (in later adulthood) heightened sensitivity/expectation of stronger responses in others.

Relative to healthy controls, greater trait rejection sensitivity is evident in both older and younger adults with BPD (Berenson et al., 2011; Berenson et al., 2016; R. C. Brown et al., 2017; Jobst et al., 2014; Staebler, Helbing, et al., 2011). Like sensitivity to threatening emotional expressions, however, state rejection sensitivity appears to become a problem only in adulthood for individuals with BPD. This developmental observation is based on various studies focused on adults with BPD, which indicate heightened state rejection sensitivity (Beeney et al., 2014; De Panfilis et al., 2015; Jobst et al., 2014; Renneberg et al., 2012), but only one study involving young people with BPD indicating greater negative affect generally, but not greater rejection sensitivity specifically (K. A. Lawrence et al., 2011).

Findings pertaining to empathy research suggest that individuals with BPD do not have a gross empathy deficit. Additionally, even within the constructs of cognitive and affective empathy, individuals with BPD demonstrate varying capacities. Specifically, regarding cognitive empathy in adults with BPD, they self-report difficulty taking another person's perspective (Dziobek et al., 2011; New et al., 2012; Petersen et al., 2016; Ritter et al., 2011). Experimental research indicates that the deficit seems specific to 'hot'/affective components of cognitive empathy and only more complex 'cold' aspects of cognitive empathy (Andreou et al., 2015; Baez et al., 2014; Dziobek et al., 2011; Harari et al., 2010; Petersen et al., 2016; Preiβler et al., 2010; Ritter et al., 2011; Vaskinn et al., 2015), but not less complex aspects (Ghiassi et al., 2010; Petersen et al., 2016). Adolescent patients with BPD show impairments in cognitive empathy, relative to adolescents with other psychiatric disorders. However, no studies have compared cognitive empathy in young people with BPD with that of their typically developing peers. Therefore, it is difficult to comment on the developmental trajectory of cognitive empathy in BPD.

Second, regarding affective empathy in adults with BPD, emotional contagion appears to be heightened (Dziobek et al., 2011; New et al., 2012; Petersen et al., 2016), but empathic concern is reduced (Baez et al., 2014; Dziobek et al., 2011; Petersen et al., 2016; Ritter et al., 2011) compared with healthy adults. From a developmental perspective, only the emotional contagion aspect of affective empathy has been studied in both young people and adults with BPD, and it appears to be heightened from early on in the disorder's trajectory (Kalpakci et al., 2016). It is not possible to speculate regarding the developmental trajectory of empathic concern because there are no published studies involving young people with BPD. Furthermore, no studies have explored unconscious simulation processes in BPD.

In summary, some aspects of social cognition in BPD appear to deteriorate during the transition from adolescence to adulthood, yet others seem to be impaired from early on in its course. Therefore, social cognition is not grossly impaired, but instead impairments are nuanced, and some might be associated with developmental stage and stage of illness (e.g., emotion recognition and sensitivity to facial emotional expressions). These findings are especially pertinent given that BPD typically first emerges, and can be accurately diagnosed, in young people between puberty and adulthood (Chanen, Jovev, McCutcheon, Jackson, & McGorry, 2008; Kaess et al., 2014; Miller, Muehlenkamp, & Jacobson, 2008; Winsper et al., 2016). In addition, developmental research with typically developing populations indicates that various sociocognitive processes continue to develop throughout adolescence and into adulthood (Ahmed et al., 2015; Blakemore & Mills, 2014; Brizio et al., 2015; Klapwijk et al., 2013). Further, adolescence is a key sensitive period during which therapeutic interventions can be implemented to reduce risk and improve future outcomes (Andersen, 2016). Therefore, young people with BPD pathology afford researchers and clinicians a unique opportunity to try to understand, and to treat, sociocognitive difficulties early in the course of BPD, which might otherwise serve to perpetuate the chronic interpersonal dysfunction seen over a lifetime despite symptomatic remission.

Understanding social cognition in BPD at different life and illness stages can have important implications for the treatment of interpersonal difficulties. A developmental approach enables us to understand the trajectory of impairment and ascertain whether there might be critical periods for early intervention for some aspects of socioemotional functioning in BPD. In order to be able to effectively treat interpersonal dysfunction early, before it becomes entrenched, we first need to understand how key underlying sociocognitive difficulties unfold, and whether the trajectory is malleable. That is, we need to understand what particular aspects are problematic, how these difficulties present at different developmental periods and different stages of illness, and whether early intervention might reduce the impact of sociocognitive deficits or perhaps assist to change the course of future interpersonal impairment. Understanding the developmental trajectory of social cognition in BPD will facilitate the development of targeted interventions that might be offered in a timely manner and can specifically aim to reduce chronic interpersonal difficulties.

2.8.2 General limitations of research to date and future directions.

This review has highlighted some general limitations of research exploring the different aspects of social cognition in BPD. First, compared with research carried out with adults, there is very little research focused on young people with BPD. Greater research focused on this period of development in all areas of social cognition is needed, but in particular in the areas of rejection sensitivity, affective empathy, and cognitive empathy. Only one study was identified that compared adolescents or youth with BPD to healthy young people in the areas of rejection sensitivity and affective empathy. There are no such studies in the area of cognitive empathy, although there are studies comparing young people with BPD with clinical controls, which suggest deficits. In addition to group comparisons, cross-sectional and longitudinal studies are much needed. Given the challenges of recruiting and retaining this population, longitudinal and cross-sectional research would likely require collaboration across centres.

Another general limitation is that the complexity of some constructs, such as attentional bias and empathy, have not always been adequately addressed in BPD research. Future research should consider the broader research literature in these areas (outside the BPD literature) including ongoing debates about what exactly various paradigms and questionnaires assess or do not assess.

The broader developmental literature should also be taken into account when trying to understand social cognition in BPD. Meta analyses and reviews need to consider developmental differences across different age groups so as not to confound different developmental stages and risk null findings due to 'mixed' results. A good starting point would be to better characterise samples in research papers. At the moment, not all papers provide age range for example (see Tables 2.1-2.7 for study demographic details), and very little consideration of stage of illness is evident. Consideration of developmental age, and stage of illness, is crucial when trying to understand social cognition because the various processes that comprise it continue to develop throughout the second and third decades of life (Ahmed et al., 2015; Blakemore & Mills, 2014; Brizio et al., 2015; Klapwijk et al., 2013). Pooling studies of these processes across the lifespan (e.g., adolescent and adult BPD studies) is likely to be misleading and might lead to inaccurate conclusions about sociocognitive functioning in BPD. Studies are needed that focus on comparing BPD populations with same aged peers at different stages of illness across the lifespan in order to understand when sociocognitive processes might begin to deviate from typical development, as well as the nature of these deviations.

Chapter 3: A Critical Review and Synthesis of Emotion Regulation Research in Borderline Personality Disorder: A Developmental Perspective

3.1 Preamble

This chapter is the second of two reviews. It critically examines and synthesises the existing literature relating to emotion regulation in BPD within a developmental framework. The existing BPD emotion regulation literature is considered alongside what is understood of normative development. The aim was to reflect on existing findings by attending to developmental patterns that might arise, as well as identify gaps and make recommendations for future research.

3.2 Introduction

Emotions are short-term multifaceted states, consisting of loosely corresponding valenced clusters of subjective thoughts and feelings, expressive behaviours, and physiological responses (Gross, 2014; Koole, 2009; Mauss, McCarter, Levenson, Wilhelm, & Gross, 2005; Mauss & Robinson, 2009; Webb, Miles, & Sheeran, 2012). Emotions can be evoked by internal or external stimuli, are personally significant, and serve to prepare the body for action. Emotions can be heightened, reduced, or maintained via emotion regulation processes, in order to accomplish individually relevant, conscious or unconscious, goals (Gross & Thompson, 2007; Koole, 2009). *Emotion regulation* involves the perception and identification of our own emotions, recognition of the need to regulate these emotions, and the ability to select and implement the most appropriate strategies to influence when, how, and for how long emotions are experienced and expressed (Eisenberg et al., 2000; Gratz & Roemer, 2004; Gross, Richards, & John, 2006; Sheppes, Suri, & Gross, 2015; R. A.

Thompson, 1994). The ability to dynamically regulate one's emotions, to suit the varying demands of different contexts and situations, is crucial for adaptive social interactions and overall socioemotional wellbeing (Eisenberg et al., 2000; Gross & John, 2003; Halberstadt, Denham, & Dunsmore, 2001; John & Gross, 2004). Difficulties with emotion regulation are implicated broadly in psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Kring & Werner, 2004; Sheppes et al., 2015).

In BPD specifically, difficulties in emotion regulation are thought to contribute to a negative feedback loop, beginning with a biologically predisposed sensitivity to emotional cues (Crowell et al., 2009; Linehan, 1993). Within this model, biological sensitivity leads to disproportionate emotional responses, and associated labile affect, to internal or external emotionally evocative cues (Crowell et al., 2009; Linehan, 1993), which cannot be adaptively regulated without access to effective emotion regulation strategies (Carpenter & Trull, 2013). This cascade, in turn, leads to negative behavioural, emotional, and interpersonal consequences that further reinforce the existing sensitivity to negative emotional cues (Carpenter & Trull, 2013).

Interest in the habitual use, and effective application, of specific emotion regulation strategies in BPD has increased over the past ten years (e.g., Baczkowski et al., 2016; Carvalho Fernando et al., 2014; S. Lang et al., 2012). The vast majority of this research has focused on adults (ranging in age from 18-65 years; See Tables 3.1 and 3.2 for study details). Developmental models of psychopathology, however, implicate emotion regulation difficulties in the development and maintenance of mental disorders (e.g., Mennin, Holaway, Fresco, Moore, & Heimberg, 2007), including BPD (Crowell et al., 2009; Putnam & Silk, 2005). Further, in typically developing young people, reduced emotion regulation success is associated with greater internalising and externalising symptoms (Silk, Steinberg, & Sheffield Morris, 2003), and emotion regulation ability continues to develop throughout adolescence and young adulthood (Ahmed et al., 2015; McRae et al., 2012). A developmental framework that attempts to understand emotion regulation throughout the course of BPD, and in the context of typical emotion regulation development, is therefore important. Thus, research attention should be given to the early stages of the disorder, such as young people at the onset of the disorder (Biskin, 2015; Chanen, 2015; Chanen & McCutcheon, 2013; Zanarini et al., 2001), as well as to young people and adults that present with later stage BPD.

3.2.1 Defining emotion regulation for the purpose of the current review.

Research on emotion regulation in BPD tends to be based on one of two conceptual frameworks that align with research into emotion regulation across psychopathologies (Sloan et al., 2017). The first encompasses models of emotion regulation that have a broad focus on deficits in emotional functioning and regulation. BPD research within this framework, largely based on Gratz & Roemer's (2004) emotion regulation model, indicates that maladaptive, dysregulated aspects of emotional and related behavioural responding (e.g., reacting aggressively and impulsively when feeling upset) are prominent characteristics in adults with the disorder (Bayes, Parker, & McClure, 2016; Beblo et al., 2013; Carvalho Fernando et al., 2014; Fletcher, Parker, Bayes, Paterson, & McClure, 2014). These characteristics are also associated with greater BPD features in adults (Cheavens, Strunk, & Chriki, 2012; Herr et al., 2013; Mancke, Herpertz, Kleindienst, & Bertsch, 2017) and in young people (high school students and undergraduate students) (Fossati, Gratz, Maffei, & Borroni, 2013; Glenn & Klonsky, 2009; Iverson, Follette, Pistorello, & Fruzzetti, 2012), and contribute to the disorder's maintenance (Stepp et al., 2014).

The second, Gross's Process Model of Emotion Regulation (1998a, 1998b), is one of the most influential and widely accepted frameworks in the emotion regulation literature (Riediger & Klipker, 2014; Sloan et al., 2017; Webb et al., 2012), and provides the theoretical context for the current review. The *process model* (Gross, 1998a, 2014; Gross & Thompson, 2007) posits that emotion generation and the application of emotion regulation strategies, unfold sequentially depending on the level of implicit, through to explicit, awareness of one's emotional responses (Gross & Thompson, 2007). Within this model, emotion regulation involves automatic as well as controlled attempts to influence which, when, and how emotions are experienced (Gross et al., 2006). Emotion regulation strategies can be *antecedent focused*, which take place in anticipation of and prior to an emotion running its course. Antecedent focused processes include *situation selection*, *situation modification*, *attentional deployment*, and *cognitive change* strategies. Finally, *response focused* processes are implemented once an emotion is being experienced and are referred to as *response modulation* strategies.

The BPD research literature has tended to focus on a handful of specific strategies: distraction, cognitive reappraisal, suppression, and acceptance/mindfulness (which tend to be used interchangeably). Therefore, these will be the focus of the current review. However, a major challenge when reviewing emotion regulation research is the fact that the same strategy label, when used across different studies, does not necessarily mean that the same emotion regulation strategy was being assessed (Webb et al., 2012). This is because the instructions given to participants vary from study to study. For example, instructions to suppress emotions can require participants to not show how they feel behaviourally, or they may ask participants to try not to subjectively experience the emotion, to push their feelings away. Therefore, for clarity, the strategies focused on in this review are first defined in each section (Sections 3.3, 3.4, 3.5, 3.6).

3.2.2 Aim and scope of the current review.

The aim of the current review was to summarise and synthesise research that has assessed the habitual use of emotion regulation strategies, and the effectiveness with which they are applied, within a developmental framework. To this end, research evaluating the implementation of emotion regulation strategies by young people and adults with BPD is reviewed separately. Because only very few studies have included clinical samples, studies that recruited participants from non-clinical settings, and which assessed for BPD features, were also included. The current review focused on studies that compared self-report or behavioural outcome studies assessing the habitual use, or effective implementation of strategies, between groups. This research is summarised in Tables 3.1 and 3.2, respectively. This review did not focus on other types of analyses (e.g., correlation) nor did it seek to review neuroimaging studies. However, reference is made to such studies where relevant. In addition, this research is discussed in the context of what is known to date of the normative use of emotion regulation strategies from adolescence through adulthood. It is noted that this is not an exhaustive review of normative developmental research, but rather, an overview of key findings to date (for reviews see Riediger & Klipker, 2014; Zimmer-Gembeck & Skinner, 2011).

3.3 Distraction

According to the process model of emotion regulation, *distraction* is an antecedent-focused, attentional deployment, strategy that occurs early in the emotion generative process (Sheppes & Gross, 2011). Distraction involves shifting attention away from emotion-eliciting stimuli, and towards neutral information, thereby avoiding processing the affective meaning of the emotion-eliciting stimulus (Sheppes & Gross, 2011). Distraction, both behavioural (e.g., doing something fun) or cognitive (e.g., thinking of something fun) tends to be used in situations where stressors are uncontrollable and inescapable (Zimmer-Gembeck & Skinner, 2011). It is particularly effective in the management of highly distressing situations (Sheppes, Scheibe, Suri, & Gross, 2011), and is a technique used for dealing with high levels of distress in dialectical behaviour therapy (DBT) (Linehan, 1993).

3.3.1 Typical development of the use of distraction as an emotion regulation strategy from adolescence through adulthood.

Infants automatically use behavioural distraction, such as gazing at attractive objects. Over time, children become increasingly aware of distraction as a possible strategy, and they develop the ability to apply cognitive distraction strategies (Zimmer-Gembeck & Skinner, 2011). They are increasingly able to deploy distraction intentionally, to choose between behavioural or cognitive distraction as needed (e.g., cognitive distraction can be used when behavioural distraction is not an option, such as during a dental appointment), and its application becomes more targeted and integrated with other coping strategies (Zimmer-Gembeck & Skinner, 2011). Importantly, reduced ability to use distraction during early childhood is associated with poorer peer relationships in early adolescence, and is thus considered an important target of early/preventative clinical interventions (Trentacosta & Shaw, 2009).

While distraction becomes increasingly available to children, a reduction in its use is evident in 12-15 year olds, relative to peers aged 8-11 and 16-18 (Cracco, Goossens, & Braet, 2017). These findings suggest a normative dip in its habitual application during early-mid adolescence, rather than a linear trajectory (Cracco et al., 2017). A concurrent increase during the same age-period was observed in the use of "withdrawal" (e.g., not wanting to be around others), "giving up" (e.g., not wanting to do anything) and "aggressive actions" (e.g., taking frustrations out on others) (Cracco et al., 2017). Early adolescence is a period of transition, with significant neurobiological, psychological and social changes, and concurrent changes in terms of interpersonal, educational, parental and societal demands (Casey, Duhoux, & Cohen, 2010; Steinberg, 2008). It might be that, combined, these changes and increased demands temporarily exceed the available emotion regulation resources during this period of development. Thus, early adolescents might resort to alternative strategies, albeit maladaptive ones, while access to more adaptive strategies improves between adolescence and young adulthood. For example, greater cortical integration of affective stimuli and cortical efficiency are evident between adolescence and young adulthood during the application of distraction (Zhang et al., 2014; Zhang et al., 2013).

In terms of the ability to apply distraction, early adolescents (10-14 years, M = 12.03) can effectively apply this strategy to regulate both positive and negative affect (Wante, Van Beveren, Theuwis, & Braet, 2017). In addition, independent emotion regulation, via distraction, is more effective than the external regulation of emotions via interaction with caregivers during this period of development (Wante et al., 2017). Distraction is also more effective in regulating both positive and negative affect compared with cognitive reappraisal and acceptance in this age group (Wante et al., 2017). These findings are consistent with studies focused on adults, which also indicate that distraction can be a more adaptive strategy, particularly when dealing with acute, short-term, highly distressing emotions (McRae, 2016; Sheppes & Gross, 2011).

3.3.2 The use of distraction as an emotion regulation strategy by adults with BPD.

Consistent with distraction research, outpatient adults with BPD, MDD and healthy controls all tend to choose distraction as the preferred technique when viewing high-intensity images (C. Sauer et al., 2016) (see Table 3.1 for study details). When distraction is instructed following negative mood induction, adult BPD outpatients can apply distraction effectively, resulting in improved self-reported positive mood and reduced negative mood (Jacob et al., 2011; Kuo, Fitzpatrick, Metcalfe, & McMain, 2016) (Table 3.2). In addition, as arousal levels increase, the effectiveness of instructed distraction increases for both adult BPD outpatients and healthy controls (evidenced by greater reductions in skin conductance levels) (Fitzpatrick & Kuo, 2016). Adult BPD outpatients are also able to apply distraction as effectively as mindfulness to regulate negative affect (Kuo et al., 2016) (Table 3.2).

These findings indicate that, like other clinical groups and typically functioning adults, outpatient adults with BPD tend to choose distraction as the preferred strategy when dealing with intensely negative stimuli. Findings also suggest that outpatient adults with BPD can implement distraction effectively to regulate both positive and negative affect, and particularly well to regulate negative affect as arousal levels increase.

3.3.3 The use of distraction as an emotion regulation strategy by young people with BPD.

No published studies have assessed the habitual use, or effective application, of distraction in young people in clinical settings diagnosed with BPD, compared with healthy controls. There is one experimental study, however, which explored the habitual use of distraction by undergraduate psychology students (mean age, 20.4, SD = 5.71, range not reported) and assessed their BPD features (Kuo, Fitzpatrick, Krantz, & Zeifman, 2017). When given the choice between distraction and cognitive reappraisal, all participants, regardless of the number of BPD features present, preferred cognitive reappraisal over distraction. This contrasts with finding with adult BPD out-patients, which indicate a preference for distraction strategies (Fitzpatrick & Kuo, 2016; C. Sauer et al., 2016). Consistent with adult BPD research, indicating that individuals with BPD are able to effectively implement various regulation strategies, this study also found that, regardless of BPD features, both cognitive reappraisal, and distraction, were able to be implemented effectively, and cognitive reappraisal was more effective than distraction (Kuo et al., 2017).

It is important to note that participants in this study were undergraduate psychology students. Therefore, generalisation of the findings of this study to clinical populations is limited. While there will be some overlap between university students and young people with BPD, particularly in terms of developmental age, there will be many factors that cannot be accounted for in such a sample. This includes factors associated with BPD, such as poor functioning, medication use, and the high prevalence of comorbid disorders.

3.4 Cognitive Reappraisal

Like distraction, *cognitive reappraisal* is also an antecedent focused strategy and generally refers to the re-evaluation, or re-interpretation, of the meaning/significance of a stimulus, or event, before the resulting emotion takes full effect, thus changing the course of a future emotional experience (Gross &

Thompson, 2007; McRae, 2016). It can also refer to cognitively distancing oneself from the stimulus, a form of perspective taking (Ochsner et al., 2004; Webb et al., 2012). Cognitive reappraisal is a crucial component of cognitive-behavioural therapies (Beck, 2014; Goldin et al., 2012; Troy, Wilhelm, Shallcross, & Mauss, 2010). In healthy adults cognitive reappraisal is associated with greater positive affect and general wellbeing, and reduced negative affect and depressive symptoms (Gross & John, 2003). Cognitive reappraisal can be particularly useful when the situation allows the individual time to reappraise. Its positive effects are long-lasting, compared with distraction, and can facilitate emotion regulation in similar future situations (Denny, Inhoff, Zerubavel, Davachi, & Ochsner, 2015; McRae, 2016; Thiruchselvam, Blechert, Sheppes, Rydstrom, & Gross, 2011). However, while cognitive reappraisal has traditionally been considered a universally adaptive emotion regulation strategy (Gross & John, 2003), recent research suggests that, as for other strategies, the timing of its deployment, the level of control one has over a stressor, and the context within which it is applied, all have a bearing on its adaptive effect (Aldao & Nolen-Hoeksema, 2010; Gross, 2015).

3.4.1 Typical development of the use of cognitive reappraisal as an emotion regulation strategy from adolescence through adulthood.

Children begin to increasingly use cognitive emotion regulation strategies, such as cognitive reappraisal, from about middle childhood (Compas et al., 2017). There is a gradual increase in the habitual use of cognitive reappraisal between late childhood and early adolescence (8-13 years of age), followed by a slight decrease and stabilisation through to late adolescence (Cracco et al., 2017; Gullone, Hughes, King, & Tonge, 2010), which is comparable to the habitual use reported by adults (Gross & John, 2003; Gullone et al., 2010). Interestingly, daily reappraisal use is associated with greater negative affect in late adolescence (17-19 years of age), compared with adults aged 20 years and over, suggesting that cognitive reappraisal is not always adaptive and benefits might only arise with increased use and practice (Brockman, Ciarrochi, Parker, & Kashdan, 2017). Similarly, adolescents (mean age = 14.34, SD = 1.34, age range 12-19 years) with greater self-reported levels of social anxiety do not appear to benefit from the use of cognitive reappraisal (Gómez-Ortiz, Romera, Ortega-Ruiz, Cabello, & Fernández-Berrocal, 2016), possibly because they are not using cognitive reappraisal effectively (Gómez-Ortiz et al., 2016).

Prefrontal brain regions associated with cognitive control develop sharply during the adolescent period with regards to structure, functionality, and connectivity (Barnea-Goraly et al., 2005; Blakemore & Choudhury, 2006; Lewis & Stieben, 2004; Luna, Padmanabhan, & O'Hearn, 2010; Pitskel, Bolling, Kaiser, Crowley, & Pelphrey, 2011). Concurrently, cognitive reappraisal ability (in 10-22 year olds) (McRae et al., 2012), and efficient modulation of the amygdala via cognitive reappraisal (in 15-25 year olds) (Stephanou et al., 2016), also increase linearly with age. Similarly, cross-sectional studies indicate that middle adolescents (14-17 years) apply cognitive reappraisal more effectively, to regulate negative affect, than pre/early adolescents (10-13 years), and reappraisal success tends to stabilise by late adolescence (18-22 years) (Silvers et al., 2012).

3.4.2 The use of cognitive reappraisal as an emotion regulation strategy by adults with BPD.

Compared with healthy controls, but not adults with major depressive disorder, outpatient adults with BPD report reduced habitual use of cognitive reappraisal (Carvalho Fernando et al., 2014) (Table 3.1). Reduced habitual use of cognitive reappraisal predicts a significant proportion (15.7 per cent) of the variance in BPD features in adult clinical samples (Ghiasi, Mohammadi, & Zarrinfar, 2016). On the other hand, greater habitual use is associated with reduced reports of non-suicidal self-injury in females out-patients with BPD and comorbid eating disorder (Navarro-Haro, Wessman, Botella, & García-Palacios, 2015). Further, when given the choice, adults with BPD and adults with major depressive disorder are equally likely to select cognitive reappraisal, and both choose cognitive reappraisal less than healthy controls (C. Sauer et al., 2016). Nevertheless, adults with BPD and adults with major depressive disorder prefer cognitive reappraisal when viewing low intensity negative emotional images (C. Sauer et al., 2016).

Several studies have explored the effectiveness of instructed cognitive reappraisal, following negative mood induction, for adults with BPD across in- and out-patient, and community settings. Findings show that they can apply cognitive reappraisal as well as healthy controls to regulate self-reported state affect (Baczkowski et al., 2016; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Marissen, Meuleman, & Franken, 2010; Schulze et al., 2011), and physiological arousal (heart rate) (C. Sauer et al., 2016) (see Table 3.2 for study details).

These findings suggest that adults with BPD do not use cognitive reappraisal as often as healthy individuals. Nevertheless, they can implement the strategy effectively to regulate self-reported affect and physiological arousal, and greater use in this group is associated with reduce non-suicidal self-injury.

However, fMRI studies indicate that adults with BPD do not engage the relevant regions of the brain to the same extent as healthy controls during cognitive reappraisal, and they demonstrate different patterns of neural activation during reappraisal (Baczkowski et al., 2016; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Schulze et al., 2011). For example, in contrast to healthy adults, adult BPD patients do not demonstrate increases in post-task amygdala resting state functional connectivity with brain regions key to the effortful regulation of emotions, such as the medial and dorsolateral prefrontal cortex, and the temporal gyrus (Baczkowski et al., 2016). They also demonstrate difficulties in the voluntary regulation of negative emotions, as evidenced by attenuated activation of the left orbitofrontal cortex, and increased activation of the bilateral insula (Schulze et al., 2011). In addition, reduced anterior cingulate cortex activity, which is known to be involved in cognitive reappraisal, has also been found (S. Lang et al., 2012). A recent review of fMRI studies in BPD during emotion regulation (all studies involved cognitive reappraisal) concluded that the most common finding was decreased activity in the anterior cingulate cortex, a key brain area involved in emotion regulation (Ochsner, Silvers, & Buhle, 2012), during emotion regulation (van Zutphen et al., 2015). However, it was also noted that conclusions regarding brain function in individuals with BPD during emotion regulation should be drawn cautiously given the very few studies, and inconsistency among those studies (van Zutphen et al., 2015).

Taken together, findings of studies exploring cognitive reappraisal among adult BPD samples suggest that there might be a dissociation between self-reported affect, when implementing reappraisal strategies, and associated neural activation and connectivity for people with BPD. That is, self-report findings suggest that adults with BPD can effectively implement cognitive reappraisal, yet, on the other hand, neuroimaging studies suggest deficits, or at least differences in processing, between adults with BPD and healthy controls.

3.4.3 The use of cognitive reappraisal as an emotion regulation strategy by young people with BPD.

No published studies have assessed the habitual use, or effective application of, cognitive reappraisal in young people diagnosed with BPD, compared with healthy controls. Two related studies, however, have assessed cognitive reappraisal in undergraduate psychology students with BPD features (Chapman, Dixon-Gordon, & Walters, 2013; Kuo et al., 2017) (Table 3.1). Undergraduate students high in BPD features reported greater habitual use of cognitive reappraisal, compared with students low in BPD features (Chapman et al., 2013). However, when given the choice between distraction and cognitive reappraisal in an experimental context, undergraduate psychology students, regardless of number of BPD features, preferred cognitive reappraisal over distraction, although BPD features did not impact the effectiveness with which cognitive reappraisal was implemented to regulate negative affect (Kuo et al., 2017). These findings contrast with adult BPD research and suggests that cognitive reappraisal is used more by university students higher in BPD features, relative to those with low BPD features, and it is preferred over distraction. Generalisability of findings derived from university student samples is limited, however, because they do not represent clinical populations, as discussed previously.

One study did assess cognitive reappraisal in a clinical sample of young people with BPD, but it did not include a comparison group (Kim, Sharp, & Carbone, 2014). That study included consecutive adolescent BPD inpatients who had failed prior treatments (aged 12-17), and examined the relationship between emotion regulation strategy use and attachment relationships in this group (Kim et al., 2014). Greater self-reported attachment security was associated with greater use of self-reported positive emotion regulation strategies (such as cognitive reappraisal, assessed using the Cognitive Emotion Regulation Questionnaire) (Kim et al., 2014). The lack of a comparison group of healthy young people, however, limits our understanding of how emotion regulation in young people with BPD might deviate from typical development.

3.5 Suppression

Suppression is a response-focused emotion regulation strategy that is enacted to avoid experiencing an emotion. It is implemented later in the emotion generation process, once the emotional response is initiated (Gross, 2014). Across the emotion regulation literature, the term suppression has been inconsistently used to describe different components of the emotional experience. For example, experimental studies have variably given participants instructions to suppress their subjective emotional experience (i.e., participants are asked to suppress any feelings that arise; *experiential suppression*), thoughts (i.e., participants are asked not to think about the emotion-eliciting stimulus; referred to as *thought suppression*) or emotional expression (i.e., participants are instructed not to show how they are feeling; referred to as *expressive suppression*) (Webb et al., 2012). Wherever possible, the types of suppression are differentiated by these more specific terms. However, not all studies make this differentiation clear. Therefore, where it is not clear which type of suppression was used, or where different types of suppression instructions were combined, the term suppression alone will be used. Suppression has traditionally been considered to be a maladaptive emotion regulation strategy and has indeed been associated with various negative outcomes, such as greater negative affect and greater psychopathology (Aldao et al., 2010; Gross & John, 2003; Gross & Thompson, 2007; Webb et al., 2012). However, recent research suggests that any emotion regulation strategy, including suppression and cognitive reappraisal, might have both positive and adverse consequences, depending on factors such as context and timing (Aldao & Nolen-Hoeksema, 2010; Gross, 2015).

3.5.1 Typical development of the use of suppression as an emotion regulation strategy from adolescence through adulthood.

The habitual use of expressive suppression has been found to generally decrease between adolescence and adulthood (Gullone et al., 2010; Zimmermann & Iwanski, 2014). Specifically, a decrease in the use of expressive suppression has been found between the ages of 9 and 15 years (Gullone et al., 2010), and between the ages of 20 and 60 years (John & Gross, 2004). Another study, however, found that the use of suppression increased between the ages of 11 and 25 years, and only decreased between 25 and 29 years of age (Zimmermann & Iwanski, 2014). This decrease was qualified, however, by emotion specific variation. For example, expressive suppression of fear increased between early adolescence and adulthood, but expressive suppression of anger was stable across the same age period (Zimmermann & Iwanski, 2014). Sex, and emotion specific, differences have also been reported. Specifically, boys tend to suppress their emotions more than girls (Gullone et al., 2010), and suppression of sadness is particularly marked, compared with the suppression of anger, for 8th graders (mean age, 14 years and 3 months) (Zeman & Shipman, 1997).

In adults, and adolescents, the habitual use of suppression has generally been associated with negative outcomes (e.g., Betts, Gullone, & Allen, 2009; Gómez-Ortiz et al., 2016; Gross & John, 2003), and suppression has been assumed to precede depressive symptoms (Larsen et al., 2013). However, while expressive suppression use and depressive symptoms were correlated among 13-year-olds, depressive symptoms preceded the use of expressive suppression, and expressive suppression did not precede depression (Larsen et al., 2013). Thus, depressive symptoms might be a precursor for the habitual use of expressive suppression in adolescents.

Little is known of the impact of expressive suppression on functioning in young people. One study, however, demonstrated that adolescents reduced their emotional arousal, as well as adults, using expressive suppression (Desatnik et al., 2017). In adults, expressive suppression is generally associated with effective modulation of the outward expression of emotion, a useful social strategy enabling the individual to express socially appropriate emotions as needed (Webb et al., 2012). However, it does not always lead to reductions in the internal, subjective experience of emotions (Webb et al., 2012).

3.5.2 The use of suppression as an emotion regulation strategy by adults with BPD.

A greater number of BPD features in adults (who were recruited from a research volunteer database, as well as from a BPD clinic) is associated with greater spontaneous use of expressive suppression, and reduced use of acceptance (Evans, Howard, Dudas, Denman, & Dunn, 2013). In adult patients diagnosed with BPD, expressive suppression is a significant predictor of BPD features, and predicted 11.8 percent of the variance (Ghiasi et al., 2016). In prison inmates with BPD features, and private patients diagnosed with BPD and comorbid eating disorder, thought suppression and expressive suppression are related to increases in non-suicidal self-injury (Chapman, Specht, & Cellucci, 2005; Navarro-Haro et al., 2015), and thought suppression is related to the reduced effectiveness of cognitive reappraisal in reducing non-suicidal self-injury (Navarro-Haro et al., 2015). However, greater habitual use of expressive suppression is not unique to BPD, as adults with MDD report similar levels of expressive suppression, and both groups report greater use of expressive suppression, compared with healthy controls (Carvalho Fernando et al., 2014) (see Table 3.1 for study details).

In community and university student samples[13], thought suppression mediates the relationship between negative affect/intensity and BPD features, even after controlling for a history of child sexual abuse (Cheavens et al., 2005; Rosenthal, Cheavens, Lejuez, & Lynch, 2005; S. E. Sauer & Baer, 2009). It also mediates the relationship between an invalidating environment and BPD symptoms (S. E. Sauer & Baer, 2009). This suggests that thought suppression might exacerbate several maladaptive behaviours associated with BPD, such as impulsivity, aggression and self-harm. Thought suppression is also associated with greater severity of BPD features in female prison inmates, though it does not mediate the relationship between self-harm and BPD (Chapman et al., 2005).

Adult patients with BPD also report greater habitual experiential suppression of both negative and positive emotions, compared with healthy participants (Beblo et al., 2013) (Table 3.1). Another study, which recruited adults from the community who met BPD criteria, assessed the impact of combined suppression strategies on negative affect following a social rejection script (Dixon-Gordon, Turner, Rosenthal, & Chapman, 2016). Contrary to expectations that suppression would increase negative affect, findings indicated that suppression did not lead to greater negative affect, compared with acceptance, and it was not associated with maladaptive behaviours in adults who met BPD criteria. These findings suggest that, at least in the context of

[13] The two college samples described here were older than the typical college sample, ranged in age from 18-30 (Cheavens et al., 2005) and 18-34 (S. E. Sauer & Baer, 2009), and are thus included here with adults rather than considered as youth samples.

social rejection, suppression might not have immediate negative effects. However, suppression led to reduced heart-rate variability (which is associated with negative affect and emotion regulation deficits), whereas acceptance led to increased heart-rate variability, in the same group of adults diagnosed with BPD. The authors suggested that greater regulatory effort might be needed by individuals with BPD in order to implement acceptance, leading to the differential heart rate variability results between conditions, and suggested that suppression might not have the physiological benefits that acceptance has (Dixon-Gordon et al., 2016). This is the only study that has explored emotion regulation in the context of social rejection in BPD. The context of social rejection is particularly relevant for this group because they experience greater actual social rejection in their social interactions and are more sensitive to perceiving social cues as socially rejecting (see Section 2.6 for a detailed discussion of rejection sensitivity in BPD). However, the focus was on the impact/outcome of suppression and acceptance, with expected increases in negative affect for suppression, rather than a focus on the effective application of the strategies per se.

Interestingly, when instructed to suppress in the broadest sense (to suppress all three components), during an ecological momentary assessment study undertaken over 6 days (participant were prompted 8 times per day), adults recruited from the community, who met BPD criteria, did not report a decreased willingness to tolerate distress, nor did they report increased urges for maladaptive behaviour (Chapman, Rosenthal, Dixon-Gordon, Turner, & Kuppens, 2017) (see Table 3.2 for study details). This finding contrasted with the expectation that suppression would increase urges for maladaptive behaviours. Another study recruited adults from the community and from a specialist personality disorder service. Number of BPD criteria met across participants (as assessed by the Personality Assessment Inventory – Borderline

Subscale, PAI-BOR) ranged broadly in this sample, from asymptomatic through to very high BPD features. Findings indicated that suppression (combined experiential and expressive suppression) did not predict poorer regulation (as indexed by self-reported affect and sympathetic activation) as was expected (Evans et al., 2013).

Combined, these findings suggest that while suppression might be a preferred strategy for adults with BPD/BPD features when dealing with negative emotions, suppression is not necessarily detrimental. This is particularly the case when needing to regulate acute social distress. Thus, suppression might be useful as a short-term strategy in the context of social rejection. Recent psychophysiological findings however, do suggest that the suppression of emotions might have relatively more negative psychophysiological consequences, compared with acceptance, in adults with BPD when used in the context of social rejection.

3.5.3 The use of suppression as an emotion regulation strategy by young people with BPD.

No published studies have assessed the habitual use, or the effective implementation, of suppression strategies in young people diagnosed with BPD in clinical settings compared with healthy controls.

A couple of studies have, however, explored the use, and application, of suppression in university/community samples of young adults with BPD features. Similar to findings among adults, greater BPD features are associated with greater thought suppression use in undergraduate student samples (Chapman et al., 2013; P. J. Geiger, Peters, & Baer, 2014). In addition, suppression (combined expressive and experiential) is not associated with negative outcomes in undergraduates with BPD features (Chapman, Rosenthal, & Leung, 2009). Similarly, and contrary to expectations, during an experience sampling study, undergraduate students with high

BPD features experienced greater positive emotions when instructed to suppress negative emotions (expressive and experiential) compared with when they were instructed to just observe their emotions (Chapman et al., 2009) (see Table 3.2 for study details). In contrast, those with low BPD features experienced more negative emotions when instructed to suppress negative emotions (expressive and experiential) than when they were instructed to just observe emotions (Chapman et al., 2009). This suggests that suppression might be more effective in managing negative emotions in young adults with higher BPD features, but not for those with lower BPD features.

Another study recruited a non-clinical community sample of young adults, from a university counselling centre and the community, aged over 18 years (M = 20.8, SD = 6.3, range n/a). Participants who met BPD criteria (BPD group) were compared with those who did not (non-BPD). Findings indicated that both groups applied experiential suppression equally as effectively to reduce self-reported sadness (Ruocco, Medaglia, Ayaz, & Chute, 2010) (Table 3.2). However, a different pattern of brain activation was evident between BPD and non-BPD participants. Using functional, near-infrared spectroscopy, the BPD group evidenced a negative and shallow slope of the rise in hemodynamic oxygenated haemoglobin, compared with a positive and steep slope for the non-BPD group. This suggests that those who met BPD criteria experienced abnormal medial prefrontal cortex activation during the processing of sadness (Ruocco, Medaglia, Ayaz, et al., 2010).

As was mentioned for distraction and cognitive reappraisal, it is important to note that participants in these studies were not recruited from clinical settings, thus limiting their generalisability to clinical youth BPD populations.

3.6 Acceptance and Mindfulness

Acceptance, often used interchangeably with the term *mindfulness*, involves the mindful and non-judgmental awareness of internal states, including emotions, and is generally considered to be an adaptive strategy (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Like suppression, acceptance has been described as a response-focused strategy (O'Driscoll, Laing, & Mason, 2014). However, it can also be defined as a cognitive reappraisal strategy because it can involve cognitive reframing by, for example, thinking of emotions as normal, and thus accepting them without judgment (Webb et al., 2012).

3.6.1 Typical development of the use of acceptance and mindfulness emotion regulation strategies from adolescence through adulthood.

Very little is known of the normal developmental trajectory of acceptance from adolescence through adulthood. This is partly because the assessment of acceptance strategies is often subsumed as part of a cluster of strategies (e.g, Silk et al., 2003; Zimmer-Gembeck & Skinner, 2011). What we do now, however, is that acceptance is the most commonly used emotion regulation strategy, and seems to be the preferred strategy with regards to minor events for adolescents (mean age = 13.9, SD = 0.95, age range 12-17) (Lennarz, Hollenstein, Lichtwarck-Aschoff, Kuntsche, & Granic, 2018). Its use is associated with lower levels of negative emotions, in adolescents aged 9-13 years, especially when events are perceived as highly negative (Tan et al., 2012), and when negative emotions are at their peak (Lennarz et al., 2018).

Despite very little understanding of the normative development of acceptance strategy use, interventions for young people have been developed based on positive findings with adults (Black, Milam, & Sussman, 2009). Research into the effectiveness of acceptance and mindfulness-based interventions for the improvement of mental health in adults (K. W. Brown, Ryan, & Creswell, 2007; Hofmann, Sawyer, Witt, & Oh, 2010), and in children and adolescents (Black et al., 2009; Burke, 2010; Zenner, Herrnleben-Kurz, & Walach, 2014) has received increased attention in relation to clinical and non-clinical populations. Reviews and meta-analyses suggest that mindfulness shows promise for the promotion of improved mental health in clinical and non-clinical populations. For example, a recent meta-analysis examining the effects of school-based mindfulness interventions indicated that participation was associated with improvements in cognitive performance, and resilience to stress, for children and adolescents (Zenner et al., 2014). However, it should be noted that most of the research exploring the impact of mindfulness on psychological outcomes has focused on adults (in clinical and non-clinical settings) (Burke, 2010). Much less research has focused on children and adolescents. Therefore, caution, with regards to interpretation and generalisation of findings, is recommended. Future research needs to address the various limitations, such as small sample sizes, of the research focused on children and adolescents to date (Burke, 2010; Zenner et al., 2014).

3.6.2 The use of acceptance and mindfulness emotion regulation strategies by adults with BPD.

In community adult volunteers, greater BPD features were found to be associated with reduced self-reported habitual use of acceptance (Evans et al., 2013). Acceptance ("observe, accept and not judge… emotional reactions", p. 552), and suppression (expressive and experiential) instructions, resulted in similarly reduced negative affect and electrodermal response (Evans et al., 2013). In addition, as BPD features increased in this same group, greater use of acceptance predicted reduced sympathetic activation (as measured by electrodermal activity) in response to negative stimuli, and it also predicted a slower recovery of negative affect (Evans et al., 2013).

In an ecological momentary assessment study (Chapman et al., 2017), the use of acceptance (in essence the instructions were to “accept your emotions without trying to get rid of them… let them come and go”, p. 7) and suppression (combined expressive, experiential and thought suppression) strategies, over a 6-day period, was assessed in community adult participants who met criteria for BPD, depression, and those who did not meet criteria for either disorder. Adults with BPD who were randomly assigned to use acceptance, reported increased urges for maladaptive behaviours (e.g., drug and alcohol use and self-harm), relative to adults with BPD, who used suppression (Chapman et al., 2017) (see Table 3.2 for study details). This pattern, indicating a negative impact of acceptance, relative to suppression, was not evident in the other groups. Findings across both studies described here suggest that, although acceptance is generally considered to be an adaptive strategy, when acceptance is used by adults with a high number of BPD features, acceptance might have undesirable immediate consequences on affect and behaviour. It might thus be that suppression has temporary benefits, and that acceptance might take longer to yield a positive effect (Chapman et al., 2017; Evans et al., 2013).

With regards to the effective implementation of instructed acceptance in the regulation of affect, a clinical sample of adult BPD outpatients were able to effectively implement acceptance to reduce self-reported negative affect, to a similar degree as healthy adults (Kuo et al., 2016) (see Table 3.2 for study details). Secondary analyses, using data collected from the same sample, indicated that the effectiveness of acceptance remained stable for adults with BPD, as stimulus arousal increased, but it decreased for healthy adults (Fitzpatrick & Kuo, 2016) (see Table 3.2 for study details). The same adult BPD participants were also able to strengthen their acceptance skills over time, but healthy controls did not demonstrate strengthening of their ability to implement the same acceptance strategy over time (Metcalfe, Fitzpatrick, & Kuo, 2017). These findings suggest that acceptance holds promise for out-patient adults with BPD, particularly in the regulation of negative affect, even when arousal increases. These findings also indicate that acceptance strategies can be learnt by adults with BPD.

Acceptance has also been found to have a positive impact on the heart rate variability of adults, recruited from the community, who met BPD criteria. In contrast to the reduced heart rate variability found when they implemented a suppression strategy (combined expressive and experiential suppression), acceptance led to greater heart rate variability for the BPD group, but not for adults who met criteria for major depression or healthy controls. Lower resting heart-rate variability is associated with negative affect and emotion regulation deficits. These findings suggests that the deliberate use of acceptance strategies might have physiological benefits for adults who meet BPD criteria, greater than that observed for adults with major depression or otherwise healthy adults (Dixon-Gordon et al., 2016) (see Table 3.2 for study details).

3.6.3 The use of acceptance and mindfulness emotion regulation strategies by young people with BPD.

No published studies have assessed the habitual use, or the effective implementation, of acceptance/mindfulness strategies in young people diagnosed with BPD in clinical settings compared with healthy controls.

Only one study has been carried out that explored the use of acceptance by young people with BPD features. Participants were undergraduate university students, and, similar to studies with adults with BPD features, students with high BPD features reported less habitual use of acceptance strategies compared with students with low BPD features (Chapman et al., 2013) (see Table 3.1 for study details). In addition, among students with high BPD features, a lack of emotional acceptance, when presented with stressors, contributed to heightened anger reactivity (Chapman et al., 2013). As previously discussed, while studies that use university student samples are informative, it is difficult to generalise findings to clinical samples.

3.7 Summary and Implications

Emotion regulation ability generally improves throughout adolescence and into young adulthood in neurotypical populations (Ahmed et al., 2015; Garnefski & Kraaij, 2006; McRae et al., 2012; Riediger & Klipker, 2014; Silvers et al., 2012). During this time, young people become adept at effectively applying emotion regulation strategies, which assist them to successfully navigate social interactions. By early adulthood, development in emotion regulation plateaus and stabilises. Adolescence and early adulthood, therefore, represent a sensitive period for the development and consolidation of emotion regulation ability (Ahmed et al., 2015). The period spanning adolescence and young adulthood is also a key period for the onset of psychopathology (Giedd, Keshavan, & Paus, 2008), including BPD (Chanen & Kaess, 2012; Fonagy et al., 2015; Kaess et al., 2014). Thus, developmental age and stage of disorder might overlap and interact during this sensitive period for the development of emotion regulation abilities.

This period has been identified as an opportune time for prevention and early intervention efforts that aim to prevent psychopathology by improving emotion regulation ability (Ahmed et al., 2015). There is also a call for a stronger focus on interventions that target individuals in the early stages of BPD (Chanen & Thompson, 2018). Early intervention with individuals presenting for treatment at the onset of BPD might assist to reduce persistence and severity of the disorder, and, importantly, to prevent the secondary consequences that are associated with BPD chronicity, such as psychosocial disability (Chanen & Thompson, 2018). However, if emotion regulation is to be targeted in young people with early stage BPD, emotion regulation in this group first needs to be understood. To date, no studies have compared the habitual use, or the effective application, of emotion regulation strategies in a clinical sample of young people with BPD, with that of healthy young people. This represents a major gap in our understanding of the developmental trajectory of emotion regulation throughout the course of BPD.

The research literature to date does, however, provide important insights regarding emotion regulation of negative affective states in adults with BPD/BPD features. It should be noted that no studies have assessed the regulation of positive affect, although some studies have measured changes in positive affect as an outcome of the regulation of negative affect. Thus, to summarise, adults with BPD/high BPD features report greater habitual use of suppression strategies, less use of cognitive reappraisal and distraction strategies, and equal or less use of mindfulness/acceptance strategies, compared with healthy adults/adults with fewer BPD features (Beblo et al., 2013; Carvalho Fernando et al., 2014; Chapman et al., 2017; C. Sauer et al., 2016). Nevertheless, adults with BPD/higher BPD features do have access, and are as able as healthy adults, to choose situationally appropriate emotion regulation strategies, such as distraction and cognitive reappraisal, when the intensity of stimuli is manipulated experimentally (C. Sauer et al., 2016). They are also able to demonstrate, in experimental settings, that they are able to effectively apply the various emotion regulation strategies to regulate their negative emotions (as indexed by self-report and psychophysiological data) (Baczkowski et al., 2016; Chapman et al., 2017; Fitzpatrick & Kuo, 2016; Koenigsberg, Fan, et al., 2009; Kuo et al., 2016; S. Lang et al., 2012;

Marissen et al., 2010; Schulze et al., 2011). However, fMRI data indicate that during cognitive reappraisal adults with BPD engage different areas of the brain, and experience reduced functional connectivity in regions central to the regulation of emotions, compared with healthy adults (Baczkowski et al., 2016; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Schulze et al., 2011). This suggests that while adults with BPD/BPD features can apply the various emotion regulation strategies to regulate negative state affect, it has been speculated that they might maladaptively rely on different/compensatory brain networks when applying cognitive reappraisal (Baczkowski et al., 2016).

Given that developmental age and stage of disorder might overlap and interact during adolescence and early adulthood, research findings from the adult BPD literature cannot simply be generalised to younger samples. Thus, studies that compare young people with BPD, at different stages of disorder, with healthy young people, are needed in order to fill this gap. This includes youth with first presentation BPD, who are the ideal target group for early intervention. However, to date, no studies have compared the habitual use, or the effective application, of emotion regulation strategies in young people with BPD with that of healthy young people.

What we know of the habitual use and application of emotion regulation strategies in younger samples is predominantly derived from samples of university students with BPD features. Findings from these studies have been mixed. Some findings have been similar to findings with adults with BPD/high BPD features. For example, correlational studies with community samples of university students indicate that suppression strategies are associated with greater BPD features (Chapman et al., 2013; P. J. Geiger et al., 2014). Also, greater BPD features are associated with reports of greater habitual use of thought suppression, and less habitual use of acceptance in undergraduate student samples (Chapman et al., 2013; P. J. Geiger et al., 2014). However, unlike adults with BPD/high BPD features, university students with high BPD features have also reported that they are more likely than those with low BPD features to habitually use distraction and cognitive reappraisal (Chapman et al., 2013). Similarly, when asked to choose between strategies, under experimental conditions, number of BPD features does not influence strategy choice in university students. That is, regardless of BPD features, they are more likely to choose cognitive reappraisal over distraction (Kuo et al., 2017). Even less is known regarding the effective application of emotion regulation strategies in young people with BPD. Like adults with BPD/high BPD features, young adults who met BPD criteria (18+, M = 20.8, SD = 6.3, range n/a), and who were recruited from a university counselling centre and the community, could apply experiential suppression as effectively as those who did not meet BPD criteria (Ruocco, Medaglia, Ayaz, et al., 2010). In summary, findings with younger samples, albeit predominantly non-clinical samples, are not always consistent with the adult BPD emotion regulation literature. However, findings from these studies should be interpreted with caution because they are based on a handful of studies with non-clinical community samples of young adults with BPD features. These findings therefore do not necessarily reflect the habitual use, or emotion regulation ability, of clinical populations of young people with BPD.

Thus, while it seems theoretically and intuitively important to offer early interventions and preventative programs that target emotion regulation in young people with BPD (Crowell et al., 2009; Linehan, 1993; Putnam & Silk, 2005; Schuppert et al., 2012), much remains to be understood in terms of the habitual use and application of emotion regulation strategies in young people with BPD. In particular, research is needed that focuses on understanding emotion regulation in young people with BPD relative to their healthy peers. Such research would help us to better understand the developmental trajectory of emotion regulation in BPD, and to be able to make recommendations for clinical trials of emotion regulation training in young people with BPD.

Table 3.1.

Summary of Emotion Regulation in BPD Studies: Habitual Use and Strategy Choice

	Participant Characteristics					Methodology	Results	
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Habitual use/choice of ER strategy[a] Measurement	Habitual use/choice of ER strategy < (reduced), > (greater), = (equal)	
BPD adults clinical								
Beblo (2013)	BPD (30) HC (30)	Range n/a 29.1 (8.9) 30.4 (9.9)	77	Germany In-pt; SCID-II Ad	All: psychosis, anorexia, AOD abuse, severe physical disorder, pregnancy. HC: Axis I/II dx	Habitual use; Emotion Acceptance Questionnaire; 4 subscales assess suppression/acceptance of negative/positive emotions; rate statements on 6-point scale	Experiential suppression[b] negative: Experiential suppression positive: Acceptance negative: Acceptance positive:	BPD > HC BPD > HC BPD < HC BPD < HC
Carvalho Fernando (2014)	BPD (49) MDD (48) HC (63)	28.6 (9.0)[c] 33.2 (8.9) 31.4 (10.0)	90[c] 54 65	Germany Hospital & clinic[d]; SCID-II Hospital & clinic; SCID-II Local ad	BPD & MDD: psychosis, neurological impairment, neurological disease, AOD dependence in last 6 mo HC: lifetime axis I/II dx	Habitual use Emotion Regulation Questionnaire; rate statements on 7-point scale	Expressive suppression: Cognitive reappraisal:	BPD & MDD > HC; BPD = MDD BPD & MDD < HC; BPD = MDD
Sauer (2016)	BPD (24) MDD (19) HC (32)	18-45 29.5 (7.4) 29.3 (5.8) 27.5 (6.9)	100	Germany Out-pt; SCID-II Out-pt; current/remitted MDD, SCID-I Ad	All: current AOD abuse/addiction, bipolar dx, current/past psychosis, SCZ, SI, antipsychotics/benzodiazepine MDD: PTSD, cluster B PD HC: lifetime mental dx/PD	Habitual use; Cognitive Emotion Regulation Questionnaire; rate statements on 5-point scale Choice; Experimental: participants trained in reappraisal & distraction; shown low or high intensity negative images; participants choose reappraisal or distraction	Reappraisal: Distraction: Acceptance: Low intensity images High intensity images	BPD & MDD < HC BPD & MDD < HC BPD = MDD = HC All groups > reappraisal All groups > distraction
BPD adults non-clinical								
Chapman (2017)	BPD (48) MDD (54) HC (50)	18-59 32.6 (11.2) (overall M/SD; gps matched)	82.9	USA Com; SCID-II c Com; SCID-I c past yr Com	All: mania/hypomania, psychotic dx MDD: > 2 BPD c; HC: hx psychiatric dx (except alcohol abuse), > 2 BPD criteria	Habitual use; White Bear Suppression Inventory; rate statements 5-point scale Mindfulness Attention and Awareness Scale; rate statements on 5-point scale	Thought suppression: Mindfulness:	BPD > MDD, HC; MDD > HC BPD < MDD, HC; MDD < HC

Table 3.1 Continued

	Participant Characteristics					Methodology	Results	
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Habitual use/choice of ER strategy[a] Measurement	Habitual use/choice of ER strategy < (reduced), > (greater), = (equal)	
BPD adults non-clinical								
Chapman (2013)	H-BPD (40)	Range n/a 21.2 (5.7) overall	57.7	Undergrad; PAI-BOR > 38	n/a	Choice; Experimental: random assignment to neutral or fear induction; Response to Emotions Questionnaire assessed strategy choice: suppression, distraction, reappraisal, attention redirection, acceptance	Distraction, cognitive reappraisal & suppression:	H-BPD > L-BPD
	L-BPD (57)			Undergrad; PAI-BOR < 23			Acceptance:	H-PBD < L-BPD

Note. (abbreviations are listed alphabetically) Ad = advertising; AOD = alcohol and other drug; BPD = borderline personality disorder; c = criteria; Com = community; dx = disorder/diagnosis; ER = emotion regulation; F = female; gps = groups; H-BPD = group with high number of BPD criteria; HC = healthy control; In-pt = inpatient; L-BPD = group with low number of BPD criteria; MDD = major depressive disorder; mo = month; n/a = not available/not reported; Out-pt = out-patient; PAI-BOR = Personality Assessment Inventory - Borderline Subscale; PD = personality disorder; PTSD = post-traumatic stress disorder; SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders; SCID-II = Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCZ = schizophrenia; SI = suicide ideation; Trau = group meets criteria for PTSD; yr/yrs = year/years.

[a]Some studies assessed the self-reported habitual use of various emotion regulation strategies via questionnaire; others used experimental paradigms to assess which strategy participants would choose.
[b]It is unclear which type of suppression is captured by this questionnaire. The original validation article is in German. From the example items it appears that the questionnaire assesses experiential suppression.
[c]Significant age and sex differences controlled for.
[d]Unclear whether participants were in- or out-patients.

Table 3.2.

Summary of Emotion Regulation in BPD Studies: Effective Application

	Participant Characteristics					Methodology	Results
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Design & instruction (regulation/control) Emotion induction Measurement	Effective application of ER strategy[a] < (less effective), > (more effective), = (equally effective)
					BPD adults clinical		
Baczkowski (2016)	BPD (48) HC (39)	18-65 30.8 (9.2) 28.7 (10.7)	100	Netherlands, Germany MH clinics[b]; SCID-II General population	All: homosexual, lifetime psychotic dx/bipolar I, ADHD, dissociative identity disorder, Serious/unstable medical illness, AOD dependence, fMRI exclusion (e.g., claustrophobia)	Repeated measures, pseudorandomised order: cognitive reappraisal/passive viewing Negative, positive, erotic, neutral static images Self-reported affective state from negative (-100) to positive (+100)	Change (direction of change was not reported) in affective state between passive viewing and cognitive reappraisal conditions BPD = HC
Fitzpatrick (2016)	BPD (25) HC (30)	18-60 32.7 (9.6) 30.1 (9.1)	64 66.7	Canada Com/DBT trial; IPDE-BPD Internet advertisement	BPD: dementia, psychotic/bipolar dx, organic brain damage or MR HC: current psychological dx; ≥ 4 BPD c, or SI/self-harm BPD c; taking psychotic, beta-blocker, or antihistamine meds	Repeated measures: mindful awareness/ distraction Negative images Self-reported negativity from 1 (not at all) to 9 (very); heart-rate; skin conductance	Negativity: Group x strategy x image arousal interaction: For HC only, effectiveness of mindfulness decreased to greater extent than effectiveness of distraction as image arousal increased. This effect greater than that observed for the BPD group. Heart rate: No interactions Skin conductance: Strategy x image arousal interaction indicating as stimulus arousal increased, effectiveness of distraction increased for both groups. No other interactions.

Table 3.2 Continued

	Participant Characteristics					Methodology	Results
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Design & instruction (regulation/control) Emotion induction Measurement	Effective application of ER strategy[a] < (less effective), > (more effective), = (equally effective)
					BPD adults clinical		
Koenigsberg (2009)	BPD (18) HC (16)	Range n/a 32.6 (10.4) 31.8 (7.7)	56	USA Out-pt; SIDP-IV Ad	All: psychotropic meds last 2 wks, or last 6 wks for fluoxetine; hx head trauma, CNS neurological dx, significant med illness; current SI; MRI contraindications BPD: bipolar I, SCZ, schizoaffective dx, AOD dependence, organic mental dx, AOD abuse < 6 mo; < 3 affective instability BPD c HC: lifetime axis I/II dx, or first degree relative axis I dx	Repeated measures: cognitive reappraisal/passive viewing Negative/neutral images depicting social interactions Self-report emotional reaction from 1 (negative) to 5 (positive)	Negative images: reduced negative affect between passive viewing and reappraisal conditions BPD = HC Neutral images: reduced positive affect between passive viewing and reappraisal conditions BPD = HC
Kuo (2016)	BPD (25) HC (30)	18-60 32.7 (9.6) 30.1 (9.1)	64 66.7	Canada BPD clinic; IPDE-BPD Ad	BPD: dementia, psychotic/bipolar dx, organic brain damage or MR HC: current psychological dx, ≥ 4 BPD c or SI/self-harm BPD c, taking psychotic, beta-blocker, or anti-histamine meds	Repeated measures: mindful awareness/ distraction Negative images Self-reported negativity/positivity from 1 (not at all) to 9 (very); heart-rate; EDA, RSA	Group x strategy interaction Negativity using both strategies: BPD = HC Positivity using distraction: BPD < HC Positivity using mindfulness: BPD = HC Greater positivity for both groups using distraction compared with mindfulness Physiological measures, both strategies: BPD = HC
Marissen (2010)	BPD (30) HC (30)	18-40 29.9 25.1[c]	100	Netherlands Out-pt; SCID-II Ad	BPD: MDD, anxiety dx, ADHD, AOD dependence/abuse, current psychotic sx, PTSD, use of benzodiazepines HC: current psychiatric dx, use of benzodiazepines	Repeated measures: passive viewing/ cognitive reappraisal Negative stimuli Rate emotional intensity 1-5 EEG (to measure ERP)	Emotional intensity: BPD = HC EEG: BPD = HC
Schulze (2011)	BPD (15) HC (15)	Range n/a 27.6 (7.9) 24.5 (2.9)	100	Germany In-pt; IPDE (including affective instability criteria) Ad	BPD: psychotropic meds; lifetime primary organic, psychotic or bipolar dx; current MDE HC: psychotropic meds; neurological or psychiatric dx	Repeated measures: cognitive reappraisal increase response, cognitive reappraisal decrease response, or maintain response Neutral and aversive images Valence and arousal ratings (1-9 scale)	Arousal and valance ratings all conditions: BPD = HC

Table 3.2 Continued

	Participant Characteristics					Methodology	Results
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Design & instruction (regulation/control) Emotion induction Measurement	Effective application of ER strategy[a] < (less effective), > (more effective), = (equally effective)
					BPD adults non-clinical		
Chapman (2009)	H-BPD (30) L-BPD (39)	Range n/a 21.2 (3.2) overall	100	USA Undergrad; PAI-BOR > 38 Undergrad; PAI-BOR < 23	n/a	Experience sampling, repeated measures: mindful awareness, suppression (experience and expression) of negative emotions Prompted 8 x per day for 4-days (each day: baseline-observe-suppress-observe) PANAS	Negative emotions: Only L-BPD greater negative emotions on suppress day than for observe day. No between group differences Positive emotions: Only H-BPD greater positive emotions on suppress day than for observe day. No between group differences
Chapman (2017)	BPD (48) MDD (54) HC (50)	18-59 32.6 (11.2) (overall M/SD; gps matched)	82.9	USA Com; SCID-II Com; SCID-I c past yr Com	All: mania/hypomania, psychotic dx MDD: > 2 BPD c; HC: hx psychiatric dx (except alcohol abuse), > 2 BPD criteria	Random assignment to suppression (expression, emotions, & thoughts)/ acceptance Ecological momentary assessment over 6 days[d] Self-reported affect (PANAS)	Suppression: reduction in negative affect BPD > MDD[e;] No other between group differences Acceptance: no between group differences in affect
Dixon-Gordon (2016)	BPD (63) MDD (73) HC (57)	18-60 32.3 (11.1) (overall range M/SD reported)	82.4	Canada & USA Com; SCID-II Com; SCID-I c past yr Com	All: Hx of manic or hypomanic episodes, or psychotic disorder MDD: > 3 BPD criteria HC: Axis I or II disorder (except hx of alcohol abuse), > 3 BPD criteria	Random assignment to receive suppression/acceptance audio instructions Social rejection induction via audio recording Self-reported negative affect (PANAS), SCR, HRV	Negative affect regulation: BPD = MDD = HC[f] SCR: BPD = MDD = HC[g] HRV: Group x Condition x Time interaction: BPD increase in HRV from induction to recovery in accept condition; decrease in the suppress condition, other groups did not.
Lang (2012)	BPD (14) Trau (15) HC (15)	27.2 (7.7) 29.3 (7.7) 24.7 (5.6)	100	Germany Com; hx trauma[h]; SCID-I Com; hx trauma[h] Com	BPD: meds last two weeks, hx neurological dx, major medical conditions, PTSD, hx SCZ-spectrum psychosis, bipolar I, AOD abuse Trau: PTSD HC: Axis I/II dx, current psychiatric tx; hx trauma	Repeated measures pseudo-randomised to cognitive reappraisal up-regulate, cognitive reappraisal down-regulate, and maintain conditions Negative/neutral scripts Self-reported valence & arousal	Valence and arousal: all groups equally able to up-regulate and down regulate emotional arousal and valence; Trau lowest arousal and valence compared with HC; No other between group differences

Table 3.2 Continued

	Participant Characteristics					Methodology	Results
First Author (year)	Group (n)	Age range Mean (SD)	% F	Location Setting; inclusion criteria	Exclusion criteria	Design & instruction (regulation/control) Emotion induction Measurement	Effective application of ER strategy[a] < (less effective), > (more effective), = (equally effective)
					BPD adults non-clinical		
Ruocco (2010)	 BPD (9) HC (8)	Range n/a 20.8 (6.3) 18.9 (0.9)	100	USA Uni & com; DIPD-IV Uni & com	All: < 18 yrs; non-English speaking; SCZ/psychotic dx, bipolar dx, lifetime/current ED requiring hospitalisation, MR, neurological/ severe somatic dx, significant head trauma (> 5 min loss of consciousness) HC: current Axis I or II disorder	Repeated measures maintain/experiential suppression Sad & neutral images Self-reported sadness (7- point scale); Oxygen haemoglobin (Oxy-Hb)	Sadness: No interactions; Both groups lower sadness during suppression compared with maintain condition. Oxy-Hb: No group x emotion x instruction or group x emotion interaction effects for any channels.

Note. (abbreviations are listed aphabetically) Ad = advertising; ADHD = attention deficit hyperactivity disorder; AOD = alcohol and other drug; BPD = borderline personality disorder; c = criteria; CNS = central nervous system; Com = community; DBT = dialectical behaviour therapy; DIPD-IV = Diagnostic Interview for DSM-IV Personality Disorder; dx = disorder/diagnosis; ED = eating disorder; EDA = electrodermal activity; EEG = electroencephalograph; ER = emotion regulation; ERP = event related potential; F = female; fMRI = functional resonance magnetic imaging; H-BPD = group with high number of BPD criteria; HC = healthy control; HRV = heart rate variability; hx = history; In-pt = inpatient; IPDE-BPD = International Personality Disorders Examination- Borderline personality disorder section; L-BPD = group with low number of BPD criteria; MDD = major depressive disorder; MDE = major depressive episode; meds = medications; MH = mental health; mo = month; MR = mental retardation; MRI = magnetic resonance imaging; n/a = not available/not reported; Out-pt = out-patient; Oxy-Hb = oxygen haemoglobin; PAI-BOR = Personality Assessment Inventory- Borderline Subscale; PANAS = Positive and Negative Affect Schedule; PTSD = post-traumatic stress disorder; RSA = respiratory sinus arrhythmia; SCID-II= Structured Clinical Interview for DSM-IV Axis II Personality Disorders; SCR = skin conductance response; SCZ = schizophrenia; SI = suicide ideation; SIDP-IV = Structured Interview for DSM-IV Personality Disorders; Trau = Trauma group met criteria for PTSD; wks = weeks; yr.yrs = yr/years

[a]Effective application of emotion regulation strategy (ER) refers to how effectively participants were able to apply the specific emotion regulation strategies to modulate their affective state; < indicates participants were less effective at applying the regulatory strategy, > indicates participants were more effective at applying the regulatory strategy, and = indicates participants were equally effective at applying regulatory strategy. Not all results are able to be reported this simply and are therefore described with the minimal amount of detail needed in order to be meaningful.
[b]Methodology did not state whether participants were in- or out-patients.
[c]Significant age difference, included as covariate.
[d]Ecological momentary assessment design: days 1 & 2 no instruction baseline phase; days 3 & 4 instruction phase (accept or suppress); days 5 & 6 no instruction, post-instruction phase. Participants were required to report on their mood, urges, and distress tolerance over the 6 days.
[e]Analysis was carried out using multilevel modelling. The only significant between group comparison was reduced negative affect from the baseline to the instruction phase, only in the suppression condition, for the BPD group compared to the MDD group.
[f]BPD participants reported greater overall negative emotions (shame/guilt, anger, fear, anxiety, and nonspecific distress) than HC across all conditions (accept, suppress) and all time-points (baseline, post-rejection-induction, post distress tolerance task, post-recovery); BPD participants reported greater anxiety than MDD participants.
[g]Greater SCR across groups and conditions during emotion induction than at baseline; Greater SCR level at recovery than baseline across conditions and groups.
[h]BPD & Trau participants had a history of criterion A trauma three months or longer prior to participation.

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Chapter 4: Methodology for Empirical Studies

4.1 Preamble and General Overview of Methodology

The two preceding chapters critically reviewed and synthesised the existing BPD social cognition and emotion regulation literature from a developmental perspective. The reviews demonstrated that a developmental approach adds significantly to the understanding of social cognition and emotion regulation in BPD. Findings suggest that there are differences in socioemotional functioning in BPD that are associated with developmental age and clinical stage of disorder. Consideration of such differences might prove important when translating empirical findings into clinical practice. In particular, by understanding the specific nature of sociocognitive and emotion regulation difficulties present at the onset of BPD, interventions can better target these early and thus aim to prevent the chronic and debilitating interpersonal dysfunction observed in BPD over a lifetime.

Therefore, this thesis focused on youth (aged 15-25) with first presentation BPD and compared them with healthy youth. Due to the challenges associated with recruiting and retaining acutely unwell clinical BPD participants, a single 90-120-minute session was required. During this single testing session, participants first completed an experimental task that assessed the rapid facial mimicry response, a low-level, simulation component, of affective empathy (Study 1). The second and third tasks (comprising Study 2) evaluated participants' ability to implement two different emotion regulation strategies (emotion suppression and cognitive reappraisal) to regulate positive and negative affect under different conditions. Specifically, the first Study 2 task assessed participants' ability to implement emotion regulation strategies under standard laboratory conditions, and the second Study 2 task assessed participants' ability to implement the same emotion regulation strategies in the context social rejection. Because all tasks were completed during the same session, the following sections will provide a description of participants, materials and equipment, as well as recruitment and experimental procedures for all experimental tasks.

4.2 Participants

A total of ninety youths aged 15-25 years took part in the current research (34 BPD, 56 healthy controls). Descriptive statistics will be detailed separately in the results sections for each study, as there are slight differences due to participant attrition and data loss (due to technical issues and EMG artifacts) between studies.

Both males and females were included in order to address the gap in the current BPD literature caused by the common exclusion of males (M. Goodman, Patel, Oakes, Matho, & Triebwasser, 2013). Males are often excluded due to the sex imbalance evident in clinical populations diagnosed with BPD, of which about 75 percent are female (American Psychiatric Association, 2013). However, population based studies suggest that similar rates of males and females are affected by BPD across adult, and child and adolescent populations (Grant et al., 2008; Lenzenweger, Lane, Loranger, & Kessler, 2007; Torgersen et al., 2001; Zanarini et al., 2011), and that the clinical presentation of men and women with the disorder is similar (Johnson et al., 2003).

All BPD participants were recruited from the Helping Young People Early (HYPE) clinic at Orygen Youth Health (OYH). OYH is the state-funded mental health service for young people, aged 15-25 years, living in the western metropolitan region of Melbourne, Australia (Chanen et al., 2015). The HYPE clinic is a specialised early intervention program for youth with BPD (Chanen, Jackson, et al., 2008). HYPE patients were eligible to take part in the current research if they met HYPE clinic entry criteria, that is, three or more DSM-IV[14] BPD criteria, as assessed by the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II) (First, Gibbon, Spitzer, Williams, & Benjamin, 1997). While the DSM-IV requires five criteria to meet full threshold BPD, it uses a categorical approach to diagnose the disorder despite the fact that personality disorders are generally accepted to be dimensional in nature (Zimmerman, Chelminski, Young, Dalrymple, & Martinez, 2013). Dimensional scoring has been found to be more reliable and valid than categorical scoring (Zimmerman et al., 2013) and studies have shown that patients, including youth, with subthreshold BPD features (1-4) have more severe mental illness and significantly greater psychosocial morbidity than those with no features (K. N. Thompson et al., in press; Zimmerman, Chelminski, Young, Dalrymple, & Martinez, 2012). Therefore, participants meeting three or more BPD criteria were included in the current research, making the results more representative of the dimensional nature of BPD.

BPD patients typically present with co-occurring disorders (Chanen, Jovev, & Jackson, 2007), therefore participants with a range of mental state disorders were included in the current research (frequency of comorbidities will be reported in the relevant result sections). However, BPD participants who presented with the following comorbidities (as assessed by the Structured Clinical Interview for DSM-IV Axis I Disorders (Patient Edition; SCID-I/P) (First, Spitzer, Gibbon, & Williams,

[14] Because some participants had participated in other studies at OYH, which shared diagnostic data with the current study (see Section 4.4.1.1 for details), and those studies had used DSM-IV, the current study continued with DSM-IV BPD criteria.

2002)) were excluded: psychosis, bipolar I disorder, or a psychiatric condition due to a medical condition. This in part reflects HYPE inclusion criteria.

Healthy control participants were recruited from a similar geographical area to the BPD participants. Potential healthy participants were excluded if they reported a current or past mental disorder at the point of screening. Following further assessment, healthy control participants were excluded if they met diagnostic criteria (as assessed by the Research Version, Non-Patient Edition, of the SCID I (SCID I/NP)) for any current or past mood or anxiety disorder, manic episodes, psychosis, eating disorder, somatic disorder, or post-traumatic stress disorder. They were also excluded if they had any features of BPD or antisocial personality disorder (APD; as assessed by the SCID-II Personality Questionnaire (SCID-II PQ)).

In addition, the following exclusion criteria applied to all participants: severe illness, such that the person would be unable to comply with either the requirements of informed consent or the experimental protocol; visual impairment (i.e., uncorrected vision or colour blindness); intellectual disability; a history of epilepsy, meningitis, encephalitis or brain infection; a history of loss of consciousness for more than 10 minutes or brain injury; or drug or alcohol intoxication at the time of testing. Finally, participants were included only if they were sufficiently fluent in English to participate fully in the protocol.

This study was approved by the Melbourne Health Human Research Ethics Committee (Appendix B-1) and the Australian Catholic University Research Ethics committee (Appendix B-2).

4.3 Measures and Equipment

4.3.1 Diagnostic and demographic measures.

4.3.1.1 All participants.

Eligibility screen.

All participants completed a telephone screen to briefly assess for eligibility. Participants were asked about their ability to comply with the protocol, to provide informed consent, and about vision impairment, learning or intellectual difficulties, chronic medical issues (such as epilepsy), and a history of loss of consciousness. In addition, potential healthy control participants were asked whether they had history of past or current mental health issues.

Wechsler Abbreviated Scale of Intelligence (WASI).

The WASI (Wechsler, 1999) provides a brief and reliable measure of intelligence and was used to match participants on cognitive ability. All participants completed the Vocabulary, Matrix Reasoning, and Block Design, subscales of the WASI. The Full-Scale-2 Subtests IQ was calculated according to WASI manual procedures.

Self-reported depression and anxiety: Hospital Anxiety and Depression Scale (HADS).

The HADS (Zigmond & Snaith, 1983) is a 14–item questionnaire that assesses levels of depression and anxiety and takes 2-3 minutes to complete. It was completed at the time of laboratory task administration and captures state depression and anxiety. It has been validated for use with various adult populations as well as with adolescents (D. White, Leach, Sims, Atkinson, & Cottrell, 1999). It has good testretest reliability and factor structure, and discriminates between adolescents diagnosed with, and those without, depressive or anxiety disorders (D. White et al., 1999).

4.3.1.2 BPD participants.

Structured Clinical Interview for DSM-IV Axis I Disorders (Patient Edition; SCID-I/P).

To determine co-occurring Axis-I disorders and to screen for psychosis (an exclusion criterion), modules A (mood episodes, dysthymic disorder, mood disorder due to a general medical condition, and substance-induced mood disorder), B (psychotic and associated symptoms), C (psychotic disorders), D (mood disorders), F (anxiety disorders), G (somatoform disorders), and H (eating disorders) of the SCID-I/P (First et al., 2002) were administered to all potential BPD participants. The SCID-I is a semi-structured clinical interview assessing for DSM-IV Axis I disorders. Research indicates that the SCID-I/P has moderate to excellent inter-rater reliability (Lobbestael, Leurgans, & Arntz, 2011), good diagnostic reliability, superior validity over standard clinical interviews (Ramirez Basco et al., 2000), and its use systematically reduces the chances of missing (i.e., not diagnosing) comorbid Axis-I disorders (Rogers, 2003; Zimmerman & Mattia, 1999).

Structured Clinical Interview for DSM-IV AXIS II Personality Disorders (SCID-II).

To determine the number of BPD features met by participants, and to assess for comorbid axis II personality disorders, the SCID-II (First et al., 1997) was administered to all potential BPD participants. The SCID-II is a semi-structured diagnostic interview used for assessing the DSM-IV Axis II personality disorders (American Psychiatric Association, 2000). It is a versatile diagnostic tool that is used in clinical as well as research settings, and has demonstrated excellent categorical and dimensional internal consistency, and inter-rater reliability (Lobbestael et al., 2011; Maffei et al., 1997).

4.3.1.3 Healthy control participants.

Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version, Non-Patient Edition (SCID-I/NP).

The SCID-I/NP was administered over the telephone to screen for the presence of Axis I disorders in the healthy control participants. The SCID-I/NP consists of the same diagnostic modules as the SCID-I/P (including the psychotic screen). The only differences between the two assessment tools are that the SCID/NP does not assume a primary diagnosis and includes an 'overview' section.

Structured Clinical Interview for DSM-IV Axis II Personality Questionnaire (SCID-II PQ).

The SCID-II PQ (First, Gibbon, Spitzer, Williams, & Benjamin, 1997) was used to screen potential healthy control participants for BPD and APD. It contains fifteen BPD items, presented in a yes/no response format, which correspond with the nine DSM-IV BPD criteria. To screen for APD, the 15 items corresponding to Criterion A (childhood conduct disorder), as well as the seven adult antisocial criteria, were administered over the phone.

4.3.2 Experimental measurement of affect.

4.3.2.1 Self-reported affect: Short Positive and Negative Affect Schedule (PANAS).

Participants completed the Short Positive and Negative Affect Schedule (PANAS), which was presented to participants as a stapled booklet to be completed when prompted by the researcher throughout the experimental testing session (the order of which is described in the procedures Section 4.4).

The Short PANAS (Mackinnon et al., 1999) is a 10-item self-report measure of positive and negative affect and was modified from the original 20-item version (Watson, Clark, & Tellegen, 1988). Participants completed a total of 21 PANAS questionnaires: three were completed as baseline measures prior to each experimental task corresponding with Studies 1 and 2 (Study 2 consisted of two experimental tasks); and eighteen further PANAS questionnaires were completed throughout Study 2 (PANAS administration procedures for Study 2 are described in Section 4.4.2.4). Participants rated, on a scale of 1-5, to what extent they felt 10 different emotions. Negative affect was comprised of 5 emotions: 'distressed', 'upset', 'scared', 'nervous', and 'afraid'; and positive affect was comprised of 5 emotions: 'excited', 'enthusiastic', 'alert', 'inspired', and 'determined'. High negative affect is characterised by subjective distress and unpleasurable engagement, and low negative affect by the absence of these feelings. Positive affect represents the extent to which individuals experience pleasurable engagement with the environment. The PANAS is a reliable and valid measure of the constructs it was intended to assess (J. R. Crawford & Henry, 2004) and the short version has also been found to have sound psychometric properties (Mackinnon et al., 1999; Merz et al., 2013). It was included to assess self-reported affect, and also to consider the potential impact of state affect at the time of testing, because some research suggests that sad mood might suppress rapid facial mimicry (Likowski et al., 2011).

4.3.2.2 Facial expression of emotion: Facial electromyography.

Facial electromyography (EMG) provides an objective measure of facial muscle responses too fleeting or subtle to be observable by the naked eye (Cacioppo et al., 1986). It has been shown to provide a robust index of positive and negative emotions, including anger (e.g.,Moody et al., 2007) and happiness (e.g., Tassinary et al., 2007). In the current research, EMG was used to objectively assess the rapid facial mimicry response (Study 1) as well as the regulation of affect (Study 2).

4.3.3 Equipment and stimuli.

4.3.3.1 Facial electromyography.

Consistent with prior research, surface EMG was used to measure muscle activity on the left side of the face (e.g., Dimberg, 1990). Subtle muscle activity was continually recorded using an amplification system that synchronises the presentation of stimuli with the recorded muscle activity data. A total of five, 4 mm Ag/AgCl (silver/silver chloride), shielded, fixed-wire, non-invasive surface electrodes were placed on the skin surface of the face (Dawson, Schell, & Filion, 2007; Dimberg, 1990; Tassinary et al., 2007). Consistent with prior research, one of the electrodes acted as a ground (placed on the forehead). The remaining pairs were placed on the left side of the face, approximately 1.25 cm apart, focusing on the left corrugator supercilii (above the brow, sensitive to anger), and zygomaticus major regions (cheek; sensitive to happiness) (Cacioppo et al., 1986; Dimberg, 1990; Moody et al., 2007; Tassinary et al., 2007). An additional inactive distracter electrode was placed on the back of the left hand to detract from the face as the only focal point (this sensor was not collecting any data), and participants were advised that the sensors measured sweat-gland activity (Dimberg & Thunberg, 1998). Electrodes contained conductance electrode gel and were attached to the face using double sided adhesive discs and adhesive tape to secure them in place. Each muscle site was first cleaned using facial wipes, and then prepared with abrasive skin pads, followed by further gentle abrasion using Nu Prep skin preparation gel, and finally cleaned with an alcohol wipe (Pedder et al., 2016; Tassinary et al., 2007; Varcin, Bailey, & Henry, 2010).

4.3.3.2 Stimuli presentation software: E-Prime 2.0.

Task instructions and stimuli were presented with E-Prime 2.0 Professional (Psychology Software Tools, 2012) on a Microsoft Windows desktop computer and LCD screen. Participants' observable facial responses were recorded using a Logitech digital webcam, which was attached to the top of the computer screen, for subsequent artifact detection and removal from the EMG signal (e.g., sneezing or coughing).

4.3.3.3 Data acquisition software and hardware.

Consistent with previous research, and facial EMG guidelines, (Cacioppo et al., 1986; Dawson et al., 2007; Dimberg, 1990; Moody et al., 2007; Tassinary et al., 2007) muscle activity was continuously recorded at a sampling rate of 1,000 Hz, using an integrated MP150 amplifier system and the AcqKnowledge 4.2 software package (Biopac Systems, Inc., Goleta, CA). A 10-500 Hz band pass filter and a 50 Hz notch interference filter were applied (Pedder et al., 2016; Perry, Henry, Nangle, & Grisham, 2012). Trial onset and offset digital event markers were sent from E-Prime to AcqKnowledge EMG recording software. The raw EMG electrical signal was transformed using the root means square (RMS) method (Tassinary et al., 2007). Post data acquisition, the raw EMG signal was screened for electrical noise and movement artifacts. Baseline muscle activity was established before stimulus presentation (500 ms prior) for Studies 1 and 2 (Chapters 5 and 6, respectively). In addition, for Study 1, percentage change in EMG activity from the baseline period and over the first 1000 ms was analysed in 100 ms epochs (P. E. Bailey et al., 2009; Dimberg et al., 2002; McIntosh, Reichmann-Decker, Winkielman, & Wilbarger, 2006; Varcin et al., 2010).

For Study 2, percentage change in EMG activity from baseline and over the first 5000 ms, was analysed in 500 ms epochs to comprise a single average percentage change from baseline score (Pedder et al., 2016).

4.3.3.4 Rapid facial mimicry (Study 1).

The stimuli for Study 1 consisted of 8 neutral, 8 happy, and 8 angry black and white, male and female (50:50) facial expressions, expressed by different actors (Ekman & Friesen, 1976) (see Figure 4.1).

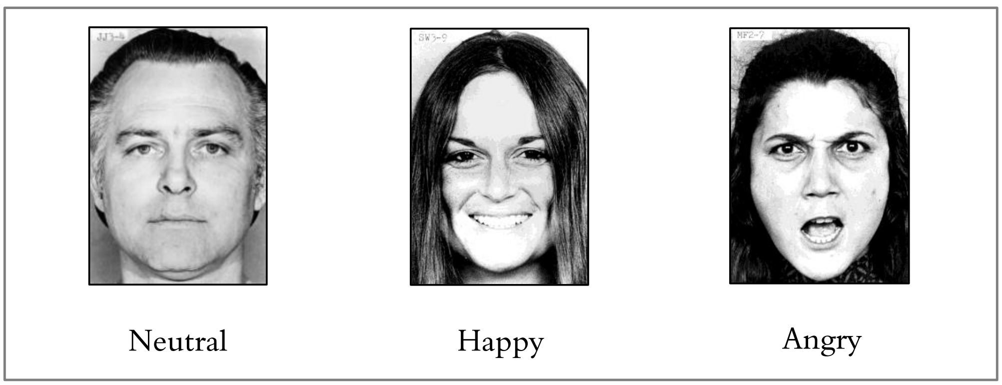

Figure 4.1. Sample facial emotional expressions used in the rapid facial mimicry task.

4.3.3.5 Emotion regulation stimuli (Study 2).

For Study 2, positively and negatively valenced images were selected from the International Affective Picture System (IAPS) (P. Lang, Bradley, & Cuthbert, 2005). In order to select images appropriate for the sample recruited for the present research (young people aged 15-25), image selection was based on a combination of affective norms for adult participants, undergraduate college students, and older children (P. Lang et al., 2005). Valance ratings for the IAPS images range from 1-9 (middle point is 5), with 9 indicating the most positive valence. Based on previous studies using the IAPS, images were divided into those with positive (> 5) and those with negative valence (< 5) (e.g., Dan-Glauser & Gross, 2011). Images depicting erotic scenes, sexual violence, and extreme violence were excluded.

Because the same emotion regulation paradigm was completed twice (first in a standard laboratory context, then in the context of social rejection) two sets of images (sets A and B) were compiled from the International Affective Picture System (IAPS) (P. Lang et al., 2005). Each set consisted of 6 neutral, 18 positive, and 18 negative images (See Figure 4.2 for sample neutral, positive and negative images). The same 6 neutral images[15] were used for both sets A and B as these were only used for practice trials, which were not included in the analyses. The 18 positive images in each set were divided into three subsets of 6 positive images (Set A: P1, P2, P3; Set B: P4, P5, P6)[16], which were matched for valence, $F(5, 30) = 1.38$, $p = .261$, $\eta_p^2 = .19$, and arousal, $F(5, 30) = 2.14$, $p = .087$, $\eta_p^2 = .26$. The 18 negative images in each set were also divided into three groups of 6 negative images (Set A: N1, N2, N3; Set B: N4, N5, N6)[17], which were also matched for valence, $F(5, 30) = .08$, $p = .996$, $\eta_p^2 = .01$, and arousal, $F(5, 30) = .47$, $p = .793$, $\eta_p^2 = .07$.

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[15] Selected IAPS neutral images were: 7150, 7000, 7034, 7002, 7179, 7041

[16] Selected IAPS positive images were: P1: 4542, 1340, 8461, 2224, 8496, 5910; P2: 5480, 4626, 5621, 8380, 8420, 7330; P3: 8499, 7270, 8200, 2209, 7502, 2058; P4: 2222, 2387, 2650, 8210, 8370, 2299; P5: 8497, 4610, 8185, 2216, 7200, 2550; P6: 2332, 2071, 2311, 8470, 2540, 2388.

[17] Selected IAPS negative images were: N1: 3100, 9621, 9421, 2120, 2700, 1051; N2: 2900, 9920, 3101, 6940, 1274, 1113; N3: 2205, 8230, 9042, 6213, 5961, 1301; N4: 3230, 2703, 5971, 8231, 1205, 3216; N5: 6370, 9622, 9424, 2490, 2100, 2095; N6: 9050, 9900, 8485, 3220, 1275, 1050.

Figure 4.2. Sample IAPS images used in the emotion regulation task.

Sets were counterbalanced, such that, in an alternating fashion, half of the participants received Set A for the standard laboratory context, and set B for the social rejection context, and the other half received Set B for the standard laboratory context and Set A for the social rejection context. The presentation of positive versus negative images was also counterbalanced, and the order of presentation of images within each subset was randomised. As much as the diversity of available images allowed, subsets were also matched for semantic content (e.g., age of persons, the nature of depicted activity).

4.3.3.6 Chatroom task (Study 2).

A modified version of the Chatroom Task (Guyer et al., 2014) was used to simulate a situation that would induce feelings of social rejection in participants. The task was obtained from, and modified in consultation with, the author (Associate Professor Amanda Guyer, Department of Human Ecology, Center for Mind & Brain University of California, Davis) and her research team (Guyer & Caouette, personal communication, June to December 2014). The Chatroom task was specifically developed to simulate online adolescent social interactions and has been shown to successfully induce social rejection in young people (Guyer et al., 2008; Guyer, McClure-Tone, Shiffrin, Pine, & Nelson, 2009; Lau et al., 2012). The task is not designed to cause extreme distress but instead aims to simulate a common, everyday situation; that of participation in an online chatroom environment. Stimuli include 60 photographs of unknown male and female peers (obtained from the authors of the task) that are presented to participants to choose from (see procedures Section 4.2.2.5).

4.4 Procedure

4.4.1 Recruitment, informed consent, and diagnostic assessment.

4.4.1.1 BPD participants.

Before being invited to take part, participants were given a verbal overview of what participation would entail, interest was gauged, and if they were interested in taking part, they were briefly screened for eligibility. All BPD participants were recruited from the HYPE clinic at OYH, and 88 per cent of participants had also participated in other research at the clinic. This allowed for data sharing (e.g., diagnostic assessments) thus reducing participant burden.

Potential BPD participants who met the initial phone screen and wished to proceed were thoroughly informed about the study verbally and in writing. Informed consent was sought directly from participants who were 18 years of age and over (Appendix C-1), or from the parent or legal guardian for participants who were under 18 years of age (Appendix C-2). All participants were offered a $50 reimbursement for their participation. Following consent, all BPD participants were administered the same demographic (Appendix D) and diagnostic measures (described in Sections 4.3.1.2 and 4.3.1.3) by research staff Orygen, The National Centre of Excellence in Youth Mental Health (Orygen) or postgraduate psychology students who were trained in the administration of the measures by senior research staff at Orygen. In order to facilitate participation, BPD participants were offered the option of completing these measures at home or at Orygen. Because of the multiple challenges faced by individuals with BPD, they were also offered to be transported to and from Orygen in order to reduce participant burden and to increase participation rates. See Figure 4.3 for flow diagram showing BPD participant numbers at different stages of recruitment.

4.4.1.2 Healthy control participants.

All healthy control participants were recruited via advertising in local venues/places and relevant media that young people in the target age-group, and local demographic area, used and frequented. Advertisements were placed on the Orygen website (www.orygen.org.au), Facebook (www.facebook.com; targeted by postcode/local government area to correspond with OYH service demographics), and Gumtree (www.gumtree.com.au). In addition, leaflets were physically handed out at train stations and bus stops, and around local universities.

Standard informed consent procedures were followed as for the BPD participants, and the phone screening and clinical interview (see Section 4.3 for details) were conducted to determine eligibility. Fifty-one per cent (n = 29) of healthy control participants had participated in an existing HYPE clinic research study and were approached because they had indicated that they would like to be contacted for further research. The other 49 per cent (n = 27) of healthy control participants were recruited via direct advertising, using the same recruitment methodology described above. Data sharing with other projects, where possible, enabled reduced participant burden and maximal use of resources. See Figure 4.4 for flowchart showing healthy control participant numbers at different stages of recruitment.

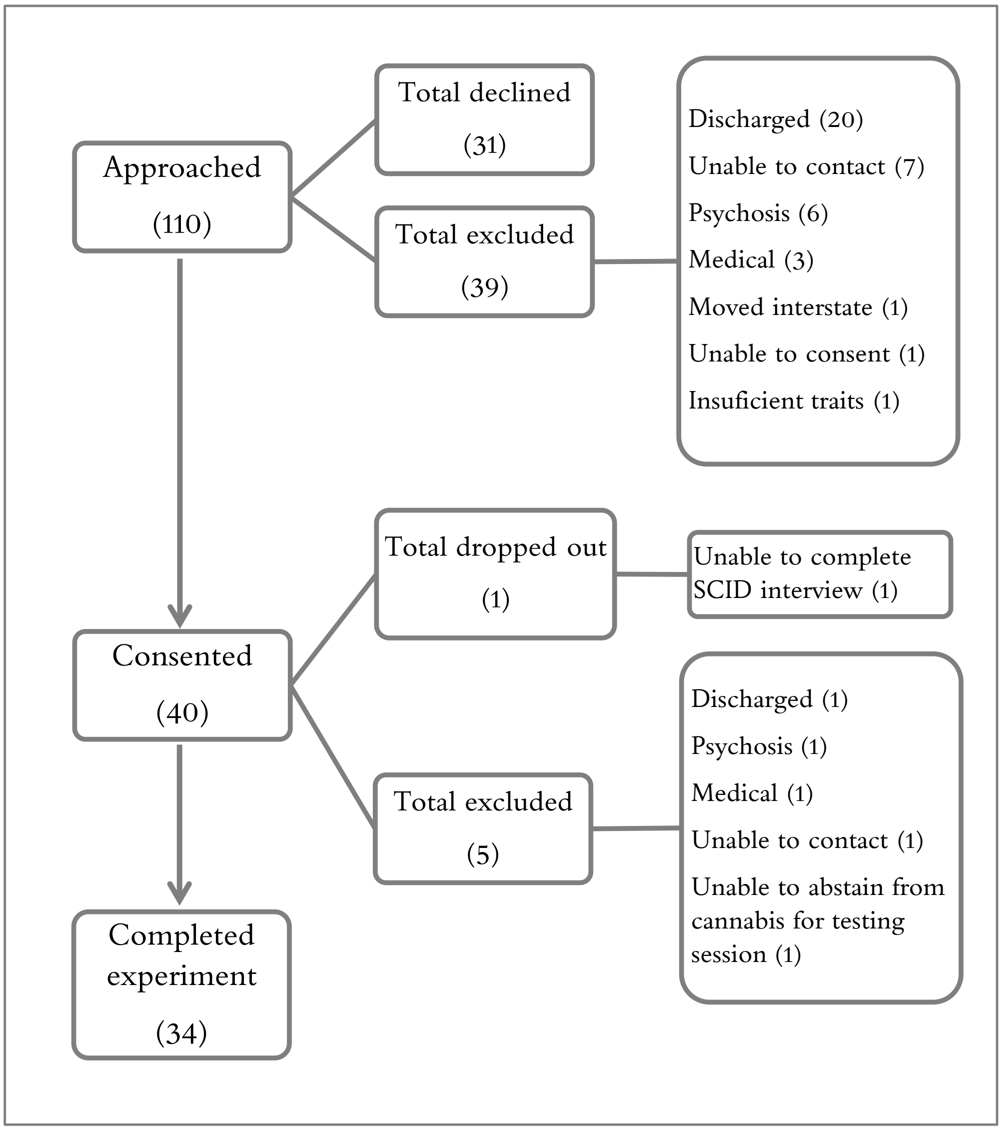

Figure 4.3. Flowchart of BPD participant involvement at various stages of recruitment.

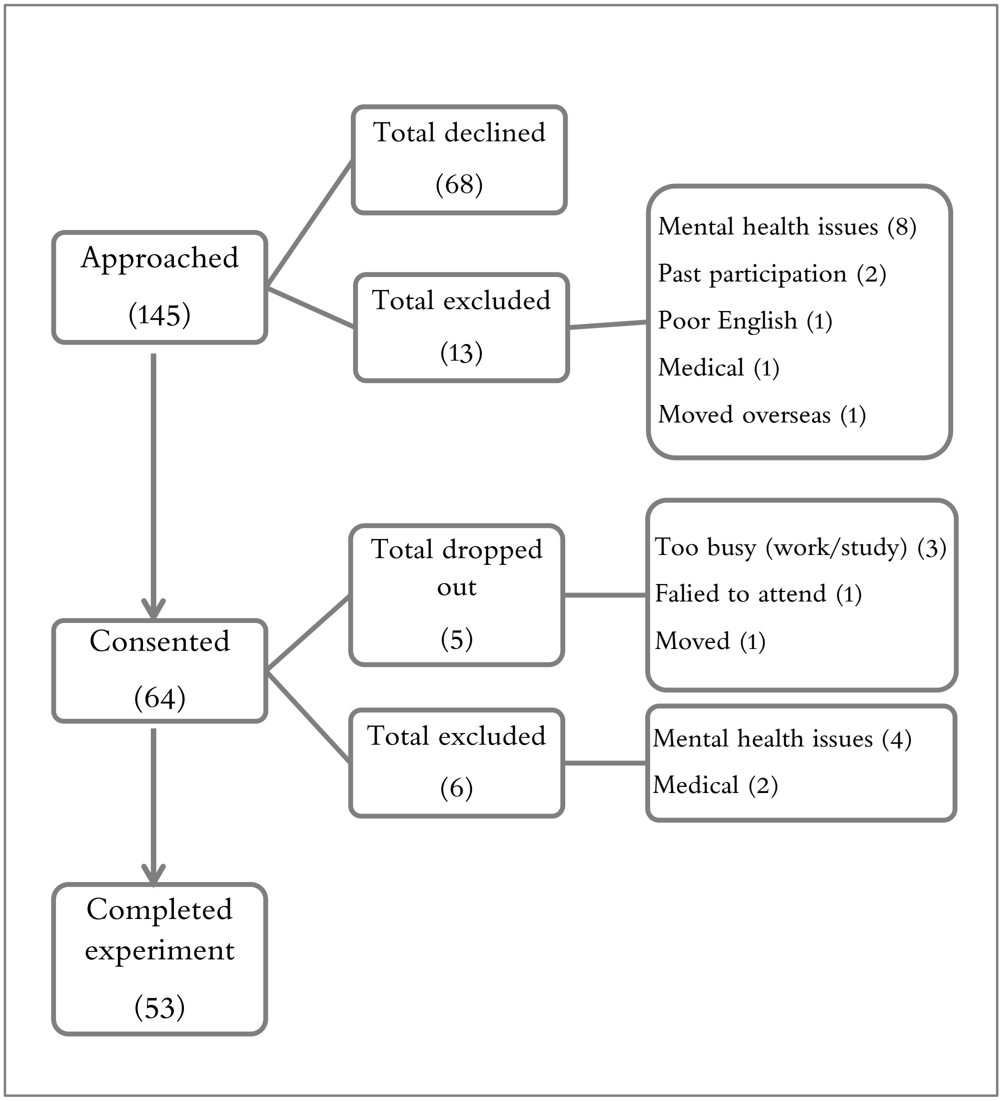

Figure 4.4. Flowchart of healthy control participant involvement at various stages of recruitment.

4.4.2 The testing appointment.

4.4.2.1 Overview.

Once eligibility was determined, consent forms signed, and demographic and diagnostic measures administered, a testing appointment was booked. The experimental tasks were undertaken at Australian Catholic University (Fitzroy, Melbourne). Participants were tested in a purpose-designed and built research lab. Participants took part in the three experimental tasks, across two studies, during a 90-120-minute session, with a short 5-10-minute break. Once completed, participants were debriefed regarding the experiments.

In order to facilitate participation, BPD participants were offered to be driven (by the researcher or by taxi) to and from research appointments. Nevertheless, BPD participants struggled to attend their scheduled appointment, which was often cancelled and rescheduled. It generally took more than one, and often up to three attempts over a 1- to 3-month period, for BPD participants to successfully attend and complete their testing appointment. Barriers were mainly associated with their clinical presentation, and included, but were not limited to, impulsivity (last minute decisions to do something else such as work or go out the previous night) poor organisation (double booking appointments), drug use the night prior, or morning of, the appointment, hospitalisation (e.g., for suicidality or self-harm), poor motivation, fatigue, and insomnia.

4.4.2.2 Orientation to tasks and preparation.

Upon arrival, participants received a brief orientation to the location of the room where testing would take place, and to the overall format of the testing session (i.e., nature of tasks, estimated duration of each task, debriefing at the end). Consent was reviewed and confirmed, and participants were reminded of the voluntary nature of research and the opportunity to withdraw at any time. A profile photograph was then taken in preparation for the Chatroom Task, to be used later during the testing session to induce social rejection (Guyer et al., 2014) (full details of the task and its administration are provided in Sections 4.3.3.6, and 4.4.2.5). Following the photograph, surface facial areas were prepared, and EMG electrodes were attached (see Section 4.3.2.2 for details). In order to avoid alerting participants to the true function of the EMG, participants were told that the EMG sensors measured sweat gland activity (Dimberg & Thunberg, 1998). While the sensors set, the WASI subtests were administered, and just prior to beginning Study 1, participants completed the HADS and baseline PANAS questionnaires. The experimental tasks were then administered in the following order: rapid facial mimicry (Study 1), emotion regulation under standard conditions (Study 2), and finally emotion regulation following social rejection induction (Study 2).

4.4.2.3 Study 1: Rapid facial mimicry task administration procedure.

The current study replicated the *passive viewing paradigm* used by Varcin et al. (2010) and P. E. Bailey et al. (2009). Participants sat on a standard office chair approximately 40 cm from the computer monitor. They were told that they would be watching a series of images on the computer monitor and that they should try to maintain a relaxed position and avoid touching their face throughout the tasks. Participants were presented with three blocks of facial emotional expressions; one block of neutral, one block of happy, and one block of angry facial expressions.

Participants were first presented with the neutral block. This was followed by the happy and angry blocks, which were presented in a counterbalanced order. There were 8 separate trials of facial emotional expressions in each block, which were presented in a randomised order. Each trial commenced with a 50 ms soft orienting tone and on-screen cross, followed by a black screen (1000 ms), then the target facial expression (5000 ms), and finally by another inter-trial black screen (6000 ms) (see Figure 4.5 for schematic depiction of stimuli presentation for the rapid facial mimicry task). The faces within each block were presented in a randomised order.

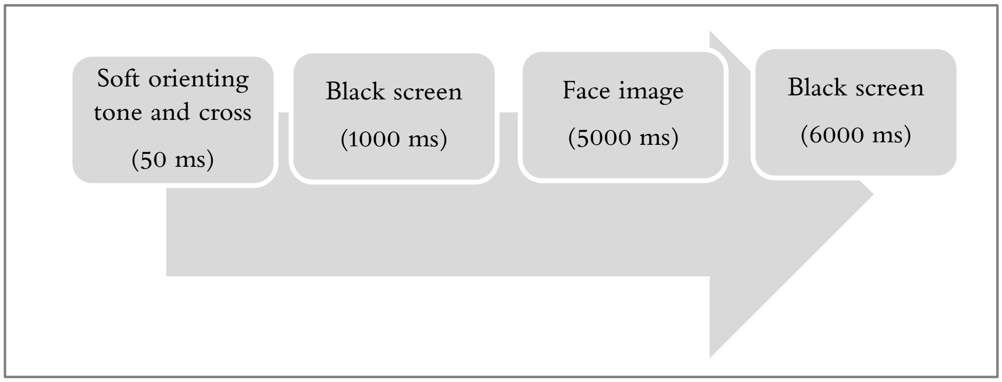

Figure 4.5. Order and length of stimuli presentation for each rapid facial mimicry trial.

4.4.2.4 Study 2: Emotion Regulation task administration procedure.

The emotion regulation task (Study 2) followed immediately after the rapid facial mimicry task. Sensors were first checked and adjusted/reattached if necessary. The task was then explained verbally, and full instructions were provided on the computer screen as the task progressed. Participants first completed a baseline PANAS. The procedure for the emotion regulation task was based on the emotion regulation paradigms described by several authors (Emery & Hess, 2011; McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008; Pedder et al., 2016). Participants received extensive training in the application of each emotion regulation strategy, which included a practice phase. All participants demonstrated competency and showed that they understood how to implement the emotion regulation strategies prior to task administration. There were three instruction conditions: watch, expressive suppression, and cognitive reappraisal. For the watch condition, participants were instructed to watch the images as they naturally would. For the expressive suppression condition, participants were instructed to do their best not to show any emotional expression. For the cognitive reappraisal condition, participants were instructed to tell themselves that that the images were not real and rather just scenes from a movie. All participants completed all conditions.

Each of the three conditions (watch, expressive suppression, cognitive reappraisal) consisted of 14 trials presented in three blocks: one block of two practice trials of neutral images which were always presented first, then a block of 6 positive image trials as well as a block of 6 negative image trials, which were counterbalanced (see Figure 4.6 for schematic representation of the order of conditions and stimulus presentation). See Section 4.3.3.5 for details of stimuli, counterbalancing and randomisation of images. They also completed a PANAS following the neutral practice block. Before each block of two practice neutral image trials, participants received extended instructions outlining how they were to approach the viewing of the images; that is, to always watch the screen, follow the instructions and keep their body still. Before each block of 6 images, participants were provided with a brief reminder of the instructions they were to follow. After each block, participants completed a PANAS.

The watch condition was always presented first because it served as the comparison, no emotion regulation instruction, condition. In effect, this condition allowed participants to react as they normally would to the valenced images. The order of presentation of emotion regulation conditions (expressive suppression, cognitive reappraisal) was counterbalanced. Instructions were presented on the computer monitor and participants proceeded once they were ready by pressing the space-bar. Each individual trial began with the presentation of a black screen (4.5 s), followed by a fixation cross and an orienting acoustic tone (0.5 s), which was followed by the stimulus (5 s).

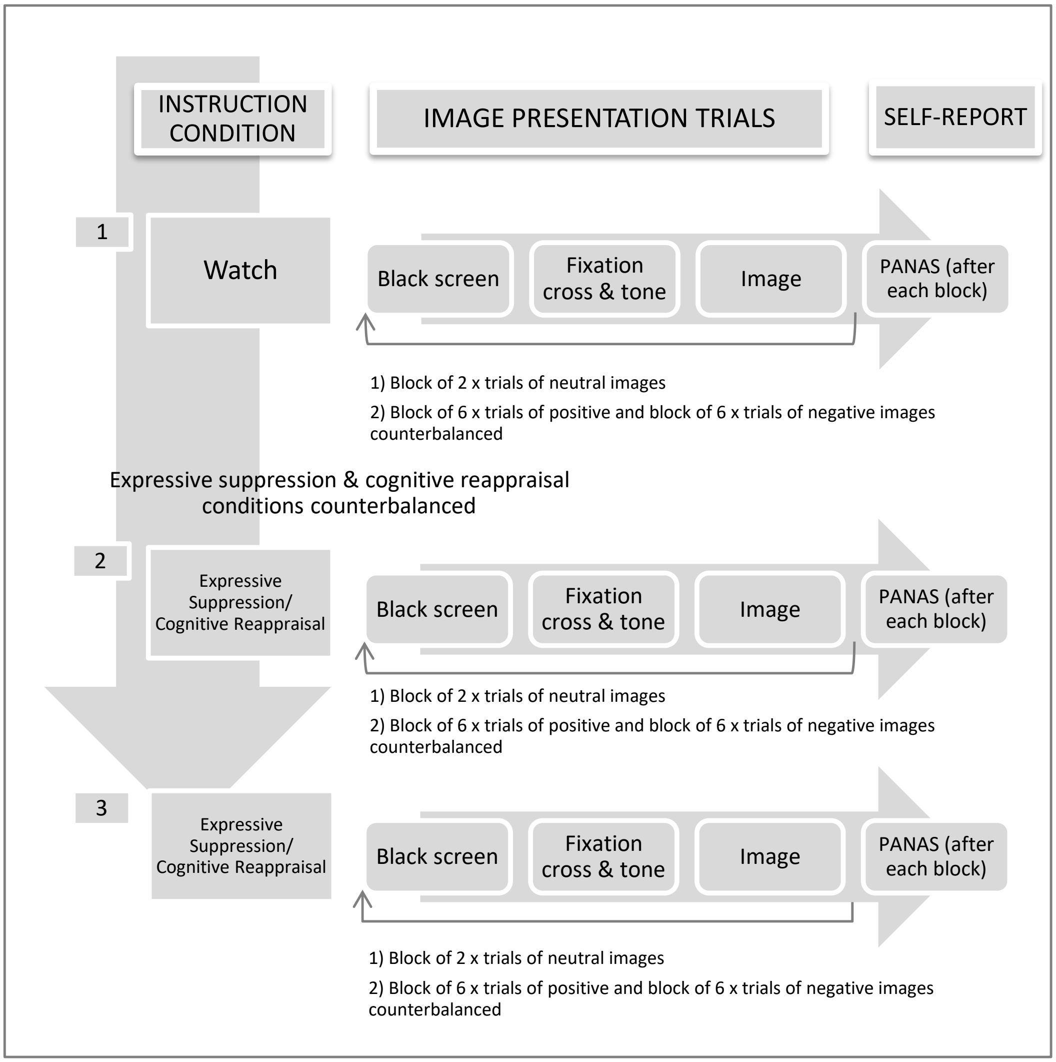

Figure 4.6. Schematic representation of the emotion regulation task instruction conditions and trial administration order.

4.4.2.5 Study 2: Chatroom task administration procedure.

Following the first administration of the emotion regulation task for Study 2, the second part of Study 2 commenced with the administration of the Chatroom Task.

This task induced social rejection. Preparation for the Chatroom Task commenced at the very beginning of the testing session when a profile photograph of participants was taken. At that time, they were advised that the photograph would be used later during the experimental session. At the completion of the first emotion regulation task (under standard laboratory conditions), the Chatroom Task was presented with participants advised that they would be taking part in a nationwide investigation of Internet based chart-room communication among young people. They were told that in order to be matched-up with a peer for the live online chat, they would need to indicate which peers they would be interested in chatting with online. This selection was done on the computer. The photographs of 60 alleged peers were presented on the top half of the computer monitor, and participants were required to select 30 peers they were interested in chatting with, and 30 they were not interested in chatting with (see Figure 4.7, part 1.a.). Selections were made by clicking the left mouse button to indicate ‘interested’, or the right mouse button for ‘not interested’. The peers participants were interested in chatting with appeared on the left bottom section of the monitor, and those they were not interested in chatting with appeared on the right bottom section of the monitor. This was not a timed task, and participants could change their minds as many times as they liked (Figure 4.7, part 1.b.).

Once all 60 alleged peers were allocated as either ‘interested’ or ‘not interested’ by participants, participants were advised that while they were doing the earlier tasks over the previous hour (i.e., the rapid facial mimicry task and the emotion regulation task), their profile picture that had been taken at the beginning of the session had been uploaded, and the same peers that they had just rated had also rated them. They were advised that the peers had indicated whether they were interested in chatting with the participant online or not. Participants were told that this was done so that pairs of people that had a mutual interest in chatting with each other could be matched.

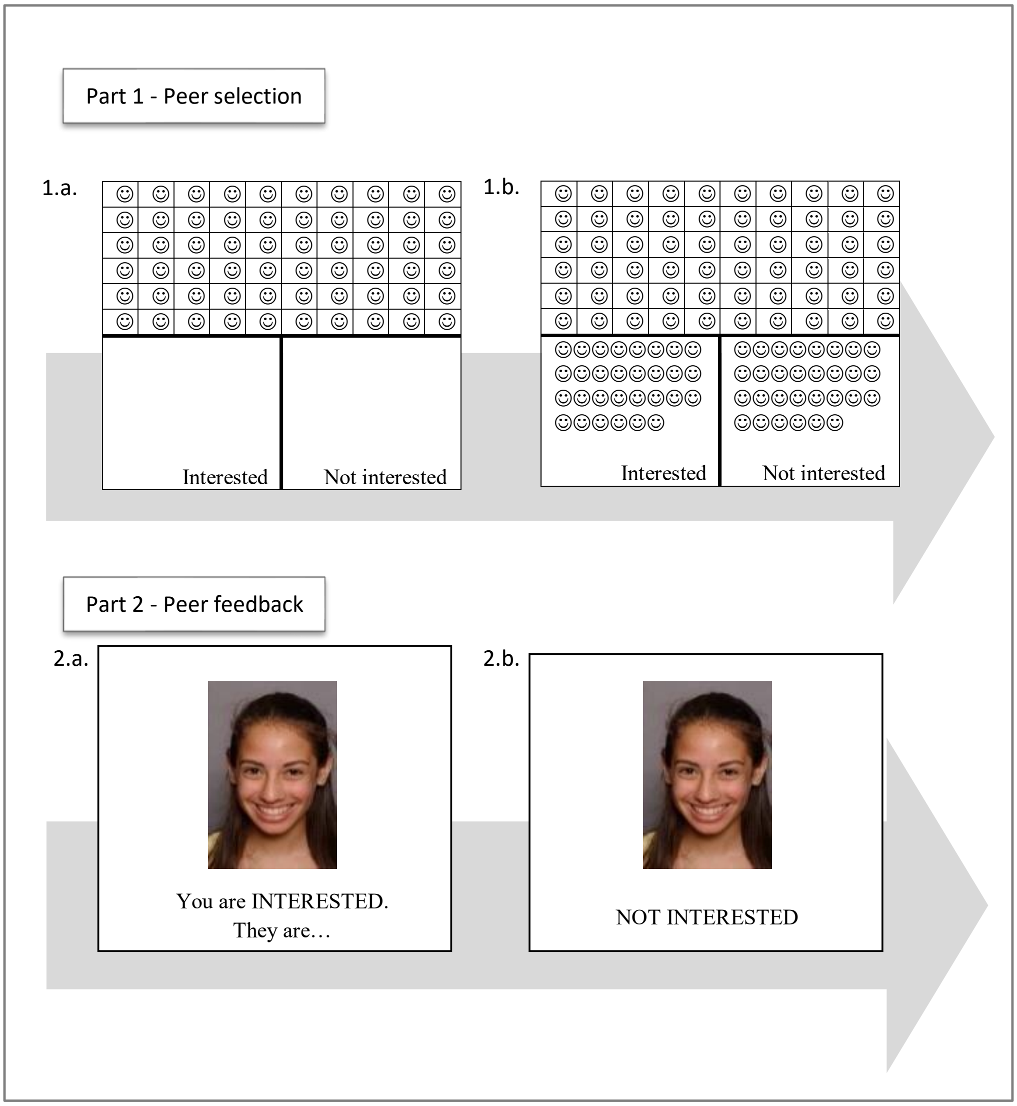

Figure 4.7. Schematic representation of the Chatroom Task.

Participants were then shown the same 60 photographs, one-at-a-time, on the computer screen (see Figure 4.7, part 2). Each photograph was accompanied by two consecutive statements. The first statement reminded the participant of their selection (that is, whether they had been interested in chatting with the alleged peer or not; Figure 4.7, part 2.a.), and the second statement advised them of the peers' choice (that is, whether the alleged peer was interested, or not interested, in chatting with them; Figure 4.7, part 2.b.). The feedback was based on participants' actual selections. Of the 30 peers participants indicated they were interested in chatting with, half (15) provided rejecting feedback and the other half (15) provided accepting feedback. Likewise, of the 30 peers participants indicated they were not interested in chatting with, half (15) provided rejecting feedback and the other half (15) provided accepting feedback.

As soon as the Chatroom task was completed, participants were advised that the experimenter would need a few minutes to set-up the live online chat based on their selections and those of their peers, and that while that was being done, they would complete a similar task to the one they had completed earlier (the emotion regulation task). Participants then completed the same emotion regulation task, with different images as described earlier (Section 4.3.3.5).

4.4.3 Participant debriefing.

Participant debriefing occurred immediately following the final task (emotion regulation following social rejection). Participants were debriefed about the two instances of deception in the experiment. They were first informed that the purpose of the EMG sensors was to record facial muscle activity, and not sweat-gland activity as they had been advised at the outset. They were told at this point that EMG provided information regarding their facial expression of emotions in response to the stimuli. Participants were also informed that no actual social evaluations were carried out and that there would be no live online chat. The Chatroom task debriefing component was based on the script originally used by the authors of the Chatroom Task (Guyer & Caouette, personal communication, June to December 2014). See Appendix E for a copy of the debriefing script.

Finally, participants completed a brief anonymous questionnaire used to collect participants' reactions to being debriefed (Appendix F). Once completed, participants placed the questionnaire in a sealed envelope which was provided to a research supervisor at Orygen. Only the participant ID was recorded on the form, which would enable the participant to be re-identified should their response raise concerns of a clinical nature, in which case the risk management protocol (outlined below) would be implemented. No participants reported being distressed by the debriefing procedures or disclosure of deceptions.

4.4.4 Risk management protocol.

In order to ensure the safety of both participants and researchers, a risk management protocol was established. Supervisors were notified when a participant was booked in for testing, and at least one supervisor was available on-site during any testing of participants. In addition, nominated clinical and research staff, from OYH and Orygen respectively, were also on call, and available for consultation, should there be a clinical emergency. All BPD participants were OYH patients at the time of testing, and the full resources of OYH were available to them as necessary. A further layer of protection was afforded by the requirement that student researchers testing participants were either registered or provisionally registered psychologists, with clinical experience, and had received suicide risk-assessment training (as part of their clinical training or on-site at Orygen) and risk management training focused on managing incidents and occupational health and safety issues (e.g., such as those that might arise when interviewing participants at home; training was provided on site at

Orygen). Orygen staff were consulted via telephone on two occasions regarding suicidal ideation of BPD participants. Assessment led to both instances being designated as low-risk, and therefore no further action was required.

4.5 Sample Size and Power

Due to the novelty of the present research there were no prior studies using the same experimental paradigms specifically with a BPD sample to base sample size and expected power calculations on. Nevertheless, previous research using similar experimental paradigms with both BPD and other clinical populations (Beblo et al., 2013; Jovev et al., 2012; Renneberg et al., 2012; Varcin et al., 2010) indicated that it was reasonable to expect a medium effect size. A priori sample size calculation using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that with a sample size of 30, and an alpha level of 0.05, there was sufficient power (over .80) to detect a medium effect size.

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Chapter 5: Empirical Study 1 – Affective Empathy in Youth with First Presentation Borderline Personality Disorder: Unconscious Motor Mimicry

5.1 Preamble

This chapter reports the first of two empirical studies that aimed to investigate whether young people with BPD show impairments in processes that are important for effective interpersonal functioning. Specifically, the study reported in this chapter investigated unconscious simulation processes, which, as noted in the review in Chapter 2, have not been previously explored in the BPD population. This study is the first to explore such a process by measuring the rapid facial mimicry response in young people with first presentation BPD.

5.2 Introduction

Impairments in social cognition are considered key contributors to the severe and chronic interpersonal dysfunction experienced by individuals with BPD (Jeung & Herpertz, 2014). One important component of social cognition is empathy, which is associated with social functioning across the lifespan in both healthy and clinical populations (P. E. Bailey, Henry, & Von Hippel, 2008; Eisenberg et al., 1996; Henry, Bailey, & Rendell, 2008). It has been suggested that abnormal empathic responses might, at least in part, contribute to the social difficulties that characterise BPD (Dinsdale & Crespi, 2013; Frank & Hoffman, 1986; Herpertz et al., 2014; Jeung & Herpertz, 2014). Empathy is a complex and multifaceted construct comprising cognitive and affective components (Singer, 2006). Cognitive empathy involves inferring others' mental states, including thoughts, beliefs and emotions (Blair, 2005; Frith & Frith, 2003; Perner, 1991), while affective empathy generally refers to the sharing of another person's emotional state (Singer, 2006; Zaki & Ochsner, 2012). These components can function independently, but also interact (see Nummenmaa et al., 2008; Ochsner, 2013; Shamay-Tsoory et al., 2009; Zaki & Ochsner, 2012). For example, heightened affective empathy has been shown to disrupt cognitive mentalising capacity in highly emotional situations (Kanske, Böckler, Trautwein, Parianen Lesemann, & Singer, 2016).

It has been argued that there might be a paradoxical presentation of empathy for individuals with BPD, whereby deficits in cognitive empathy coexist with intact or abnormally heightened affective empathy (Dinsdale & Crespi, 2013; Herpertz et al., 2014). Studies exploring empathy in BPD have predominantly focused on cognitive empathy, with most reporting that adult patients with BPD experience deficits[18] (Andreou et al., 2015; Baez et al., 2014; Dziobek et al., 2011; Harari et al., 2010; Petersen et al., 2016; Preiβler et al., 2010; Ritter et al., 2011; Vaskinn et al., 2015). By contrast, the few studies to explore affective empathy in BPD have reported inconsistent findings, in part due to the lack of explicit differentiation between three key components of affective empathy: *unconscious simulation processes, emotional contagion,* and *empathic concern* (Blair, 2005; Eisenberg & Miller, 1987; Gonzalez-Liencres et al., 2013; Singer & Lamm, 2009; Zhou et al., 2003) (see Section 2.7 in Chapter 2 of this thesis for a broader discussion of the different aspects of affective empathy).

When the different components of affective empathy are considered separately, findings predominantly suggest that adult (Dziobek et al., 2011; New et al., 2012; Petersen et al., 2016) and adolescent BPD patients (Kalpakci et al., 2016) typically

[18] While outside the scope of this chapter, it is noted that cognitive empathy itself is not a unitary construct. Individuals with BPD appear to have impairments regarding complex and emotional aspects of cognitive empathy, but not less complex aspects (Ghiassi et al., 2010; Petersen et al., 2016). These nuanced findings are discussed in Chapter 2.

demonstrate heightened emotional contagion (i.e., the tendency to ‘catch’ other people’s emotions/affective states) compared with healthy controls. Whereas empathic concern (i.e., compassion for the other, which requires awareness that the caught emotion belongs to the ‘other’ and not oneself) is reduced relative to healthy controls, at least in adult BPD patients (Baez et al., 2014; Dziobek et al., 2011; Petersen et al., 2016; Ritter et al., 2011), although it has not been studied in youth BPD patients.

Automatic motor mimicry, an unconscious simulation process, is considered to be the most primitive component of affective empathy (Adolphs, 2002; Blair, 2005; Decety & Meyer, 2008; Oberman & Ramachandran, 2007; Preston & de Waal, 2002; Singer & Lamm, 2009). It has been argued that the ability to unconsciously mimic observed emotional facial expressions in others (rapid facial mimicry) facilitates appropriate empathic responses in the observer (Adolphs, 2002; Decety & Meyer, 2008). Facial muscles serve as a feedback system such that when the *receiver* automatically responds with a congruently matched facial expression to that of the *sender*, they receive feedback from their own facial reactions, thus inducing a similar emotion (Adelmann & Zajonc, 1989; Dimberg, Andreasson, & Thunberg, 2011; Hatfield et al., 1993). By rapidly and automatically mimicking and synchronising one’s facial expressions with the other, the embodied sharing of another’s state facilitates empathy (Blair, 2005).

This rapid facial mimicry response is too subtle to be detected by the naked eye and is therefore typically assessed using facial electromyography (EMG). In neurotypical volunteers, facial EMG studies have consistently shown that merely observing others’ facial emotional expressions is sufficient to elicit congruent facial emotional expressions in the observer within milliseconds (Dimberg & Thunberg, 1998; Dimberg et al., 2000). For example, viewing angry facial expressions consistently evokes activity in the corrugator supercilii muscle region (i.e., the brow), and similarly, viewing happy facial expressions evokes activity in the zygomaticus major muscle region (i.e., cheek). This robust rapid facial mimicry response occurs within one second of stimulus presentation in typically developing children and adults, even when individuals are instructed not to react, and when facial expressions are presented subliminally (P. E. Bailey et al., 2009; Beall et al., 2008; Dimberg et al., 2000; Dimberg et al., 2002; Moody et al., 2007). By contrast, this response has been found to be impaired in disorders with marked interpersonal impairments, including autism and schizophrenia (Mathersul, McDonald, & Rushby, 2013; McIntosh et al., 2006; Varcin et al., 2010).

Rather than impaired unconscious simulation, recent theoretical accounts of social dysfunction in BPD implicate intensely heightened automatic mimicry of others' facial expressions (Herpertz & Bertsch, 2014; Herpertz et al., 2014; In-Albon, Bürli, Ruf, & Schmid, 2013). Heightened motor mimicry is thought to partly account for heightened emotional contagion and personal distress in individuals with BPD, which in turn is thought to result in the use of maladaptive self-regulatory strategies. Whether this unconscious motor mimetic response functions normally in BPD has not been directly tested. However, in support of this view, the key neural system purported to underlie motor mimetic responses, the mirror neuron system (MNS) (Preston & de Waal, 2002), appears to function abnormally in people with BPD. More specifically, compared to neurotypical controls, patients with BPD show a general pattern of hyperactivation in the insula (Zhao, Luo, Li, & Kendrick, 2012), reduced, and less consistent, resting state activity in the right precuneus, as well as altered functional connectivity with other brain regions (Lei et al., 2017), and reduced volume in the inferior frontal gyrus (Richter et al., 2014).

In the only study to date to use EMG to examine facial reactions to facial expressions in this population (Matzke et al., 2014), an extended 10-second time-frame was used. This more extended time-frame means that participants' facial responses were susceptible to influences from conscious cognitive processes. Thus, although this study showed that individuals with BPD exhibit a comparable zygomaticus major (smiling) response when viewing happy faces, but a heightened corrugator supercilii response (frowning) to angry, sad and disgusted facial expressions, it remains unknown whether people with BPD show any abnormalities in facial motor mimicry responses at the unconscious level (i.e., *rapid* facial mimetic responding). Thus, despite theory implicating heightened unconscious simulation in the heightened emotional contagion and emotion regulation difficulties observed in BPD, it is currently not known whether rapid facial mimicry is intact or heightened in BPD.

The current study assessed the rapid facial mimicry response in youth with first presentation BPD. Understanding affective empathy in young people with BPD, particularly those in the early stages of disorder, provides potentially clearer insights into whether and how affective empathy might be affected by the presence of BPD specifically, as opposed to whether difficulties might be the consequence of the many non-specific factors linked to the chronic experience of BPD (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes et al., 2015; Skodol et al., 2002; Zanarini et al., 1998b). Importantly, if, as theorised, heightened unconscious mimetic processes in BPD result in heightened emotional contagion and impaired emotion regulation, the potential implications for long-term interpersonal dysfunction are significant. Therefore, it will be important to identify whether heightened unconscious motor mimicry is present early in the disorder's trajectory. An intact rapid facial mimicry response is present from infancy through to adulthood in neurotypical populations (e.g., Beall et al., 2008; Dimberg et al., 2011; Dimberg et al., 2000), thus a heightened response in youth with first presentation BPD, relative to healthy young people, could indicate that this most primitive form of empathy is affected early on. The only study to have assessed any aspect of affective empathy in young people with BPD found that emotion contagion was heightened for in-patient adolescents with the disorder (Kalpakci et al., 2016). Thus, it could be expected that the rapid facial mimicry response will also be heightened in youth with first presentation BPD.

5.2.1 Aims and hypotheses.

The current study is the first to assess rapid facial mimicry in BPD with the aim of understanding unconscious simulation processes involved in affective empathy early in the disorder's course. As noted earlier, theoretical accounts predict that the capacity to rapidly mimic others' facial emotional expressions is intact but might be more intense in individuals with BPD (Dinsdale & Crespi, 2013; Herpertz et al., 2014). Moreover, empirical evidence points to neural abnormalities in brain areas linked to the MNS (Lei et al., 2017; Richter et al., 2014; Zhao et al., 2012), and also shows emotional contagion, particularly for negative stimuli and distress, is heightened in adults and adolescents with BPD (Dziobek et al., 2011; Kalpakci et al., 2016; New et al., 2012; Petersen et al., 2016).

It was therefore hypothesised that individuals with BPD would show intact, but exaggerated facial mimetic responding to negative facial stimuli (angry faces). In terms of operationalising this response, rapid facial mimicry to anger is evident when angry faces elicit a greater corrugator supercilii response than happy faces (Dimberg & Thunberg, 1998; Dimberg et al., 2000; Varcin et al., 2010). An intact facial mimicry response to positive facial stimuli (happy faces) was also anticipated, but less clear was whether a negative bias would be seen here too. Because an intact rapid facial mimicry response to happiness is evident when happy faces elicit a greater zygomaticus major response than angry faces (P. E. Bailey et al., 2009; Datyner et al., 2017; Dimberg et al., 2000; Dimberg et al., 2002), any reduction in this mimicry response would manifest in terms of weaker zygomaticus responding.

5.3 Method

A detailed methodology is provided in Chapter 4 of this thesis. A summary is provided here in order to enable flow and facilitate comprehension.

5.3.1 Participants.

Seventy-nine participants were included in the study, 47 healthy controls (HC) and 32 BPD participants. Of the 87 participants recruited to take part in the testing session (see Figures 4.3 and 4.4, in Chapter 4 of this thesis, for recruitment flowcharts), 6 healthy control, and 2 BPD participants were excluded due to a combination of excessive movement artefacts (e.g., fidgeting, yawning, jaw grinding) or electrical signal noise that affected the quality of the EMG signal. Participants were males and females ranging in age from 15-25 years, and were matched for sex, age, and IQ (as indexed by the Wechsler Abbreviated Scale of Intelligence, Full-Scale-2 Subtests IQ; WASI (Wechsler, 1999)).

All BPD participants were recruited from the HYPE Clinic, at OYH, a specialised treatment program for youth with first presentation BPD servicing the western metropolitan Melbourne region. BPD participants met three or more DSM-IV BPD criteria as assessed by the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II) (First et al., 1997). BPD participants who met criteria for psychosis, bipolar I disorder, or a psychiatric condition due to a medical condition, as assessed by the Structured Clinical Interview for DSM-IV Axis I Disorders (Patient Edition; SCID-I/P) (First et al., 2002), were excluded.

Healthy control participants were recruited from the same geographical area as BPD participants, via posters displayed in local venues (e.g., libraries and community centres), handing out of pamphlets at train stations, and online advertising (e.g., Facebook). Potential healthy control participants were excluded if they met any BPD or APD criteria (assessed by the SCID-II Personality Questionnaire, SCID-II PQ), or met criteria for any current or past mood or anxiety disorder, manic episodes, psychosis, eating disorder, somatic disorder, or post-traumatic stress disorder (assessed by the Research Version, Non-Patient Edition, of the SCID I, SCID I/NP).

Both healthy control and BPD participants were excluded if they met any of the following criteria: severe disturbance, such that the person would be unable to comply with either the requirements of informed consent or the experimental protocol; visual impairment (i.e., uncorrected vision or colour blindness); intellectual disability; a history of epilepsy, meningitis, encephalitis or brain infection; a history of loss of consciousness for more than 10 minutes or brain injury; or drug/alcohol intoxication at the time of testing. Participants were included only if they were sufficiently fluent in English to participate fully in the protocol. All participants received a $50 reimbursement for their participation.

Groups were well matched on sex, X^2 (1, N = 79) = 1.10, p = .295, with 75 per cent of the BPD group and 64 per cent of the healthy control group being female. The groups were also well matched on age and IQ (see Table 5.1 for demographic details). However, as is typical in this cohort, BPD participants reported greater levels of anxiety and depression symptoms (HADS) over the previous week compared with the healthy control group (Table 5.1). Of the thirty-two BPD participants, the majority (62.5%) met five or more BPD criteria, and 37.5% met 3-4 criteria. There was also a high rate of comorbidity with Axis-I disorders and Axis-II personality disorders (see Table 5.2).

Table 5.1.

Study 1 Participant Characteristics

Variable	Healthy Controls (n = 47)		BPD (n = 32)			
	M	*SD*	*M*	*SD*	*t*	*Cohen's d*
Age	20.09	2.77	19.66	3.23	0.63	0.14
IQ	107.46	12.08	106.68	13.30	0.25	0.06
Anxiety[a]	3.38	2.80	12.10	4.15	10.82***	2.46
Depression[a]	1.22	1.75	9.16	3.92	11.09***	2.74

[a]Hospital Anxiety and Depression Scale subscale scores for anxiety and depression.

*** $p < .001$

Table 5.2.

Study 1 Comorbid Mental Disorders Present in the BPD Group

Mental Disorders	Number & percentage of BPD participants meeting criteria for 1, 2, and 3 comorbid disorders					
	1		2		3	
	n	%	*n*	%	*n*	%
Axis I Disorders[a]						
Mood disorder	16	50	8	25	1	3
Anxiety disorder	6	19	4	13	3	9
Eating disorder	1	3	2	6	1	3
PTSD	-	-	1	3	2	6
Total	**23**	**72**	**15**	**47**	**7**	**21**
Axis II Personality Disorders						
Depressive	5	16	-	-	n/a	n/a
Paranoid	3	9	3	9	n/a	n/a
Avoidant	3	9	-	-	n/a	n/a
Obsessive compulsive	2	6	1	3	n/a	n/a
Passive aggressive	2	6	1	3	n/a	n/a
Antisocial	1	3	1	3	n/a	n/a
Histrionic	-	-	1	3	n/a	n/a
NOS	1	3	-	-	n/a	n/a
Total	**17**	**52**	**7**	**21**	**n/a**	**n/a**

Note. PTSD = post-traumatic stress disorder; NOS = not otherwise specified DSM-IV category; n/a = not applicable.

[a]Axial descriptors are used here because DSM-IV-TR diagnoses were used in the current study.

5.3.2 Experimental measures, equipment and procedures.

At the beginning of each testing session, participants were administered the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) to assess depression and anxiety symptoms during the week prior to testing. The EMG component of the study used the passive viewing paradigm procedures described in Varcin et al. (2010) and P. E. Bailey et al. (2009). Participants sat in front of a Microsoft Windows desktop computer and LCD screen and were instructed to be still throughout task administration. Stimuli were presented in three separate blocks of 8 neutral, 8 happy and 8 angry black and white, male and female (50:50 ratio), facial expressions, expressed by different actors (Ekman & Friesen, 1976).

Each trial unfolded in the following order: 50 ms soft orienting tone and black cross on the screen, 1000 ms black screen, 5000 ms presentation of facial emotional expression, 6000 ms black screen. The neutral block was always presented first as a practice and was followed by the happy and angry blocks, which were presented in a counterbalanced order. Faces within each block were presented in a random order. Participants were continuously recorded using a Logitech digital webcam, placed above the screen, for subsequent artefact detection and data cleaning. To avoid alerting participants to the true nature of the task and purpose of the EMG, they were advised that the ‘sensors’ measured sweat gland activity (Dimberg & Thunberg, 1998).

Consistent with previous research, surface EMG was used to continually measure subtle facial muscle activity in the corrugator supercilii (above the brow, sensitive to anger) (Cacioppo et al., 1986; Moody et al., 2007), and zygomaticus major regions (cheek, sensitive to happiness) on the left side of the face (Dimberg, 1990; Tassinary et al., 2007). Each site was cleaned with facial wipes, gently abraded with abrasive skin pads and Nu Prep skin preparation gel and cleaned with an alcohol wipe. Four 4 mm Ag/AgCl, shielded, fixed wire, non-invasive surface electrodes were placed in pairs, approximately 1.25 cm apart, over the left zygomaticus and corrugator muscle regions in accordance with guidelines (Fridlund & Cacioppo, 1986; Tassinary et al., 2007). A fifth, ground, electrode was placed on the forehead. An additional inactive distracter electrode was placed on the back of the left hand to detract from the face as the only focal point (this sensor was not collecting any data). Electrodes contained conductance electrode gel, and were adhered to the face using double sided adhesive discs and adhesive tape (Varcin et al., 2010).

Facial muscle activity was continuously recorded at a sampling rate of 1,000 Hz, using an integrated MP150 amplifier system and the AcqKnowledge 4.2 software package (Biopac Systems, Inc., Goleta, CA), with a 10-500 Hz band pass filter and a 50 Hz notch interference filter (Pedder et al., 2016). Trial onset and offset digital event markers were sent from E-Prime to AcqKnowledge EMG recording software. Post data acquisition, the raw EMG signal was screened for electrical noise and movement artefacts. The raw EMG electrical signal was transformed using the root means square (RMS) method (Tassinary et al., 2007). Baseline activity for each trial consisted of the average RMS EMG activity 500 ms prior to each stimulus presentation. The average RMS EMG activity for each 100 ms epoch was calculated for the first 1000 ms post stimulus onset (Dimberg et al., 2002; McIntosh et al., 2006). Percentage change from baseline for each 100 ms epoch, averaged across each trial, was calculated.

5.3.3 Statistical analyses.

Chi-square tests were used to compare groups on sex, and t-tests were used to compare groups on age, IQ, depression and anxiety symptoms (as assessed by the HADS), as well as for preliminary analyses comparing groups on baseline levels of EMG activity. Where Levene's test for equality of variances was significant, results are reported for equal variances not assumed. In addition, depression and anxiety symptoms were correlated separately with EMG activity using Pearson's *r*.

To examine whether appropriate rapid facial mimicry responses were demonstrated by each group, a 2 (group: HC, BPD) x 2 (emotion: happy, angry) x 10 (epoch: 0-100 ms, 100-200 ms, 200-300 ms, 300-400 ms, 400-500 ms, 500-600 ms, 600-700 ms, 700-800 ms, 800-900 ms, 900-1000 ms) repeated measures mixed design analysis of variance was carried out separately for each muscle region (zygomaticus, corrugator). Outliers were brought in, as per procedures outlined in Tabachnick and Fidell (2014). Greenhouse-Geisser corrected values are reported when assumptions of sphericity were violated.

5.4 Results

5.4.1 Preliminary analyses: EMG baseline activity.

Group differences in baseline activity (500 ms period just prior to stimulus presentation) were analysed separately for each muscle to examine whether group differences were present. There were no group differences in zygomaticus muscle activity at baseline for either the happy ($t(69) = 0.37$, $p = .717$, $d = 0.09$) or angry ($t(69) = 0.15$, $p = .717$, $d = 0.04$) facial expression conditions. Similarly, no group differences were found in corrugator muscle activity at baseline for either happy ($t(69) = 1.05$, $p = .296$, $d = 0.24$) or angry ($t(69) = 1.14$, $p = .258$, $d = 0.26$) facial expression conditions.

5.4.2 Analysis of the pattern of facial responding.

The next step in analyses was to establish whether the BPD and control groups demonstrated an appropriate mimicry response, and whether there were any group differences in the magnitude of these responses. That is, whether zygomaticus activity was greater in response to happy relative to angry facial expressions, and whether corrugator activity was greater in response to the viewing of angry relative to happy faces. Only interactions involving group, but not time, were followed-up.

Focusing first on rapid facial mimetic responses to happy facial stimuli, assessment of zygomaticus muscle activity revealed that there was no main effect of group $F(1, 69) = 0.62$, $p = .433$, $\eta_p^2 = .01$, or any interaction of emotion by group $F(1.00, 69) = 1.94$, $p = .168$, $\eta_p^2 = .03$, time by group $F(2.10, 69) = 0.49$, $p = .621$, $\eta_p^2 = .01$, or a three-way interaction of emotion by time by group $F(3.09, 69) = 0.91$, $p = .440$, $\eta_p^2 = .01$. However, there was a main effect of emotion $F(1.00, 69) = 16.47$, $p < .001$, $\eta_p^2 = .19$, and for time $F(2.10, 69) = 10.80$, $p < .001$, $\eta_p^2 = .14$, and there was an interaction of emotion by time $F(2.10, 69) = 5.31$, $p = .001$, $\eta_p^2 = .07$. As shown in Figure 5.1, this pattern of results indicates that overall, all participants demonstrated greater zygomaticus activity when viewing happy faces relative to angry faces.

Focusing next on rapid facial mimetic responses to angry facial stimuli, assessment of corrugator muscle activity revealed that there was again no main effect of group $F(1, 75) = 0.77$, $p = .383$, $\eta_p^2 = .01$, or any interaction of emotion by group $F(1.00, 75) = 0.24$, $p = .627$, $\eta_p^2 < .01$, time by group $F(2.42, 75) = 1.17$, $p = .317$, $\eta_p^2 = .02$, or a three-way interaction of emotion by time by group $F(3.23, 75) = 1.17$, $p = .323$, $\eta_p^2 = .02$. However, there was a main effect of emotion, $F(1.00, 75) = 21.51$, $p < .001$, $\eta_p^2 = .22$, and for time $F(2.42, 75) = 7.40$, $p < .001$, $\eta_p^2 = .09$, and an interaction of emotion by time $F(3.24, 75) = 8.62$, $p < .001$, $\eta_p^2 = .10$. This pattern of results again indicates that overall, all participants had greater corrugator activity when viewing angry faces relative to happy faces.

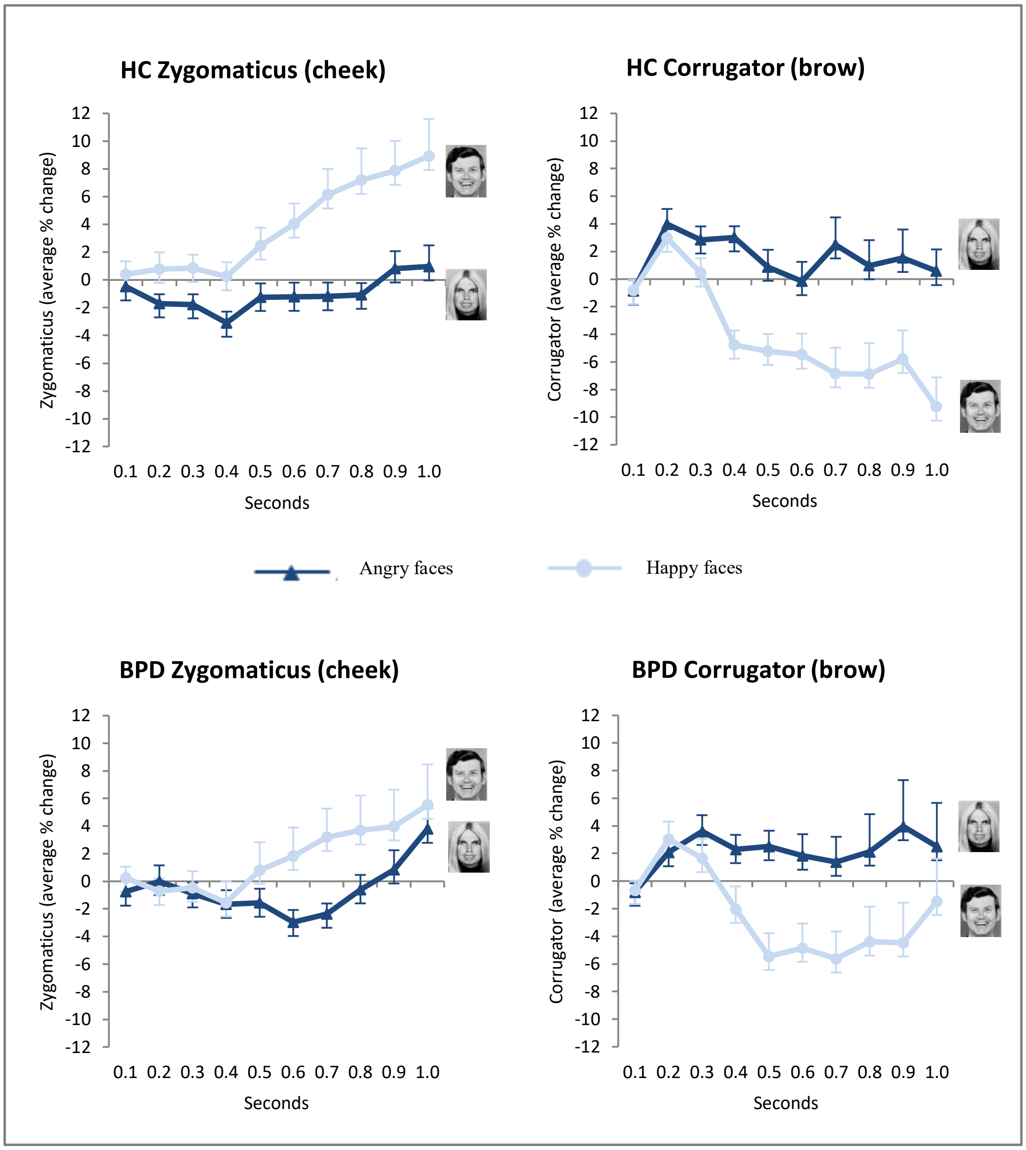

Figure 5.1. Mean zygomaticus and corrugator EMG response, to angry and happy stimuli, as percentage change from baseline (plus standard error) for healthy control and BPD participants.

Note. 0.1 = 0-100 ms, 0.2 = 100-200 ms, 0.3 = 200-300 ms, 0.4 = 300-400 ms, 0.5 = 400-500 ms, 0.6 = 500-600 ms, 0.7 = 600-700 ms, 0.8 = 700-800 ms, 0.9 = 800-900 ms, 1.0 = 900-1000 ms.

5.4.3 Correlates of facial responding.

Levels of current positive and negative affect (PANAS, positive and negative affect subscales), as well as depression and anxiety symptoms over the past week (HADS) were each correlated with zygomaticus muscle activity in response to happy faces and corrugator muscle activity in response to angry faces separately for each group. None of the correlations was significant, indicating that neither positive or negative affect, nor depression or anxiety symptoms, were associated with level of facial muscle responding in either group (all *p*-values greater than 0.05).

5.5 Discussion

5.5.1 Summary and implications of findings.

These data provide the first empirical assessment of a core aspect of affective empathic responding that has not previously been assessed in BPD to date: unconscious simulation processes. By using EMG to assess rapid facial mimetic responding, the results show that these processes appear to be preserved in BPD, with the pattern and strength of this mimetic response comparable to that seen in healthy controls. Specifically, as predicted, both the healthy control and BPD groups demonstrated intact rapid facial mimicry responses to angry and happy facial expressions as reflected in their greater corrugator supercilii response to angry relative to happy facial expressions, and their stronger zygomaticus major response to happy relative to angry facial expressions. However, while it was predicted that the pattern of responding would not vary between groups (i.e., that both groups would exhibit intact rapid facial mimicry), the failure to identify group differences in the absolute magnitude of facial muscle activity was unexpected. Thus, contrary to the negative bias hypothesis (Matzke et al., 2014), the corrugator response to anger was not heightened in the BPD group relative to the healthy control group, and the zygomaticus response to happy faces was also comparable to the healthy control group.

These findings have important theoretical implications. This is because they directly contradict theoretical models of social dysfunction in BPD that propose that heightened unconscious motor simulation in BPD might heighten emotional contagion, which in turn might impair emotion regulation capacity (Herpertz & Bertsch, 2014; Herpertz et al., 2014; In-Albon et al., 2013). Instead, the current findings suggest that at least some automatic emotion processes might be unaffected in BPD, and are consistent with previous behavioural research that has also provided evidence for preserved unconscious emotion processing (Baer et al., 2012; Donges, Dukalski, Kersting, & Suslow, 2015). For example, an unconscious attentional bias to emotive stimuli does not appear to be present in BPD, although conscious attention to emotive stimuli is heightened in adults with the disorder and manifests as a difficulty in disengaging from negative stimuli (Baer et al., 2012) (see Section 2.3, Chapter 2 for discussion).

The current findings, coupled with these other empirical studies, therefore point to the need for future research to explore alternative explanations for what appears to be heightened emotional contagion in both adults and adolescents with BPD (Dziobek et al., 2011; Kalpakci et al., 2016; New et al., 2012; Petersen et al., 2016). One possibility is that affective empathy abnormalities in BPD are actually only present at the level of conscious processing (i.e., emotional contagion and empathic concern), but not unconscious processing (e.g., rapid facial mimicry). It might also be the case that conscious processes underlie the heightened contagion seen in individuals with BPD. For example, impairments in aspects of cognitive empathy (Andreou et al., 2015; Baez et al., 2014; Dziobek et al., 2011; Harari et al., 2010; Petersen et al., 2016; Preiβler et al., 2010; Ritter et al., 2011; Vaskinn et al., 2015) (see Section 2.7.1 for discussion) might be involved in the process of 'catching' another's emotion. As discussed previously, cognitive and affective empathy are not mutually exclusive and act in concert (de Waal & Preston, 2017; Decety & Jackson, 2004; Ochsner, 2013; Telle & Pfister, 2016; Zaki & Ochsner, 2012). Indeed, recent research indicates that the conscious process of perspective taking, where one imagines oneself in the place of a suffering other, is associated with increased emotional contagion, increased emotional distress, and leads to a physiological state of threat in non-clinical populations (Buffone et al., 2017). Indeed, relative to youth with MDD, youth with early stage BPD have less sophisticated perspective taking capacity (Jennings et al., 2012).

As detailed earlier, in addition to providing the first empirical assessment of unconscious simulation processes in BPD, a further key strength of this study was the focus on clinical youth patients with first presentation BPD as this provides clearer insights into how affective empathy is affected by the presence of BPD specifically, as opposed to the many potentially confounding influences linked to chronicity. These data are therefore also important in showing that relatively early in the trajectory of the disorder, rapid facial mimetic responding does not differ in young people with BPD relative to their typically developing peers. It is of course possible that abnormalities in unconscious simulation processes arise later in the disorder's trajectory, as appears to be the case for other aspects of social cognition (e.g., including facial emotion recognition; see Sections 2.4 and 2.6, in Chapter 2 of this thesis for further discussion). Environmental risk factors, such as iatrogenic harm and stressful life events (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008;

Newton-Howes et al., 2015; Pagano et al., 2004; Wingenfeld et al., 2011), could all contribute to the development of such abnormalities later in the course of the disorder. Also, sociocognitive ability continues to develop during adolescence and early adulthood (Ahmed et al., 2015; Blakemore & Mills, 2014; Brizio et al., 2015; Klapwijk et al., 2013). Consequently, the current findings do not rule out the possibility that abnormalities in the unconscious processing of facial emotional expressions might be present in adults with BPD, or in young people presenting with later stage (e.g., persistent and unremitting) BPD. Further work is now needed to gain a clearer and more nuanced understanding of how unconscious simulation processes are affected at later stages of the disorder, and if these abnormalities do present later in life, the mechanisms that might contribute to their development and progression.

5.5.2 Limitations.

While the methodological approach used in the present study to index rapid facial mimicry is robust and well validated (P. E. Bailey et al., 2009; Beall et al., 2008; Dimberg et al., 2000; Dimberg et al., 2002; Varcin et al., 2010), it might be argued that even responses within the first 1000 ms following stimulus exposure could be affected by one's present emotional state (Likowski et al., 2011; Moody et al., 2007). Importantly, any potential influence of mood seems to be very unlikely in the present study. This is because, although the BPD group reported greater levels of negative affect, depression and anxiety as well as lower levels of positive affect relative to controls, these variables do not appear to have influenced the activation of either the corrugator or zygomaticus muscles. That is, there were no differences between groups in baseline levels of corrugator or zygomaticus activity, no differences in the rapid facial mimicry response, and no correlations with muscle activation. Nevertheless, future research might consider implementing alternative paradigms in conjunction with EMG, such as mood induction or backward masking (e.g., Likowski et al., 2011; Mathersul et al., 2013), to further explore any potential impact of affective state on rapid facial mimicry in BPD.

It should be noted that broader limitations that apply equally to both empirical studies presented in this thesis are discussed in the overall thesis discussion (Chapter 7).

5.5.3 Conclusions.

These data provide the first empirical evidence that rapid facial mimicry is preserved in youth with early stage BPD, with both the pattern and magnitude of facial mimetic responding comparable to that seen in non-clinical demographically matched controls. Thus, although it has been argued that abnormalities in unconscious simulation processes might underlie what appears to be heightened emotional contagion in people with BPD, these data point to the need for future research to explore alternative explanations for this phenomenon. Further work is needed, however, to explore whether the current findings are robust across different developmental epochs and stages of disorder for individuals with BPD, and in particular, older (adult) cohorts and young people with later stage BPD.

Chapter 6: Empirical Study 2 - Emotion Regulation in Youth with First Presentation Borderline Personality Disorder

6.1 Preamble and General Overview

Study 1 concluded that the rapid facial mimicry response is intact in youth with first presentation BPD. It is therefore unlikely that heightened unconscious mimicry underpins emotional contagion or emotion regulation difficulties associated with chronic interpersonal dysfunction in BPD. Deficits in the application of emotion regulation strategies have also been implicated to underlie social deficits in BPD. Therefore, the current study explored whether, compared with healthy youth, youth with first presentation BPD demonstrate difficulty applying two specific emotion regulation strategies (cognitive reappraisal and expressive suppression) to regulate their emotional responses to emotionally valenced stimuli, in a standard laboratory context compared with the context of social rejection.

6.2 Introduction

6.2.1 Emotion regulation ability in individuals with BPD.

The capacity to effectively regulate our emotional responses is a critical ability linked to social functioning (Eisenberg et al., 2000; Gross, 2014; Gross & John, 2003; Halberstadt et al., 2001; John & Gross, 2004). Referred to as emotion regulation, this capacity involves the perception, identification and evaluation of our own emotions, recognition of the need to modify our emotional reactions, and the ability to dynamically select and implement the most appropriate emotion regulation strategies to accomplish individually relevant goals (Eisenberg et al., 2000; Gratz & Roemer, 2004; Gross, 2014; Gross et al., 2006; Koole, 2009; Sheppes et al., 2015; R. A.

Thompson, 1994). Optimal emotion regulation involves the selection and application of the most contextually appropriate emotion regulation strategies to different emotions (Aldao & Tull, 2015; Eisenberg et al., 2000; Rivers, Brackett, Katulak, & Salovey, 2007).

In typically developing populations, poor emotion regulation ability is linked to reduced social functioning and poor socioemotional wellbeing, as reflected in, for example, poor social relationships and greater peer rejection (Trentacosta & Shaw, 2009), and increased anger intensity and aggressive behaviour (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002). Consistent with these findings, theories of BPD have proposed that difficulties in emotion regulation might partly account for the negative behavioural, emotional, and interpersonal difficulties observed in individuals with BPD (Carpenter & Trull, 2013; Crowell et al., 2009; Linehan, 1993). Difficulties in applying emotion regulation strategies are thought to contribute to a negative feedback loop, whereby individuals with BPD struggle to adaptively regulate their emotional reactions and labile negative affect (Carpenter & Trull, 2013). This difficulty, in turn, is thought to result in negative behavioural, emotional, and interpersonal consequences that further reinforce sensitivity to negative emotional cues (Carpenter & Trull, 2013; Crowell et al., 2009; Linehan, 1993). A clear understanding of emotion regulation capacity in this group is therefore essential to improve understanding of processes that might underpin key features of the presentation of the disorder.

However, surprisingly little research has been conducted directly testing the ability of individuals with BPD, particularly young people with the disorder, to apply emotion regulation strategies (e.g., Beblo et al., 2013; S. Lang et al., 2012; C. Sauer et al., 2016) (see Chapter 3 for a review of this literature). Therefore, it is currently unclear whether difficulties applying emotion regulation strategies might underlie the characteristic negative emotional, behavioural, and interpersonal difficulties in youth with BPD.

The current study aimed to address this gap by investigating the capacity of youth with first presentation BPD to regulate their emotions using cognitive reappraisal and expressive suppression. These are two key emotion regulation strategies described in Gross' *process model* of emotion regulation (1998b, 2014; Gross & Thompson, 2007). This model has informed most of the, albeit limited, emotion regulation research undertaken with BPD thus far, and is one of the most influential frameworks in the emotion regulation literature more broadly (Riediger & Klipker, 2014; Sloan et al., 2017; Webb et al., 2012). Of the various emotion regulation strategies described in the model, cognitive reappraisal and suppression strategies have received the most empirical attention in neurotypical adolescent and adult populations (Ahmed et al., 2015), and are the focus of the current research. See Chapter 3 for a review of the process model, and research exploring other emotion regulation strategies in BPD.

Cognitive reappraisal is an antecedent focused strategy that is optimally applied early in the emotion generation process. It refers to the evaluation of a potentially emotionally evocative stimulus in a manner that alters its emotional impact, thus changing the course of an anticipated emotional experience (Gross & Thompson, 2007; John & Gross, 2004). For example, one might choose to construe someone cutting in at the front of a queue as inconsequential rather than as a personal slight. The second strategy, *suppression*, is a response focused strategy that is applied later in the emotion generation process and can involve the individual directly focusing on inhibiting the subjective emotional experience, associated thoughts, and/or explicit emotional expressions (hereon referred to as experiential, thought, or expressive suppression, respectively). While BPD research has explored all three of these aspects of suppression, they have most often been combined, making it difficult to assess the relative effectiveness of these strategies individually. The current study therefore focused on only one suppression strategy, namely *expressive suppression,* which has not been previously investigated on its own in individuals with BPD. *Expressive suppression* involves the regulation of emotion expressive behaviour, such as facial expressions, allowing the individual to elect not to express an emotion on their face if, for example, it is deemed inappropriate or counterproductive to do so at that time (for instance, smiling during a funeral) (Gross et al., 2006; Gross & Thompson, 2007; John & Gross, 2004).

The capacity to successfully apply both cognitive reappraisal and expressive suppression strategies is desirable. While in the past, emotion regulation research has tended to categorise different emotion regulation strategies as adaptive or maladaptive, recent advances in emotion regulation theory and experimental research highlight the adaptive value of flexible access to a range of strategies at different times and in different contexts, in order to facilitate desired goals (Aldao & Nolen-Hoeksema, 2010; Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013; Gross, 2015; McRae, 2016).

6.2.2 Suppression and cognitive reappraisal in BPD.

6.2.2.1 The regulation of negative emotions.

To date, research exploring how effectively individuals with BPD apply different regulation strategies has largely focused on the regulation of negative affect. This is unsurprising given that individuals with BPD experience greater negative emotional instability and reactivity compared with their non-clinical counterparts

(American Psychiatric Association, 2013; Kuo, Neacsiu, Fitzpatrick, & MacDonald, 2013; Silvers et al., 2016). In relation to suppression, studies have shown that adult BPD patients, and adults recruited from the community with high BPD features, can regulate negative affect as well as healthy controls when applying a combination of all three types of suppression, and experiential suppression alone (Chapman et al., 2017; Dixon-Gordon et al., 2016; Ruocco, Medaglia, Ayaz, et al., 2010). In terms of cognitive reappraisal, a number of studies have shown that adult BPD patients, and adults recruited from the community with BPD features, are able to apply this strategy to regulate negative affect just as effectively as control participants (Baczkowski et al., 2016; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Marissen et al., 2010; C. Sauer et al., 2016; Schulze et al., 2011).

It appears, then, that individuals with BPD can implement both cognitive reappraisal and at least some types of suppression as effectively as their healthy peers to regulate negative affect. As previously noted however, most of the studies investigating suppression have focused on either combination approaches or suppression of thoughts or feelings, with no study to date having investigated the application of expressive suppression alone to regulate negative affect in BPD. This constitutes an important gap in our understanding of the ability of individuals with BPD to suppress the behavioural expression of emotions, especially given that greater BPD features are associated with a preference for the use of expressive suppression when individuals are given the freedom to choose the strategy they wish to use to regulate negative affect (Evans et al., 2013).

6.2.2.2 The regulation of positive emotions.

In comparison to research into the regulation of negative emotions, research focused on the regulation of positive emotions is more limited in both the broader emotion regulation literature (Eisner, Johnson, & Carver, 2009; Kashdan, Young, & Machell, 2015; Tugade & Fredrickson, 2007), as well as in the BPD literature more specifically. However, investigating positive emotion regulation ability in BPD is important for two key reasons. First, while it might be assumed that people want to experience positive emotions (e.g., happiness) all of the time, this generalised application of the hedonic principle to positive emotions is misplaced, and there are certainly occasions and contexts that require the regulation of positive emotions (Kalokerinos, Greenaway, Pedder, & Margetts, 2014; Kashdan et al., 2015; Soto, Perez, Kim, Lee, & Minnick, 2011). In fact, the ability to selectively down-regulate positive affect is associated with improved attention, judgement, and interpersonal functioning (Kashdan et al., 2015), and promotes social cohesion and harmony within interdependent relationships (Le & Impett, 2013). Therefore, for a more complete understanding of emotion regulation in individuals with BPD, both the regulation of negative and positive emotions needs to be investigated.

Second, research on positive affect in BPD has generally focused on the capacity of this clinical group to experience positive emotions, rather than on their capacity to regulate these emotions. This literature shows that that individuals with BPD report feeling reduced positive affective and cognitive states, which distinguishes them from people with other personality disorders (Reed & Zanarini, 2011). At a neural level, it has also been shown that people with BPD exhibit reduced caudate activation (a brain area associated with the experience of pleasure) while watching positive images (Koenigsberg, Siever, et al., 2009). However, as noted earlier, little is currently understood about how BPD influences the capacity to regulate positive affect, with no research to date, for example, investigating the ability of individuals with BPD to regulate positive affect using either cognitive reappraisal or suppression strategies.

6.2.3 Emotion regulation in young people with BPD.

While there is clearly a need to understand emotion regulation ability in individuals with BPD for both negative and positive emotions, another issue that needs to be addressed is the fact that the limited research to date has predominantly focused on clinical samples of adults (ranging in age from 18-65 years) diagnosed with the disorder (e.g., S. Lang et al., 2012; C. Sauer et al., 2016), or community samples of adults (usually university students) with BPD features (e.g., Chapman et al., 2009; S. E. Sauer & Baer, 2009). By contrast, there are no published studies that have assessed the ability of youth with BPD/BPD features in clinical settings, relative to healthy controls, to effectively apply emotion regulation strategies.

This focus on adults means that it is currently unclear whether emotion regulation difficulties are present in youth early in the course of the disorder. The onset of BPD typically first occurs between puberty and young adulthood (Biskin, 2015; Chanen, 2015; Chanen & McCutcheon, 2013). A focus primarily on adults, therefore, risks skewing our understanding of emotion regulation in BPD towards populations experiencing greater severity and chronicity. Greater severity and chronicity are associated with increased exposure to comorbid mental disorders (Skodol et al., 2002; Zanarini et al., 1998b), cumulative stressors associated with BPD (Pagano et al., 2004; Wingenfeld et al., 2011), and increased iatrogenic harm (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes et al., 2015). This makes it increasingly difficult to disentangle core emotion regulation difficulties that might be present early in the course of the disorder, from those that might arise later in it course, and which might be a consequence of the various factors associated with chronicity and severity of BPD.

Thus, while it is important to investigate emotion regulation capacity in adults with BPD, there is also a need to separate the impact of the numerous non-specific factors linked to chronic mental health problems from the impact of BPD specifically by investigating emotion regulation ability in first presentation BPD youth. These individuals are earlier in the trajectory of the disorder (Chanen et al., 2016) and therefore less likely to be affected by chronicity-related factors. In addition, this life stage is a sensitive period for the development and consolidation of emotion regulation capacity (Ahmed et al., 2015), and might therefore represent a unique opportunity to most effectively treat emotion regulation difficulties present early in the disorder's trajectory.

6.2.4 The role of context in emotion regulation.

Another key feature of the current study is its exploration of the influence of context on emotion regulation ability. The field of emotion regulation has begun to recognise the importance of emotion regulation flexibility, including the ability to effectively apply various emotion regulation strategies across different contexts (Aldao et al., 2010; Aldao et al., 2015; Aldao & Tull, 2015; Bonanno & Burton, 2013; Dixon-Gordon, Bernecker, & Christensen, 2015; Gross, 2015). The specific context of interest in the current study is social rejection.

Social rejection and exclusion are inherently perceived as threats to survival and reproduction by humans (Chester & Riva, 2016; K. D. Williams, 2009), thus the context of social rejection causes heightened distress (K. D. Williams et al., 2000). This includes a neural *social pain* response, characterised by increased dorsal anterior cingulate cortex and inferior insula activation (Eisenberger, 2015; Rotge et al., 2015).

Individuals high in trait rejection sensitivity, the tendency to anxiously expect and perceive rejection from others (Downey & Feldman, 1996), are more susceptible to perceiving greater rejection in social situations. When social rejection is induced experimentally, such individuals respond with a heightened neural social pain response, and reduced activation of the prefrontal regions required for effective behavioural and emotional regulation (Burklund et al., 2007; Kross, Egner, Ochsner, Hirsch, & Downey, 2007).

Understanding the impact of the context of social rejection on emotion regulation ability is particularly important for individuals with BPD because it is a particularly familiar day-to-day experience for them. For example, they experience greater negative attitudes and social rejection from health professionals, compared with individuals experiencing other mental health issues such as schizophrenia and affective disorders (Knaak, Szeto, Fitch, Modgill, & Patten, 2015; Lam, Poplavskaya, Salkovskis, Hogg, & Panting, 2016; Markham, 2003). They also elicit and experience greater rejection in their daily social interactions as a consequence of their alternating prototypic attachment styles, clinginess/proximity seeking and fearfulness of dependency (Gunderson, 2007), as well as their heightened anger and aggression within interpersonal relationships (Berenson et al., 2011; Whisman & Schonbrun, 2009). As such, the context of social rejection is arguably more reflective of their experience of social interactions and relationships in their daily lives and thus has greater ecological validity for individuals with BPD than benign social situations.

In addition, individuals with BPD are thought to be biologically predisposed to experience heightened rejection sensitivity (Gunderson, 2007; Gunderson & Lyons-Ruth, 2008). Consistent with this view, adult BPD patients, and adults recruited from the community with high BPD features, report higher levels of trait-rejection sensitivity compared with healthy adults and adults diagnosed with anxiety, mood, and avoidant personality disorders (e.g., Berenson et al., 2016; Chesin et al., 2015; Jobst et al., 2014; Renneberg et al., 2012; Staebler, Helbing, et al., 2011), although there are no published studies which have assessed trait rejection sensitivity in BPD youth (see Section 2.6 for a review of rejection sensitivity in BPD). One recent study did, however, find that in- and out-patient young adults with BPD (age range was not reported, mean age of 23.6 years) reported greater trait rejection sensitivity relative to healthy controls (R. C. Brown et al., 2017).

In relation to state rejection sensitivity, results are mixed. For example, some studies have found that following social rejection, adult BPD patients, and adults recruited from the community with high BPD features, experience higher levels of self-reported negative affect and anxiety (e.g., Beeney et al., 2014; De Panfilis et al., 2015), and are more likely to respond with aggressive behaviours (e.g., Beeney et al., 2014; Berenson et al., 2011; Renneberg et al., 2012) than their healthy counterparts. However, other studies, including the only youth BPD study conducted to date that has assessed state affect following social rejection (K. A. Lawrence et al., 2011), have found greater baseline self-reported negative affect in individuals with BPD even prior to social rejection (Renneberg et al., 2012; Staebler, Renneberg, et al., 2011), suggesting that there might have been pre-existing differences not attributable to the experience of social rejection. One other recent study found that, relative to healthy controls, a clinical sample of young adults with BPD reported greater social rejection following Cyberball (R. C. Brown et al., 2017). While the impact of the context of social rejection on state affect in individuals with BPD may be currently unclear, trait studies and theory would suggest greater rejection sensitivity is likely to be apparent in individuals with BPD. If this is indeed the case, it could thus be expected that applying emotion regulation strategies would be particularly challenging in socially rejecting contexts relative to socially benign contexts for this group.

Empirical studies addressing this issue are, however, limited. Indeed, no studies to date have investigated the impact of social rejection on the ability of individuals with BPD to effectively apply cognitive reappraisal or suppression strategies. One study did consider suppression in the context of social rejection in a non-clinical adult sample who met BPD criteria, however the focus of that study was on whether suppression was associated with greater negative feelings compared to another regulation strategy (i.e. acceptance), rather than its efficacy as a strategy for this clinical group (Dixon-Gordon et al., 2016). Contrary to what had been expected, suppression did not result in greater self-reported negative affect compared with the acceptance strategy, and it was not associated with maladaptive behaviours in the BPD group. However, heart-rate variability decreased for individuals with BPD, which the authors noted had previously been associated with negative affect and deficits in emotion regulation (Dixon-Gordon et al., 2016). This, therefore, suggests that in the context of social rejection, adults with BPD might have difficulties regulating at some aspects of negative emotional experiences but not others.

In addition, no studies thus far have assessed the ability of youth with BPD to effectively use regulation strategies, including cognitive reappraisal or suppression, to regulate positive or negative emotions in the context of social rejection. Youth with BPD might be particularly vulnerable to difficulties regulating their emotions when experiencing social rejection given that, even for healthy individuals, adolescence is a period of heightened rejection sensitivity (Marston et al., 2010), during which the success of emotion regulation strategy application is impacted by dispositional and situational factors (Silvers et al., 2012). It is therefore important to try to understand the impact of social rejection on the ability of youth with BPD to effectively apply emotion regulation strategies.

6.2.5 The current study.

As detailed, there are several important gaps in the current emotion regulation BPD literature. Specifically, there are gaps with regards to: 1) understanding of how BPD affects the regulation of positive emotions; 2) the ability of youth with BPD, and in particular those with first presentations of the disorder, to effectively apply emotion regulation strategies; and 3) the impact of the context of social rejection on the ability of individuals with BPD to apply emotion regulation strategies. The current study addressed these gaps focusing on the specific strategies of expressive suppression and cognitive reappraisal.

The aim of this study was to build on previous research into emotion regulation in BPD, which has primarily focused on adults, has only assessed the regulation of negative affect, and has paid limited attention to the effect of social rejection on emotion regulation in BPD. This study therefore extended this research by assessing the ability of youth with first presentation BPD in an outpatient setting to apply cognitive reappraisal and expressive suppression strategies to regulate both negative and positive affect, and within a standard laboratory context as well as in the context of social rejection.

6.2.5.1 Indices of emotion regulation.

Because emotions are multifaceted and consist of subjective experiences, physiological responses, as well as expressive behaviours (Gross, 2014; Koole, 2009; Mauss et al., 2005; Mauss & Robinson, 2009; Webb et al., 2012), emotion regulation strategies can impact any or all of these aspects of the emotional experience.

Consequently, the current study used two different measures to operationalise emotion regulation ability. The first index was self-reported affect, which provides an index of the subjective experience of emotions. This is in keeping with the majority of previous studies with BPD participants (e.g., Chapman et al., 2017; S. Lang et al., 2012).

The second index was facial muscle reactivity, measured using electromyography (EMG). It provides an objective measure of expressive behaviour as reflected in facial expressions, such as anger and happiness (Tassinary et al., 2007). Similar to previous research with clinical and non-clinical populations, EMG was used to assess positive and negative affect, and to observe its regulation as reflected in changes in facial muscle reactivity following application of regulation strategies (Pedder et al., 2016; Perry et al., 2012; Ray, McRae, Ochsner, & Gross, 2010). To date, no studies have objectively assessed the ability of individuals with BPD to apply expressive suppression (or indeed any form of suppression), nor cognitive reappraisal, to regulate the behavioural expression of emotions as indexed by changes in facial muscle reactivity. This is an important omission given that the face plays a key role in social communication, serving as a crucial social signal (Ekman & Friesen, 1971; Hugenberg & Wilson, 2013). As such, the regulation of the outward behavioural expression of emotion has important implications for successful social interactions.

6.2.5.2 Hypotheses.

The regulation of negative affect across contexts.

BPD theory (Carpenter & Trull, 2013; Crowell et al., 2009; Linehan, 1993), and studies assessing broad-based emotion regulation ability in individuals with BPD (Bayes et al., 2016; Beblo et al., 2013; Carvalho Fernando et al., 2014; Fletcher et al., 2014), suggest that relative to healthy controls, individuals with BPD experience greater difficulty regulating their emotions. However, contrary to predictions, the few studies that have specifically assessed the effectiveness with which combined suppression strategies and cognitive reappraisal are applied by individuals with BPD, indicate that adults with BPD are as able to apply cognitive reappraisal and various forms of suppression to regulate negative emotions as effectively as non-clinical controls (Baczkowski et al., 2016; Chapman et al., 2017; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Marissen et al., 2010; e.g., Ruocco, Medaglia, Ayaz, et al., 2010).

The effective application of emotion regulation strategies has not previously been assessed in youth with BPD, therefore adult BPD studies are the only available evidence regarding the application of emotion regulation strategies in BPD. Therefore, in light of the available empirical findings specific to the application of emotion regulation strategies by adults with BPD, it was hypothesised that youth with first presentation BPD and healthy control participants would also not differ in terms of their ability to apply expressive suppression and cognitive reappraisal to regulate negative affect while viewing negative images (as indexed by facial electromyography and self-reported affect) in the standard condition. This is an important hypothesis to test because it will inform our conceptualisation of, and therefore treatment approaches for, emotion regulation in youth with first presentation BPD.

In addition, BPD theory (Gunderson, 2007; Gunderson & Lyons-Ruth, 2008), and the majority of empirical findings (e.g., Beeney et al., 2014; Berenson et al., 2016; De Panfilis et al., 2015) suggest that individuals with BPD are high in trait rejection sensitivity and are particularly susceptible to the context of social rejection.

Furthermore, research with non-clinical populations shows that individuals high in trait rejection sensitivity struggle to engage the prefrontal brain regions required for effective behavioural and emotional regulation (Burklund et al., 2007; Kross et al., 2007). Based on these findings, it was anticipated that, relative to the standard laboratory context, in the context of social rejection, youth with first presentation BPD would exhibit greater difficulties regulating their emotions when applying expressive suppression and cognitive reappraisal relative to non-clinical controls.

The regulation of positive affect across contexts.

Given the absence of prior research in this area, and implications for functioning, the current study also included positive images and explored the use of cognitive reappraisal and expressive suppression to regulate positive affect in youth with BPD compared with their healthy peers, and across contexts.

6.3 Method

A detailed methodology is provided in Chapter 4 of this thesis.

6.3.1 Participants.

Participants in this study were a subset of the participants who took part in Study 1. Because the current study compared the emotion regulation ability of participants across two different contexts, only participants who had viable data across both contexts were able to be included, thus resulting in some attrition between studies. Data were excluded due to excessive movement artefacts (e.g., fidgeting, yawning, jaw grinding), electrical signal noise that affected the quality of the EMG signal, or the Chatroom Task crashing before participants were able to complete the task. As a result, data from 35 healthy controls and 29 BPD participants were eligible for inclusion in the current study.

Participants were males and females ranging in age from 15-25 years, and were matched for sex, age, and IQ (as indexed by the Wechsler Abbreviated Scale of Intelligence, Full-Scale-2 Subtests IQ; WASI (Wechsler, 1999)). The healthy control and BPD groups were well matched on sex, X^2 (1, N = 69) = 0.42, p = .517, with 79 per cent of the BPD group and 73 per cent of the healthy controls being female. The groups were also well matched on age and IQ (Table 6.1). However, BPD participants reported greater levels of anxiety and depression symptoms (indexed by the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983)) over the past week compared with healthy controls (Table 6.1). Of the twenty-nine BPD participants, the majority (66 per cent) met five or more BPD criteria, and 34 per cent met 3-4.

Table 6.1.

Study 2 Participant Characteristics

Variable	Healthy Controls (*n* = 35)		BPD (*n* = 29)			
	M	*SD*	*M*	*SD*	*t*	*Cohen's d*
Age	20.28	2.85	19.90	3.24	0.51	0.13
IQ	109.23	11.01	108.46	12.24	0.25	0.07
Anxiety[a]	3.55	2.60	11.21	5.76	6.69***	1.71
Depression[a]	0.98	2.18	8.83	3.92	9.75***	2.48

[a]Hospital Anxiety and Depression Scale subscale scores for anxiety and depression.

*** $p < .001$

Participants were recruited from the western metropolitan region of Melbourne, Australia. Specifically, the BPD group was directly recruited from the HYPE clinic at OYH, which is a state-funded mental health service for young people aged 15-25 years (Chanen et al., 2015). In accordance with HYPE clinic eligibility criteria, BPD participants met three or more BPD criteria (DSM-IV) and typically presented with various comorbid disorders, as is typical in BPD populations (see Table 6.2). BPD participants were excluded if they met DSM-IV criteria for psychosis, bipolar I disorder, or a psychiatric disorder due to a medical condition, as assessed by the Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition (SCID-I/P; First et al., 2002).

Healthy control participants were recruited from the same region of Melbourne as BPD participants. They were recruited via online advertising (e.g., Facebook) and direct solicitation (e.g., at train stations). Healthy control participants were excluded if they reported a past or current mental disorder at the point of screening, if they had any BPD or APD disorder features, as assessed by the Structured Clinical Interview for DSM-IV Axis II Personality Questionnaire (SCID-II PQ) (First et al., 1997), or met diagnostic criteria for any past or current mood or anxiety disorders, manic episodes, psychosis, eating disorder, somatic disorder, or post-traumatic stress disorder, as assessed by the Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version, Non-Patient Edition (SCID I/NP).

Table 6.2.

Study 2 Comorbid Mental Disorders Present in the BPD Group

Mental Disorders	Number & percentage of BPD participants meeting criteria for 1, 2, and 3 comorbid disorders					
	1		2		3	
	n	%	*n*	%	*n*	%
Axis I Disorders[a]						
Mood disorder	14	48	6	21	1	3
Anxiety disorder	6	21	4	14	2	7
Eating disorder	1	3	2	7	1	3
PTSD	-	-	1	3	2	7
Total	**21**	**72**	**13**	**45**	**6**	**20**
Axis II Personality Disorders						
Depressive	4	14	-	-	n/a	n/a
Paranoid	3	10	3	10	n/a	n/a
Avoidant	2	7	-	-	n/a	n/a
Obsessive compulsive	2	7	-	-	n/a	n/a
Passive aggressive	2	7	1	3	n/a	n/a
Antisocial	1	3	1	3	n/a	n/a
Histrionic	-	-	1	3	n/a	n/a
NOS	1	3	-	-	n/a	n/a
Total	**13**	**51**	**6**	**16**	n/a	n/a

Note. PTSD = post-traumatic stress disorder; NOS = not otherwise specified DSM-IV category; n/a = not applicable.

[a]Axial descriptors are used here because DSM-IV-TR diagnoses were used in the current study.

All potential participants (BPD and HC) were also excluded during an initial phone screen if they reported a severe disability, visual impairment, intellectual disability, history of epilepsy, meningitis, encephalitis or brain infection, or a history of loss of consciousness for more than 10 minutes or brain injury. In addition, they were excluded if they presented with drug or alcohol intoxication at the time of testing, or if their English was insufficiently fluent to participate fully in the protocol. Participants aged 18-25 years who met the initial phone screen and wished to proceed, completed standard informed consent procedures. For participants who were aged 15-17 years, informed consent was sought from their parent or legal guardian.

6.3.2 Experimental measures, equipment and procedures.

As part of the larger research protocol comprising this thesis, participants took part in two studies during a single 90-120-minute session. Only procedures for the second study are presented here.

6.3.2.1 Initial task.

Upon arrival at the testing session, and following a brief orientation, a profile photograph of each participant was taken in preparation for the social rejection induction task (Chatroom task) (Guyer et al., 2014), to be used later during the session (see Section 6.3.2.4).

6.3.2.2 Emotion regulation task.

Participants were then prepared for facial electromyography (EMG). In accordance with standard EMG protocol, facial muscle activity was continually recorded using 4 mm Ag/AgCl, shielded, fixed wire, non-invasive surface electrodes, which were adhered to the skin on the left side of the face (Dawson et al., 2007; Dimberg, 1990; Tassinary et al., 2007). Electrodes contained conductance electrode gel and were adhered to the face using double sided adhesive disks, and adhesive tape. In line with previous research and EMG guidelines (Pedder et al., 2016; Tassinary et al., 2007; Varcin et al., 2010), each muscle site was first cleaned using facial wipes, and then prepared with abrasive skin pads to remove non-conductive skin cells, followed by further gentle abrasion using Nu Prep skin preparation gel, and finally cleaned with an alcohol wipe. A total of five active electrodes were used: one acted as a ground (placed on the forehead); and the remaining four electrodes were placed in pairs, approximately 1.25 cm apart, on the left corrugator supercilii muscle region (above the brow, sensitive to anger), and zygomaticus major muscle region (cheek; sensitive to happiness) (Cacioppo et al., 1986; Tassinary et al., 2007). To hide the true nature and purpose of the electrodes (i.e., collecting data about facial expression of emotion), an additional inactive distracter electrode was placed on the back of the left hand to detract attention away from the face as the only focal point, and participants were told that the EMG sensors measured sweat gland activity (Dimberg & Thunberg, 1998).

The experimental tasks were then administered in the following order: rapid facial mimicry (Study 1; see Chapter 5), emotion regulation under standard conditions and finally emotion regulation following social rejection (Study 2). In each emotion regulation experiment, participants had to respond to images presented on a computer screen and to apply an emotion regulation strategy as directed by the experimenter. The procedures for emotion regulation in standard conditions and in the context of social rejection were identical and were based on paradigms described by several authors (e.g., Emery & Hess, 2011; McRae et al., 2008; Pedder et al., 2016). The only difference between them was that the second administration of the emotion regulation task was preceded by a social rejection induction task (described in section 6.3.2.4).

The emotion regulation task was first explained verbally to participants, and full instructions were provided on the computer screen as the task progressed. There were three experimental conditions: (1) ‘watch’, in which participants were instructed to watch the images as they naturally would; (2) ‘expressive suppression’, in which participants were instructed to do their best not to display their emotions; and (3) ‘cognitive reappraisal’, in which participants were instructed to tell themselves that that the images were not real but rather just scenes from a movie. All participants completed all conditions, with the watch condition always presented first, followed by expressive suppression and cognitive reappraisal which were presented in a counterbalanced order. Each condition (watch, expressive suppression, reappraisal) consisted of a block of two practice trials of neutral images, which were always presented first, followed by a block of 6 positive image trials and a block of 6 negative image trials, which were counterbalanced. Two sets of images (Set A, Set B) from the International Affective Picture System (P. Lang et al., 2005), that were matched on valence and arousal, were compiled and counterbalanced for the two administrations of the emotion regulation task (see Chapter 4, Section 4.3.3.5 for details of image selection and the composition of each set of images). Each individual trial began with the presentation of a black screen (4.5 s), followed by a fixation cross and an orienting acoustic tone (0.5 s), which was followed by the stimulus (5 s).

After each block of images, participants completed the Short Positive and Negative Affect Schedule (PANAS) (Mackinnon et al., 1999). It is comprised of a negative affect and a positive affect subscale, to provide an index of current self-reported affect. The PANAS was also completed at baseline, just prior to beginning the emotion regulation task.

6.3.2.3 Social rejection induction: Chatroom task and administration procedure.

The second administration of the emotion regulation task was preceded by the induction of social rejection. This was achieved through administration of the

Chatroom task. The Chatroom task was specifically developed to simulate online adolescent social interactions and has been shown to successfully induce social rejection in young people (Guyer et al., 2008; Guyer et al., 2009; Lau et al., 2012). For the purposes of the current research, the task was obtained from, and modified in consultation with, the author, Associate Professor Amanda Guyer (Department of Human Ecology, Center for Mind & Brain University of California, Davis) and her research team (Guyer & Caouette, personal communication, June to December 2014). The task was not intended to cause extreme distress but rather aimed to simulate a common, everyday situation; that of participation in an online chatroom environment.

At the completion of the emotion regulation task under standard laboratory conditions, participants were advised that they would be taking part in a nationwide investigation of Internet based chatroom communication among young people. In order to be matched-up with a person for what they were told would be a live online chat, participants were presented with photographs of 60 same aged peers on the computer screen and were required to indicate 30 peers that they were interested in chatting with and 30 peers that they were not interested in chatting with (see Figure 6.1, Part 1.a.). Their responses were indicated via button press (left mouse button to indicate ‘interested’, or the right mouse button for ‘not interested’). Pictures of the peers that participants were interested in chatting with appeared on the left bottom section of the monitor, and pictures of those they were not interested in chatting with appeared on the right bottom section of the monitor (Figure 6.1, Part 1.b.). This was not a timed task, and participants could change their minds as many times as they liked. It is noted that the people in the photos were not real participants.

Once participants indicated which of the 60 alleged peers they were ‘interested’ or ‘not interested’ in chatting with, participants were advised that while they had been completing tasks over the previous hour, their profile picture that had been taken at the beginning of the session had been uploaded, and the same peers that they had just rated had similarly indicated whether they wanted to chat with the participant or not. Participants were then given feedback regarding peer preferences to chat with them or not. This was done by showing the same 60 photographs of peers, one-at-a-time, on the computer screen. Each photograph was accompanied by two consecutive statements. The first statement reminded the participant of their selection (that is, whether they had been interested in chatting with the alleged peer or not), and the second statement advised them of the peer's choice (that is, whether the alleged peer was interested, or not interested, in chatting with them). The feedback was based on participants' actual selections and was equally weighted for rejecting or accepting feedback. Of the 30 peers the participants were interested in chatting with, participants were told that 15 peers provided rejecting feedback (i.e., they did not want to chat with the participant), and that the other 15 peers provided accepting feedback (i.e., they did want to chat with the participant). Of the 30 peers that participants were not interested in chatting with, participants were told that 15 provided rejecting feedback, and that the other 15 peers had provided accepting feedback.

As soon as the Chatroom task was completed, participants were advised that the experimenter would need a few minutes to set up the live online chat based on their and peer selections, and while that was being done they would be required to complete a similar task to the one they had completed earlier (the emotion regulation task). Participants then completed the same emotion regulation task described in Section 6.3.2.2, although the images were replaced with a new set (Sets A and B were counterbalanced between the two administrations of the emotion regulation task).

Once this second emotion regulation task was completed, no actual online chat took place and participants were debriefed.

6.3.2.4 Stimuli presentation, electromyography, and data acquisition equipment.

Emotion regulation and Chatroom task instructions and stimuli were presented with E-Prime 2.0 Professional (Psychology Software Tools, 2012) on a Microsoft Windows desktop computer and LCD screen.

During the emotion regulation task participants' observable facial responses were recorded using a Logitech digital webcam, which was attached to the top of the computer screen, for subsequent artifact detection and removal from the EMG signal (e.g., sneezing or coughing) (Pedder et al., 2016; Perry et al., 2012). Based on previous research (Pedder et al., 2016; Perry et al., 2012), muscle activity was continuously recorded at a sampling rate of 1,000 Hz, using an integrated MP150 amplifier system and the AcqKnowledge 4.2 software package (Biopac Systems, Inc., Goleta, CA). A 10-500 Hz band pass filter and a 50 Hz notch interference filter were applied. Trial onset and offset digital event markers were sent from E-Prime to AcqKnowledge EMG recording software. The raw EMG electrical signal was transformed using the root means square (RMS) method (Tassinary et al., 2007). Post data acquisition, the raw EMG signal was screened for electrical noise and movement artifacts. Baseline muscle activity was established by averaging EMG muscle activity over the 500 ms prior to stimulus presentation. Percentage change in EMG activity from baseline was calculated for each 500 ms epochs over the 5000 ms period of stimulus presentation (Pedder et al., 2016). An average percentage change over the whole 5000 ms period was then calculated to provide an average percentage change from baseline score.

6.3.3 Data analyses.

Chi-square was used to compare the BPD and healthy control groups on sex, and *t*-tests were used to compare groups on age, IQ, depression and anxiety symptoms (HADS).

Preliminary analyses, comparing groups on baseline levels of affect (EMG, and PANAS scores), were also carried out using *t*-tests. When Levene's test for equality of variances was significant for *t*-test, results of equal variances not assumed are provided. In addition, depression and anxiety symptoms (HADS) were each correlated separately with EMG activity (for each muscle region) and self-reported affect, using Pearson's r.

Four separate 2 (group: BPD, HC) x 3 (instruction: watch, expressive suppression, cognitive reappraisal) x 2 (context: standard laboratory context, social rejection context) mixed-model ANOVAs were carried out to examine how effectively participants were able to apply the instructions to regulate their negative and positive affect, as indexed by EMG and self-report (PANAS) measures. Change in activity from baseline muscle activity was analysed separately for corrugator and zygomaticus muscle regions in response to negative and positive images, respectively, and for each PANAS subscale (negative affect, positive affect). Two-way interactions were followed-up with tests of simple effects, and three-way interactions were followed up-with separate ANOVAs. Outliers were addressed as per procedures outlined in Tabachnick and Fidell (2014) to reduce extreme values. Greenhouse-Geisser corrected values are reported where assumptions of sphericity were violated, and Bonferroni corrections were applied to post-hoc comparisons where appropriate.

6.4 Results

6.4.1 Analyses of negative affect.

6.4.1.1 Preliminary analyses: Negative affect.

Negative mood induction congruence check.

Corrugator muscle activity was first checked for congruent responses to negatively valanced IAPS images during the watch condition, and in each context (Dan-Glauser & Gross, 2011). Importantly, t-tests indicated that negatively valenced images elicited congruent negative facial expressions and self-reported negative affect, as indexed by EMG (corrugator muscle) and the PANAS negative affect subscale, respectively, and in both contexts (Dan-Glauser & Gross, 2011). Specifically, in the standard laboratory context, there was greater corrugator activity when viewing negative (M = 6.55, SD = 13.01) compared with positive images (M = 3.87, SD = 12.30), $t(64) = 5.57$, $p < .001$, $d = 0.82$. Similarly, in the social rejection context, there was greater corrugator activity when viewing negative (M = 9.80, SD = 13.95) compared with positive images (M = 2.44, SD = 14.84), $t(63) = 3.06$, $p = .003$, $d = 0.51$. This indicates that negatively valenced images elicited congruent negative facial expressions in both contexts.

Participants also reported greater negative affect when viewing negative (M = 8.13, SD = 3.73) compared with positive images (M = 5.90, SD = 1.76), $t(67) = 5.35$, $p < .001$, $d = 0.83$, in the standard laboratory context. They also reported greater negative affect when viewing negative (M = 7.66, SD = 3.67) compared with positive images (M = 5.58, SD = 1.28), $t(66) = 5.40$, $p < .000$, $d = 0.76$, in the social rejection cntext. This indicates that negatively valenced images elicited congruent negative self-reported affect in both contexts.

Baseline negative affect between group comparisons.

Group differences in resting baseline corrugator muscle activity (i.e., baseline EMG corrugator activity during the 500 ms period just prior to stimulus presentation) were analysed separately for the corrugator muscle, for each instruction condition (watch, expressive suppression, cognitive reappraisal), for each context. There were no baseline differences between groups for the corrugator response to negative stimuli in the watch, expressive suppression or cognitive reappraisal conditions, in either context (all p's > .05).

Group differences in baseline self-reported negative affect (indexed by the negative subscale of the PANAS, assessed just prior to task administration) were also analysed separately for each instruction condition (watch, expressive suppression, cognitive reappraisal), in each context. In the standard laboratory context, the BPD group reported greater negative affect ($M = 7.52$, $SD = 3.23$) compared with the healthy controls ($M = 5.87$, $SD = 1.74$), $t(39.98) = 2.49$, $p = .017$, $d = 0.64$. In the context of social rejection self-reported negative affect did not differ between BPD ($M = 7.03$, $SD = 3.22$) and healthy control participants ($M = 6.29$, $SD = 2.45$), $t(65) = 1.08$, $p = .286$, $d = 0.26$.

Correlation of depression and anxiety with negative affect.

Given that the groups differed in terms of anxiety and depression subscale scores (HADS), these were separately correlated, by group, with EMG activity for the corrugator muscle region, as well as with self-reported negative affect, during the watch condition, in each context. Results indicated no significant correlations for either group between anxiety or depression scores and corrugator activity during the watch condition, for either context (all p's $\geq .128$). Therefore neither depression nor anxiety were included as covariates in the group-comparison analyses for corrugator muscle activity (Tabachnick & Fidell, 2014).

For self-reported negative affect, there were no significant correlations for the healthy controls, in either context (all p's $\geq .060$). For the BPD group, however, there was a positive correlation between self-reported negative affect and both depression ($r = .57$, $n = 29$, $p = .001$) and anxiety ($r = .64$, $n = 28$, $p < .001$) symptoms, in the standard laboratory context, suggesting that the greater the depression and anxiety symptoms experienced over the past week by BPD participants, the greater the level of subjective negative affect they reported. In the context of social rejection, however, BPD HADS anxiety and depression subscale scores were not correlated with self-reported negative affect (all p's $\geq .085$). Given that a systematic pattern of correlations was not observed, no statistical control was required for the ANOVAs (Tabachnick & Fidell, 2014).

6.4.1.2 The regulation of negative facial expression in response to negative stimuli, across contexts.

The regulation of negative facial expression in response to negative stimuli, across the three instruction conditions, within and between groups, and across two contexts, was analysed first. For corrugator muscle responses to negative stimuli, there was a main effect of context ($F(1, 62) = 15.41$, $p < .001$, $\eta_p^2 = .20$) and instruction ($F(2, 124) = 9.97$, $p < .001$, $\eta_p^2 = .14$), but no main effect of group ($F(1, 62) = 1.43$, $p = .236$, $\eta_p^2 = .02$). There were no interactions of context by group ($F(1, 62) = 1.75$, $p = .677$, $\eta_p^2 < .01$), instruction by group ($F(2, 124) = 2.194$, $p = .116$, $\eta_p^2 = .03$), or context by instruction ($F(1.76, 108.84) = 0.343$, $p = .682$, $\eta_p^2 = .01$). There was however, a non-significant trend, with an almost medium effect size, of a three-way group, by instruction, by context interaction ($F(2, 124) = 2.27$, $p = .108$, $\eta_p^2 =$

.04), which was followed up with two separate 2 (group: BPD, HC) x 3 (instruction: watch, expressive suppression, cognitive reappraisal) mixed model ANOVAs, one for each context.

The decision to follow this up was made for two reasons. First, this is the first study of its kind to be carried out with a BPD sample, innovatively bringing together an emotion regulation paradigm with a social rejection paradigm and comparing the application of emotion regulation strategies across contexts. And second, it involved a particularly challenging clinical group, who, due to their diagnosis and their age (youth aged 15-25), were especially difficult to recruit. This resulted in a small BPD sample (with 29 and 35 respectively for BPD and healthy controls), which is, nevertheless, on par with previous emotion regulation studies that recruited adults with BPD from clinical settings (see Table 3.2, in Chapter 3, for a summary of emotion regulation studies; the mean number of participants across the 6 studies that recruited adults with BPD from clinical settings was 27). Even so, this number potentially reduced power to detect a complex three-way interaction.

6.4.1.3 Follow-up of three-way interaction: The regulation of negative facial expression in response to negative stimuli, in a standard laboratory context.

The regulation of negative facial expression in response to negative stimuli, across the three instruction conditions, within and between groups, was first analysed in the standard laboratory context. For corrugator muscle responses to negative stimuli (Figure 6.1 (a)), there was a main effect of instruction, $F(2, 124) = 8.48$, $p < .001$, $\eta_p^2 = .12$, but there was no main effect of group $F(1, 62) = 1.95$, $p = .168$, $\eta_p^2 = .03$, and no instruction by group interaction, $F(2, 124) < 0.01$, $p = .997$, $\eta_p^2 < .01$. Post hoc analysis of the main effect of instruction showed that all participants had a lower corrugator response for the expressive suppression condition ($M = 0.19$, $SD = 5.20$) compared to the watch condition ($M = 6.55$, $SD = 13.01$, $p < .001$, $d = 0.64$), and there was a trend approaching significance indicating that there was also a lower corrugator response for the cognitive reappraisal condition ($M = 2.58$, $SD = 11.59$, $p = .053$, $d = 0.32$) compared to the watch condition. There was no overall difference in corrugator response to negative stimuli between the expressive suppression and cognitive reappraisal conditions ($p = .329$, $d = 0.27$).

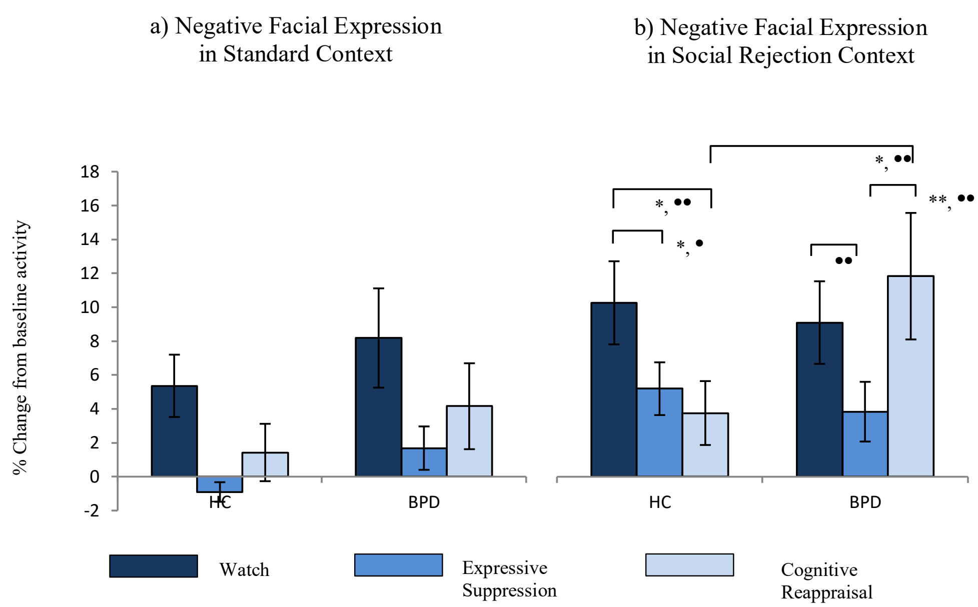

Figure 6.1. Negative facial expression in response to negative stimuli for the healthy control and BPD groups, for each instruction condition, in the standard laboratory context (a) and in the context of social rejection (b). Only a main effect of instruction was found. There were no interactions to show for the standard laboratory context.

* $p < .05$, ** $p < .01$

• small effect size, ••medium effect size

In summary, in the standard laboratory context, both groups demonstrated a similar level of negative facial expression during the watch condition. All participants were able to demonstrate the ability to regulate negative facial expression by applying the expressive suppression strategy, and there was a trend in the same direction for the cognitive reappraisal strategy. Finally, both the expressive suppression and cognitive reappraisal strategies were equally effective for both groups.

6.4.1.4 Follow-up of three-way interaction: The regulation of negative facial expression in response to negative stimuli, in the context of social rejection.

Next, the regulation of negative facial expression in response to negative stimuli, across the three instruction conditions, within and between groups, was followed-up in the context of social rejection. There was no main effect of group for corrugator muscle responses to negative stimuli, $F(1, 62) = 0.61$, $p = .437$, $\eta_p^2 = .01$ (Figure 6.1(b)). There was however, a main effect of instruction, $F(1.76, 109.02) = 3.34$, $p = .045$, $\eta_p^2 = .05$, and an instruction by group interaction, $F(1.76, 109.02) = 3.56$, $p = .037$, $\eta_p^2 = .05$.

For the instruction by group interaction, tests of simple effects showed that corrugator activity to negative images did not differ between groups during the watch ($p = .743$, $d = 0.08$) or the expressive suppression ($p = .568$, $d = 0.15$) conditions. However, during the cognitive reappraisal condition, the corrugator response was greater for the BPD group compared with the healthy control group ($p = .041$, $d = 0.48$). A further test of simple effects showed that there was a trend for a simple main effect for the healthy control group, $F(2, 61) = 2.77$, $p = .070$, $\eta_p^2 = .08$, and a simple main effect for the BPD group, $F(2, 61) = 5.05$, $p = .009$, $\eta_p^2 = .14$. When compared with the watch condition, the healthy control group had a lower corrugator response during the expressive suppression condition (p = .034, d = 0.41) and the cognitive reappraisal condition (p = .038, d = 0.49). Corrugator response did not differ between expressive suppression and cognitive reappraisal conditions for the healthy control group (p = .553, d = 0.14). For the BPD group, the corrugator response during the expressive suppression condition was lower than during the watch condition and this difference approached significance (p = .059, d = 0.48). In addition, the corrugator response was higher during the cognitive reappraisal compared with the expressive suppression condition (p = .006, d = 0.53), but the corrugator response did not differ between the watch and cognitive reappraisal conditions (p = .450, d = 0.17).

To summarise, in the context of social rejection, both groups responded with similar levels of corrugator activity to negative images during the watch condition, and they were both able to demonstrate a reduction in negative facial expression during the expressive suppression condition. However, while healthy control participants were able to reduce their corrugator response using the cognitive reappraisal instruction, the BPD group was not, and their corrugator response was significantly greater than for the healthy control group.

6.4.1.5 The regulation of subjective negative affect in response to negative stimuli, across contexts.

The regulation of subjective negative affect in response to negative stimuli, across the three instruction conditions, within and between groups, and across two contexts, was analysed (Figure 6.2). There was a main effect of context (F(1, 65) = 5.99, p = .017, η_p^2 = .08), and a main effect of instruction (F(2, 130) = 3.44, p = .035, η_p^2 = .05). There was no main effect of group (F(1, 65) = 0.35, p = .555, η_p^2 < .01), context by group interaction (F(1, 65) = 0.36, p = .549, η_p^2 < .01), instruction by group interaction (F(2, 130) = 0.83, p = .438, η_p^2 = .01), context by instruction interaction ($F(2, 130) = 1.47$, $p = .233$, $\eta_p^2 = .02$), or a three-way context, by instruction, by group interaction ($F(2, 130) = 1.44$, $p = .241$, $\eta_p^2 = .02$).

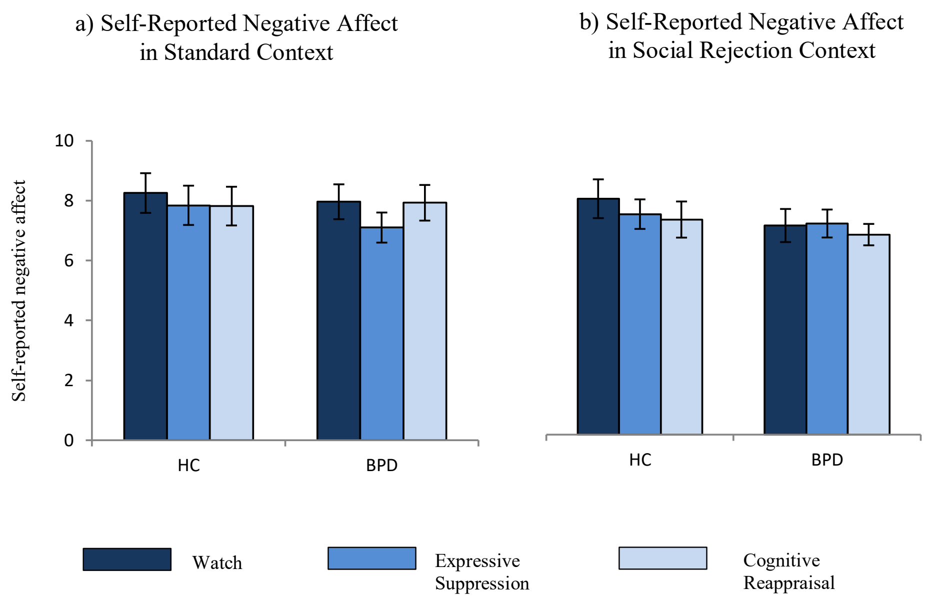

Figure 6.2. Self-reported negative affect (PANAS-NA) in response to negative stimuli for the healthy control and BPD groups, for each instruction condition, in the standard laboratory context (a) and in the context of social rejection (b). Only a main effect of instruction was found. There were no interactions to be shown for the standard laboratory context.

Post hoc analysis of the main effect of context showed that there was greater overall self-reported negative affect, for all participants, and across all instruction conditions, in the standard laboratory context ($M = 7.84$, $SD = 3.65$) compared with the context of social rejection ($M = 7.35$, $SD = 3.23$, $p = .017$, $d = 0.14$). Post hoc analysis of the main effect of strategy showed reduced self-reported negative affect overall, for all participants and across contexts, for the expressive suppression instruction ($M = 7.44$, $SD = 3.23$) relative to the watch instruction ($M = 7.86$, $SD = 3.69$, $p = .062$, $d = 0.12$). There were no overall differences in self-reported negative affect between the watch and cognitive reappraisal instruction ($M = 7.48$, $SD = 3.42$, $p = .168$, $d = 0.11$), or the expressive suppression and cognitive reappraisal instruction conditions ($p = 1.000$, $d = 0.01$).

In summary, participants overall reported greater negative affect in the standard laboratory context, relative to the social rejection context, overall. In addition, only expressive suppression appears to have reduced self-reported negative affect for all participants, but cognitive reappraisal did not.

6.4.2 Analyses of positive affect.

6.4.2.1 Preliminary analyses: Positive affect.

Positive mood induction congruence check.

Zygomaticus muscle activity was first checked for congruent responses to positively valanced IAPS images, during the watch condition in each context (Dan-Glauser & Gross, 2011). Importantly, t-tests indicated that positively valenced images elicited the respective congruent positive facial expressions and positive self-reported affect, as indexed by EMG and the PANAS positive affect subscale, respectively (Dan-Glauser & Gross, 2011). Specifically, there was greater zygomaticus activity evident when participants viewed positive ($M = 22.94$, $SD = 35.93$) compared with negative images ($M = 3.62$, $SD = 9.87$), $t(63) = 4.33$, $p < .001$, $d = 0.73$, in the standard laboratory condition. Greater zygomaticus activity was also evident when participants viewed positive ($M = 39.10$, $SD = 61.02$) compared with negative images ($M = 9.35$, $SD = 25.63$), $t(61) = 3.75$, $p < .001$, $d = 0.64$, in the social rejection context. This indicates that positively valenced images elicited congruent positive facial expressions in both contexts.

Similarly, participants reported greater positive affect when they viewed positive (M = 10.79, SD = 4.59) compared with negative images (M = 9.16, SD = 3.60), $t(67) = 4.73$, $p < .001$, $d = 0.40$ in the standard laboratory condition. They also reported greater positive affect when viewing positive (M = 9.55, SD = 4.04) compared with negative images (M = 8.24, SD = 3.27), $t(66) = 3.70$, $p < .000$, d = 0.37, in the social rejection context. These results indicate that positively valenced images elicited congruent self-reported affect across contexts.

Baseline positive affect between group comparisons.

Group differences in resting baseline muscle activity (i.e., baseline EMG activity during the 500 ms period just prior to stimulus presentation) were analysed separately for the zygomaticus muscle, for each condition (watch, expressive suppression, cognitive reappraisal). In the standard laboratory context, there were no baseline differences between groups for the zygomaticus response to positive stimuli in the watch and expressive suppression conditions (*p's* > 05). The only significant difference was that zygomaticus muscle activity was lower at baseline for the BPD group (M = 0.00135, SD = 0.00052) compared with the healthy control group (M = 0.00187, SD = 0.00133) during the cognitive reappraisal condition, $t(45.73) = 2.12$, $p = .039$, $d = 0.52$. It is noted that percentage change in EMG activity was calculated for the key analyses, rather than relying on unadjusted raw scores. Therefore, this difference is not expected to affect the interpretation of results. In the context of social rejection, there were no baseline zygomaticus differences between groups for any instruction condition (watch, expressive suppression, cognitive reappraisal) (all p's ≥ .580).

Group differences in baseline self-reported positive affect (indexed by the positive affect subscale of the PANAS, assessed just prior to task administration) were also analysed separately for each instruction condition (watch, expressive suppression, cognitive reappraisal), in each context. In the standard laboratory context, the healthy controls reported greater positive affect ($M = 12.46$, $SD = 4.70$) compared with the BPD group ($M = 9.48$, $SD = 3.29$), $t(65.81) = 3.08$, $p = .003$, $d = 0.73$. Similarly, in the context of social rejection the controls reported greater positive affect ($M = 10.97$, $SD = 4.74$) compared with the BPD group ($M = 7.83$, $SD = 2.61$), $t(59.74) = 3.46$, $p = .001$, $d = 0.82$.

Correlation of depression and anxiety with positive affect.

Given that the groups differed in terms of anxiety and depression subscale scores (HADS), these were separately correlated, by group, with EMG activity for the zygomaticus muscle, as well as with self-reported positive affect, during the watch condition, for each context. Results indicated no significant correlations for either group between anxiety or depression scores and zygomaticus EMG activity during the watch conditions, for either context (all p-values $\geq .263$). Similarly, there were no significant correlations for the healthy control group or the BPD group, between anxiety or depression scores and self-reported positive affect, for either context self-reported affect, (all p-values $\geq .175$). Therefore neither depression nor anxiety were included as covariates in the following group-comparison analyses (Tabachnick & Fidell, 2014).

6.4.2.2 The regulation of positive facial expression in response to positive stimuli, across contexts.

The regulation of positive facial expression in response to positive stimuli, across the three instruction conditions, within and between groups, and across two different contexts, was analysed (Figure 6.3). For zygomaticus muscle responses to positive stimuli, there was a main effect of context (F(1, 62) = 7.13, p = .010, η_p^2 = .10), instruction (F(1.27, 78.96) = 19.30, p < .001, η_p^2 = .24), and group (F(1, 62) = 8.66, p = .005, η_p^2 = .12). There were no significant two-way interaction effects between context and group (F(1, 62) = 1.95, p = .168, η_p^2 = .03), instruction and group (F(2, 124) = 1.81, p = .168, η_p^2 = .03), or a three-way interaction between context, instruction, and group (F(2, 124) = 0.531, p = .589, η_p^2 = .01). There was, however, a non-significant trend for an interaction between context and instruction (F(1.67, 103.22) = 2.77, p = .077, η_p^2 = .04).

Post hoc analysis of the main effect of group showed that there was an overall significant between group difference in zygomaticus muscle activity, across strategies and contexts, with reduced overall positive facial expression for the BPD group (M = 7.43, SD = 26.51) compared with the healthy control group (M = 21.78, SD = 41.39, p = .005, d = 0.41). The non-significant trend for an interaction between context and instruction was followed up with tests of simple effects, which showed that for the watch instruction, all participants had greater zygomaticus activity in the context of social rejection (M = 36.76, SD = 60.45) compared with the standard laboratory context (M = 21.87, SD = 35.93, p = .017, η_p^2 = .09). Zygomaticus activity did not differ significantly between the standard laboratory context (M = 3.30, SD = 8.20) and the context of social rejection (M = 7.24, SD = 20.38, p = .097, η_p^2 = .04) for the expressive suppression instruction. Zygomaticus activity also did not differ for the cognitive reappraisal instruction, between the standard laboratory context ($M = 7.73$, $SD = 17.41$) and the context of social rejection ($M = 10.78$, $SD = 27.10$, $p = .370$, $\eta_p^2 = .01$).

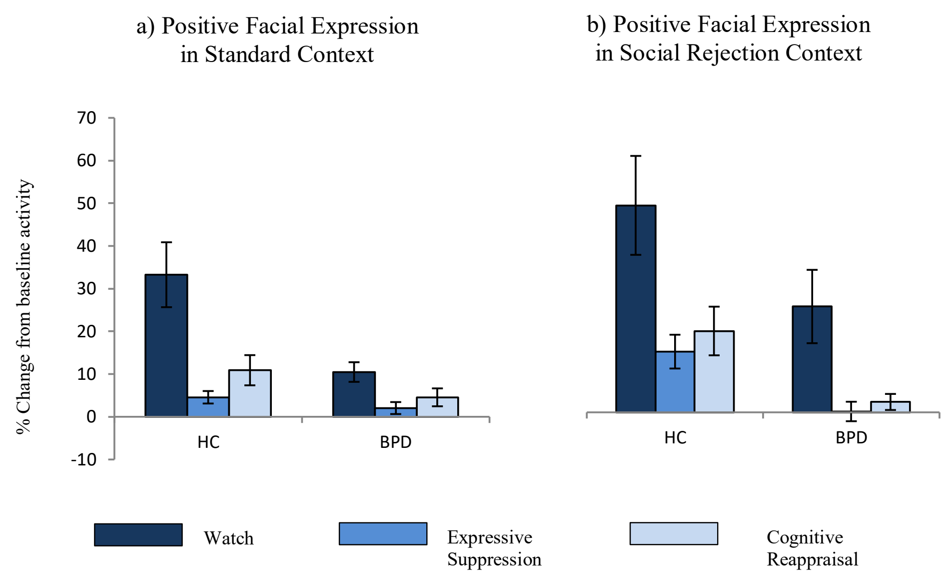

Figure 6.3. Positive facial expression in response to positive stimuli for the healthy control and BPD groups, for each instruction condition, in the standard laboratory context (a) and in the context of social rejection (b).

Further tests of simple effects showed that in the standard laboratory context, participants overall had reduced zygomaticus activity for the expressive suppression ($p < .001$, $d = 0.71$), and the cognitive reappraisal ($p = .010$, $d = 0.50$) instructions, relative to the watch instruction. There was no difference in zygomaticus activity between the expressive suppression and cognitive reappraisal instructions in the standard laboratory context ($p = .153$, $d = 0.35$). Similarly, in the context of social rejection participants had reduced zygomaticus activity for the expressive suppression (p $< .001$, $d = 0.65$), and the cognitive reappraisal ($p < .000$, $d = 0.55$) instructions, relative to the watch instruction. There was no difference in zygomaticus activity between the expressive suppression and cognitive reappraisal instructions in the context of social rejection (p = .954, d = 0.15).

In summary, relative to healthy controls, BPD participants demonstrated blunted positive facial expression overall, across both contexts and all instructions. Interestingly, there was greater positive facial expression, for participants overall, during the watch condition in the context of social rejection compared with the standard laboratory context. Nevertheless, all participants in both contexts, demonstrated down-regulation of positive facial expression using both the expressive suppression and cognitive reappraisal instructions.

6.4.2.3 The regulation of subjective positive affect in response to positive stimuli, across contexts.

The regulation of self-reported positive affect in response to positive stimuli, across the three instruction conditions, within and between groups, and across two different contexts, was analysed. For self-reported affect in responses to positive stimuli, there was a main effect of context (F(1,64) = 11.89, p = .001, η_p^2 = .16), instruction (F(1.68, 107.21) = 11.32, p < .001, η_p^2 = .15), and group (F(1, 64) = 9.07, p = .005, η_p^2 = .12). There were no significant two-way interaction effects between context and group (F(1, 64) = 0.66, p = .419, η_p^2 = .01), or instruction and group (F(2, 128) = 0.40, p = .670, η_p^2 = .01). There was, however, a significant interaction between context and instruction (F(1.67, 106.98) = 4.71, p = .011, η_p^2 = .07), and a non-significant trend for a three-way interaction between context, instruction, and group (F(2, 128) = 2.215, p = .113, η_p^2 = .03). This trend for an interaction effect was followed up with two separate 2 (group: BPD, HC) x 3 (instruction: watch, expressive suppression, cognitive reappraisal) mixed model ANOVAs, one for each context.

6.4.2.4 Follow-up of three-way interaction: The regulation of subjective positive affect in response to positive stimuli, in a standard laboratory context.

The regulation of subjective positive affect in response to positive stimuli across the three conditions in the standard condition was analysed first. For self-reported positive affect in response to positively valenced stimuli (Figure 6.4(a)) there was a main effect of group, $F(1, 66) = 8.67$, $p = .004$, $\eta_p^2 = .12$, and instruction, $F(1.71, 112.54) = 13.03$, $p < .001$, $\eta_p^2 = .17$. However, there was no instruction by group interaction, $F(1.71, 112.54) = 1.32$, $p = .269$, $\eta_p^2 = .02$.

For the main effect of group, the BPD group reported reduced positive affect in response to positively valenced images across all instruction conditions ($M = 8.36$, $SD = 3.28$) compared with the healthy controls ($M = 11.13$, $SD = 4.62$, $p = .004$, $d = 0.69$). Post hoc analysis of the instruction main effect revealed that compared with the watch condition ($M = 10.63$, $SD = 4.58$), participants across both groups reported lower positive affect following both the expressive suppression ($M = 9.21$, $SD = 4.06$, $p < .001$, $d = 0.33$) and cognitive reappraisal ($M = 9.39$, $SD = 4.24$, $p = .003$, $d = 0.28$) conditions, but no overall difference between the expressive suppression and cognitive reappraisal conditions ($p = 1.000$, $d = 0.04$).

In summary, compared with the healthy control group, the BPD group demonstrated a lower level of self-reported positive affect across all three instruction conditions. Nevertheless, all participants demonstrated the ability to reduce their positive affect using expressive suppression and cognitive reappraisal strategies, and both strategies were equally effective.

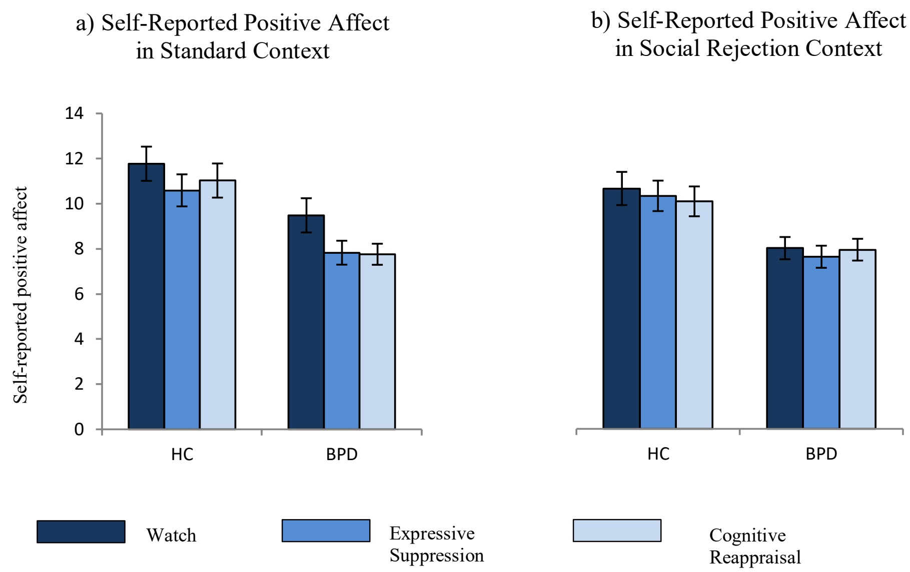

Figure 6.4. Self-reported positive affect (PANAS-PA) in response to positive stimuli for the healthy control and BPD groups, for each instruction condition, in the standard laboratory context (a), and in the context of social rejection (b).

6.4.2.5 Follow-up of the three-way interaction: The regulation of subjective positive affect in response to positive stimuli, following social rejection induction.

The regulation of subjective positive affect in response to positive stimuli across the three conditions was then analysed for the social rejection condition. For self-reported positive affect in response to positively valenced stimuli (Figure 6.4(b)) there was no main effect of instruction, $F(1.75, 111.86) = 1.50$, $p = .228$, $\eta_p^2 = .02$, or group by instruction interaction, $F(1.75, 111.86) = 0.93$, $p = .388$, $\eta_p^2 = .01$. There was however a main effect of group, $F(1, 64) = 8.52$, $p = .005$, $\eta_p^2 = .12$. For the main effect of group, the BPD group reported reduced positive affect in response to positively valenced images across all instruction conditions ($M = 7.82$, $SD = 2.59$) compared with the healthy control group ($M = 10.30$, $SD = 4.17$, $d = 0.71$).

In summary, the BPD group reported blunted positive affect while watching positive images, across the three instruction conditions compared with the healthy control group. Overall, participants did not demonstrate the ability to use expressive suppression or cognitive reappraisal to reduce self-reported positive affect compared with the watch condition, and there was no difference in self-reported positive affect between the two regulation conditions.

6.5 Discussion

This study provides the first empirical assessment of the ability of youth with first presentation BPD, in a clinical setting, to regulate their emotions using expressive suppression and cognitive reappraisal. It is also the first study to assess emotion regulation ability in this group in two different contexts; to assess the ability of individuals with BPD, of any age, to apply specific emotion regulation strategies to regulate positive affect; and to objectively assess the regulation of behavioural (specifically facial) emotional expression.

6.5.1 The regulation of negative facial affect across contexts.

The current results show, for the first time, that like their typically developing peers, youth with first presentation BPD can effectively apply expressive suppression, and to some extent cognitive reappraisal, to regulate their emotional experience as indexed by a reduction in negative facial expression, in an innocuous social context. These findings support the hypothesis, and are consistent with adult BPD emotion regulation research, which indicates that adults with BPD/BPD features can regulate negative emotional experiences using cognitive reappraisal and a combination of suppression strategies (Baczkowski et al., 2016; Chapman et al., 2017; Dixon-Gordon et al., 2016; Koenigsberg, Fan, et al., 2009; Ruocco, Medaglia, Ayaz, et al., 2010; C.

Sauer et al., 2016). However, these findings are arguably somewhat incongruent with theoretical conceptualisations of BPD as a disorder characterised by heightened baseline reactivity which should make emotion regulation more difficult for this group (Carpenter & Trull, 2013; Crowell et al., 2009; Linehan, 1993). Overall, given that no studies of individuals with BPD to date have assessed the effectiveness of expressive suppression alone, or the regulation of facially expressed negative emotions using expressive suppression or cognitive reappraisal, these findings extend previous research by demonstrating that both strategies are effective in regulating negative facial emotional expression for youth with first presentation BPD.

It should be noted, however, that this reduction in facial expression of negative emotion, found for all participants, was significant using expressive suppression, but was a trend when cognitive reappraisal was applied. This pattern is consistent with the developmental literature, which indicates that while neurotypical young people are as adept as neurotypical adults at applying expressive suppression (Desatnik et al., 2017), cognitive reappraisal ability improves through adolescence and into early adulthood (McRae et al., 2012). This is possibly because brain regions associated with cognitive control continue to develop during the adolescent period, and even into early adulthood (Barnea-Goraly et al., 2005; Blakemore & Choudhury, 2006; Lewis & Stieben, 2004; Luna et al., 2010; Pitskel et al., 2011). The trend for cognitive reappraisal to be used successfully by all participants in the current study, therefore, appears to reflect some, though possibly not yet fully consolidated, ability to apply this strategy by youth across both groups. Most importantly, however, the overall findings indicate that youth with first presentation BPD show a similar pattern to typically developing youth in terms of their ability to regulate their facial expression of emotions using the two strategies under standard conditions.

The current study also assessed the ability of youth with first presentation BPD and healthy controls to apply the same two emotion regulation strategies in the context of social rejection. Specifically, as was found under standard conditions, and contrary to what was predicted, both groups could regulate their negative facial expression using expressive suppression following social rejection. The current findings are consistent with emerging evidence suggesting that suppression strategies might have short-term benefits, particularly in the regulation of negative emotions such as anger (Chapman et al., 2009; Germain & Kangas, 2015), and that expressive suppression, specifically, effectively modulates the neural correlates of emotion regulation in adolescents (Desatnik et al., 2017). Therefore, the current findings suggest that expressive suppression might be useful and effective in the regulation of the behavioural expression of negative emotions for youth with first presentation BPD, at least in the short-term.

It should be noted that expressive suppression appears to have been less effective in reducing negative facial expression for both groups in the context of social rejection, relative to the standard condition, as reflected by higher *p*-values and smaller effect sizes. This finding is consistent with previous research suggesting that the heightened rejection sensitivity generally observed in typically developing young people might impact the ability to successfully apply emotion regulation strategies (Marston et al., 2010; Silvers et al., 2012). Thus, it appears that social rejection makes it somewhat more difficult to apply expressive suppression successfully, at least to negative facial expressions, but importantly, this impact is not restricted to youth with first presentation BPD, and is therefore developmentally appropriate.

A key difference between the groups did, however, emerge in relation to cognitive reappraisal, whereby this strategy was effective for the healthy controls, but not for the BPD group, in regulating negative facial expression in the context of social rejection, consistent with what was hypothesised. In fact, negative facial emotional expression *increased* for the BPD group when they were instructed to apply the cognitive reappraisal strategy. These results contrast with findings for the standard laboratory context which showed both groups were similarly able to apply cognitive reappraisal to regulate negative facial expression. The greater difficulty applying cognitive reappraisal shown by youth with first presentation BPD in the context of social rejection cannot be linked to higher levels of negative reactivity in the BPD group during the watch condition, as there were no differences between groups in the watch condition. This findings of similar affective reactivity between healthy controls and youth with BPD, in the context of social rejection, is consistent with the only other study that has assessed emotion processing in BPD youth in the context of social rejection (K. A. Lawrence et al., 2011). That study assessed self-reported state affect and also did not find differences in reactivity between healthy controls and youth with first presentation BPD. However, it did not assess the active, instructed application of specific emotion regulation strategies.

Therefore, it appears that a key difficulty for youth with first presentation BPD might be related to the *application* of the cognitive reappraisal strategy to regulate negative facial expressions in the context of social rejection. This difficulty might be related to heightened rejection sensitivity (Berenson et al., 2016; Gunderson & Lyons-Ruth, 2008; Jobst et al., 2014; Staebler, Helbing, et al., 2011) and an associated greater neural *social pain* response when feeling excluded (Domsalla et al., 2014; Ruocco, Medaglia, Tinker, et al., 2010), which have previously been shown to characterise adult BPD patients. A heightened social pain response in individual high in rejection sensitivity has been linked to reduced activation of prefrontal brain regions (in particular the ventrolateral prefrontal cortex and the ventral anterior cingulate cortex) important for emotion regulation (Burklund et al., 2007; Kross et al., 2007). In addition, the medial prefrontal cortex, associated with emotion regulation in neurotypical populations, has been found to be over-activated, relative to controls, in individuals with BPD following social exclusion induction using Cyberball (Domsalla et al., 2014; Ruocco, Medaglia, Tinker, et al., 2010). This suggests greater regulatory effort, which might lead to depletion and impairments in the top-down neural processes involved in cognitive reappraisal (Wagner, Altman, Boswell, Kelley, & Heatherton, 2013).

In essence, these findings are consistent with the proposal that social rejection interferes with the capacity of youth with first presentation BPD to apply the emotion regulation strategy of cognitive reappraisal, possibly because social rejection affects neural functioning in parts of the brain implicated in emotion processing and regulation. The fact that the impact was apparent when applying cognitive reappraisal, but expressive suppression remained effective, suggests it is the more cognitively demanding strategies that might be most disrupted in the context of social rejection. What the current study suggests then, is that youth with first presentation BPD might have difficulty effectively applying cognitive reappraisal to regulate behavioural expressions of negative emotions (as reflected in the inability to regulate facial displays of negative emotion), in the context of social rejection, but not in an otherwise innocuous context. Thus, future research attempting to understand emotion regulation ability in youth with BPD, and over the course of the disorder, should take the context of social rejection into account. This could be done, as was done in the current study for example, by combining emotion regulation and social rejection paradigms.

Such research should, in turn, inform intervention efforts attempting to improve emotion regulation and interpersonal function in BPD, particularly during the early stages of disorder. Thus, from a clinical perspective, the current findings could be taken to suggest that instructed cognitive reappraisal might be contraindicated as a tool for the regulation of negative emotional expression, in the immediate context of social rejection. Cognitive reappraisal was not only ineffective, but it also seems to have acted as an *accelerant* by increasing negative expression in the context of social rejection. Alternatively, the current findings could be taken as evidence that youth with first presentation BPD require interventions that target the improvement of cognitive reappraisal in the context of social rejection. Therefore, future research should test whether the current findings are replicated and confirmed, particularly for youth with first presentation BPD, but also for individuals at different stages of disorder. Future research should also test whether, via psychological intervention, the emotion regulation strategy of cognitive reappraisal can be coached so as to have a positive, rather than a counterproductive, effect on the expression of negative emotions in the context of social rejection.

However, if cognitive reappraisal cannot be improved via intervention for application in the context of social rejection, then alternative strategies need to be evaluated for use in this particular context. For example, the current study suggests that expressive suppression might be an effective short-term strategy in the regulation of the behavioural expression of negative affect, in the context of social rejection, for youth with first presentation BPD. It should be noted, however, that previous research has shown that the habitual use of suppression strategies is associated with negative mental health outcomes (Aldao et al., 2010; Gross & John, 2003; Gross & Thompson, 2007; Webb et al., 2012), therefore its long-term consequences need to be better understood. Nevertheless, recent research highlights the value of flexible access to a range of strategies, rather than indiscriminate, rigid, adherence to any one particular strategy across contexts (Aldao et al., 2010; Aldao et al., 2015; Aldao & Tull, 2015; Bonanno & Burton, 2013; Dixon-Gordon et al., 2015; Gross, 2015; Haines et al., 2016). Future research should therefore explore both the effectiveness, as well as the short- and long-term consequences of the use of various emotion regulation strategies, in the context of social rejection, for youth with first presentation BPD.

6.5.2 The regulation of subjective negative affect across contexts.

In contrast to the findings related to negative facial expression, for which the context of social rejection had a unique impact in the application of cognitive reappraisal for youth with first presentation BPD, neither context, nor group, played a significant role in the regulation of subjective negative affect. Indeed, participants overall were able to down-regulate their negative affective experience using expressive suppression, across contexts, but not using cognitive reappraisal. In relation to BPD youth, these findings are not consistent with expectations, and differ to those for adults with BPD, who have been shown to effectively regulate self-reported negative affect using both suppression and cognitive reappraisal strategies (Baczkowski et al., 2016; Chapman et al., 2017; Evans et al., 2013; Koenigsberg, Fan, et al., 2009; S. Lang et al., 2012; Marissen et al., 2010; Schulze et al., 2011).

However, when these findings are considered within a developmental context, it is important to note that youth with first presentation BPD did not differ from their healthy peers in their abilities. As noted earlier, neurotypical young people can apply expressive suppression as effectively as adults (Desatnik et al., 2017). However, due to ongoing development in the neural brain regions associated with cognitive control during adolescence and early adulthood (Barnea-Goraly et al., 2005; Blakemore &

Choudhury, 2006; Lewis & Stieben, 2004; Luna et al., 2010; Pitskel et al., 2011), the ability to effectively apply cognitive reappraisal is still developing during this period, and is only consolidated later in adulthood (McRae et al., 2012). Therefore, the difficulty regulating subjectively experienced negative affect using cognitive reappraisal, found in youth with first presentation BPD, is consistent with normal development in healthy youth.

It should also be noted that during the watch condition both groups unexpectedly reported greater subjective negative affect during the standard laboratory condition relative to the social rejection condition. This intuitively appears to challenge the effectiveness of the social rejection induction in the current study. However, it is in fact a pattern that is commonly observed when social rejection paradigms are applied. This is apparent in the findings of a meta-analysis of 165 studies that experimentally induced social rejection and assessed self-reported affective states. The results showed that the immediate subjective affective reaction to being rejected is not negative, but is instead neutral (Blackhart, Nelson, Knowles, & Baumeister, 2009). Thus, while social rejection might trigger a neural social pain response (Eisenberger, 2015; Rotge et al., 2015), the impact of social rejection does not appear to be reflected in negative affective states, at least as indexed by self-report (Blackhart et al., 2009). As such, there is no reason to suggest that the social rejection paradigm in the current study was ineffective.

Thus, youth with first presentation BPD experienced developmentally appropriate difficulties regulating subjectively experienced negative affect using cognitive reappraisal across contexts. Future research could therefore explore ways to enhance this strategy across contexts and could also explore alternative strategies for the regulation of negative state affect. This research should be done with caution, however, as strategies that are effective for adults do not have the same positive effects, and can be counterproductive, for young people while they are still developing (Brockman et al., 2017; Gómez-Ortiz et al., 2016). Thus, future research into the application of emotion regulation strategies for the regulation of state affect should be cognisant of the normal development of emotion regulation in youth.

6.5.3 The regulation of positive affect across contexts: Positive facial expression and subjective positive affect.

The most striking and consistent finding relating to positive affect in youth with first presentation BPD was that, relative to healthy controls, they demonstrated persistently blunted positive facial expression, as well as persistently blunted subjective positive emotions, across both contexts and all three instructions. To date, no prior studies (to the author's knowledge) have specifically set out to assess the expression or experience of positive emotions in youth with first presentation BPD, therefore this is the first study to show such a pervasive blunting of positive affect in this group. However, there is a precedent, albeit derived from the adult BPD literature, suggesting aberrant processing of positive emotions in BPD, and attenuated positive emotional expression (Beblo et al., 2013; Davies et al., 2016; Herpertz et al., 2001; Koenigsberg, Siever, et al., 2009; Reed & Zanarini, 2011; Renneberg, Heyn, Gebhard, & Bachmann, 2005; Staebler, Renneberg, et al., 2011). While the focus of the current study was not on the expression or experience of positive emotions per se, but rather on its regulation, these data are nevertheless consistent with previous findings indicating blunted positive facial expression, and reduced positive affective states, in adults with BPD. It might be that globally reduced positive affectivity, across external and internal domains, is associated with the heightened anhedonia documented in BPD (Marissen, Arnold, & Franken, 2012). Thus, an unintended, but nevertheless interesting finding of the current study, is that blunted positive affect is also apparent in early stages of the disorder, that is, in youth with first presentation BPD.

Despite grossly reduced positive affect for the BPD group, both groups demonstrated down-regulation of positive facial expression, using expressive suppression and cognitive reappraisal instructions, across both contexts. These findings illustrate that, like healthy youth, youth with first presentation BPD can effectively apply expressive suppression across contexts. Being able to regulate positive affect is a valuable social skill, which facilitates interpersonal interactions (Kalokerinos et al., 2014; Kashdan et al., 2015; Le & Impett, 2013; Soto et al., 2011).

In addition, both groups also demonstrated the ability to down-regulate self-reported positive affect in the standard laboratory context. However, neither group was able to regulate their subjective positive affect in the context of social rejection. That self-reported affect was not down-regulated by either group following social rejection might have been driven by previously documented prohedonic motivation to maintain, or increase, positive affective states in this context (Riediger & Klipker, 2014; Riediger, Schmiedek, Wagner, & Lindenberger, 2009). An alternative explanation is that this effect is an artefact of the reduced self-reported positive affect observed for both groups during the watch instruction, in the context of social rejection, relative to the standard laboratory context. Thus, because all participants had less self-reported positive affect to regulate in the context of social rejection, neither group was able to significantly reduce their level of positive self-reported affect as it was already somewhat low. This finding of reduced positive felt emotion in the context of social rejection for youth is consistent with previous research which has highlighted the significance of social acceptance during this period of development (Masten et al., 2009), and a normative decrease in internal positive emotionality resulting from social rejection (Silvers et al., 2012).

Another interesting finding arising from this study regarding positive affect, was that there was greater positive facial expression for participants overall during the watch condition, in the context of social rejection, compared with the standard laboratory context. This increased reactivity might have been the result of both groups automatically (i.e., without instruction) up-regulating their positive facial expression as a way of counteracting the negative emotional experience of social rejection. This interpretation is consistent with research indicating that social rejection triggers automatic emotion regulation processes, which serves to increase people's receptiveness to positive emotion cues, and increases positive affect (DeWall et al., 2011). Thus, the current findings suggest that youth with first presentation BPD do not differ from non-clinical populations in terms of their positive emotional reactivity in the context of social rejection.

To summarise, while youth with first presentation BPD do not experience deficits in the regulation of positive affect, they do experience pervasive blunting of positive affect across contexts. Future research could therefore explore whether youth with BPD can up-regulate positive affect, and whether there are any be benefits associated with interventions that target the up-regulation of positive affect (e.g., Livingstone & Srivastava, 2012; Martin & Ochsner, 2016; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010; Wong, Tschan, Messerli, & Semmer, 2013).

6.5.4 Strengths and Limitations.

First, it is noted that the findings relating to the regulation of negative facial expression, and to self-reported positive affect, originated from a non-significant trend evident in the all-inclusive ANOVA that included context as an independent variable, which was followed-up with separate ANOVAs (one for each context). The decision to follow-up non-significant trends detected by the three-way interactions in the ANOVAs was not pursued without careful consideration. Essentially, while non-significant, the effect size was almost medium and it was felt that the novelty of the current research, in terms of it being the first to assess the regulation of the facial expression of emotion in BPD, the first to assess the regulation of emotions in youth with first presentation BPD, and the first to assess the regulation of positive affect in BPD, justified some exploration with the intention of expanding this topic for future research. Nevertheless, it is acknowledged that the current findings should be interpreted with caution and require replication.

A concurrent strength and limitation of the current study was the focus on two distinct emotion regulation strategies, that is, expressive suppression and cognitive reappraisal. This has provided specific information about the instructed application of two distinct strategies, but at the same time of course limits generalisations to other emotion regulation strategies. Future research should also explore the effectiveness of other emotion regulation strategies in the context of social rejection, for individuals with BPD. This includes, for example, other suppression strategies, such as thought suppression and emotion suppression, which differ from expressive suppression. See the Webb et al. (2012) paper for a detailed breakdown and description of various emotion regulation strategies derived from the process model of emotion regulation.

The current findings are also limited to youth with first presentation BPD, who are an important target for early intervention with the aim of preventing chronic interpersonal dysfunction (Chanen et al., 2017). Therefore, future research should investigate whether these findings are also observed over the course of BPD, at different developmental period and stages of disorder. This will provide a fuller picture of the trajectory of emotion regulation in individuals with BPD across the lifespan and the course of the disorder.

A persistent challenge for researchers trying to understand BPD are the high rates of comorbidity with affective/state disorders (Grant et al., 2008; Kaess et al., 2013; Lenzenweger et al., 2007). This study elected to capture a clinically representative sample and thus included participants with a range of comorbidities, as is typical for this group (Ha, Balderas, Zanarini, Oldham, & Sharp, 2014; Kaess et al., 2013; Skodol et al., 2002). A strength of the study however, were the steps taken to account for the potential role of common symptomatology in terms of levels of anxiety and depression. As is to be expected in any sample of individuals with BPD, depression and anxiety symptoms were higher in the BPD group compared with the healthy control group. However, because results indicated no correlation with facial EMG in either context, it is unlikely that the group effects identified in the behavioural data were attributable to variations in depression or anxiety symptoms between the groups. There was however, a positive correlation between negative self-reported affect and depressive and anxiety symptoms across contexts. However, there were no group differences in self-reported negative affect across any of the three conditions, therefore the relevance of the correlation to the interpretation of findings is reduced.

A further potential limitation of the current study was the lack of an alternative stressful situation that did not elicit social rejection. The Chatroom task was chosen specifically because it is intended, and has been shown in previous research, to simulate social rejection and elicit mild levels of social distress among young people (Guyer et al., 2008; Guyer et al., 2009; Lau et al., 2012). It would be useful to replicate the current study and include an alternative mildly stressful, but non-social situation. This would enable closer exploration of whether more general, non-social stress would lead youth with first presentation BPD to experience a similar pattern of difficulties to the ones observed in the context of social rejection. Future research might also include stronger positive affect induction, or perhaps a positive social context, such as overinclusion, a manipulation that is possible with tasks such as Cyberball, or another social experience that might be considered the opposite of rejection, such as inclusion. This might possibly be achieved by manipulating the Chatroom task so that participants only receive inclusion feedback, or feedback that is weighted more heavily towards inclusion.

It is noted that broader limitations that apply equally to both empirical studies presented in this thesis are discussed in the overall thesis discussion (Chapter 7).

6.5.5 Conclusions.

Overall, this study demonstrated that the ability to apply emotion regulation strategies is not grossly impaired in youth with first presentation BPD. Furthermore, the data suggest that BPD youth are more alike than different compared with healthy youth in terms of their ability to effectively apply expressive suppression and cognitive reappraisal to regulate both positive and negative affect. That is, they generally showed a similar pattern of strengths and deficits. There were, however, two key differences compared with their neurotypical peers. First, unlike their healthy counterparts, BPD youth could not effectively apply cognitive reappraisal to regulate the behavioural expression of negative emotions during social rejection, and indeed, attempts to apply this strategy in that context increased the facial expression of negative affect. Second, BPD youth demonstrated a pervasive pattern of blunted affect, although they were still able to apply expressive suppression and cognitive reappraisal to regulate positive affect. These findings have specific implications for how emotion regulation is understood in youth in the early stages of BPD, and thus have implications for early intervention efforts that aim to improve interpersonal functioning in BPD.

Chapter 7: General Discussion

7.1 Introduction and Chapter Overview

This thesis aimed to improve understanding of socioemotional processing in BPD, which is thought to underlie the chronic interpersonal dysfunction associated with BPD over a lifetime, by focusing on youth earlier in the course of the disorder. This was achieved via two critical narrative reviews (Chapters 2 and 3) and two empirical studies (Chapters 5 and 6). The reviews aimed to summarise and synthesise findings to date, regarding social cognition and emotion regulation in BPD, to place these findings within a developmental context, and to highlight important gaps remaining to be addressed. The two empirical studies explored social cognition and emotion regulation in youth with first presentation BPD. Study 1 assessed unconscious simulation processes, a key aspect of affective empathy. Study 2 assessed the application of two emotion regulation strategies, expressive suppression and cognitive reappraisal, in the regulation of negative and positive affect, in a standard laboratory context, as well as in the context of social rejection. The key observations, findings, implications, and conclusions of this thesis are presented herein.

7.2 Literature Reviews: Summary and Future Directions

7.2.1 Summary of social cognition and emotion regulation research findings in BPD, from adolescence through adulthood.

Chapters 2 and 3 respectively summarised and synthesised the empirical literature to date regarding social cognition and emotion regulation, within a developmental framework. These reviews represent a first step towards describing the developmental trajectory of social cognition and emotion regulation in BPD, based on research to date, and highlight the importance of considering developmental age, and clinical stage, when trying to understand these processes in BPD.

The review of social cognition in BPD demonstrates that, despite the shared BPD diagnosis, sociocognitive functioning in adults and young people with BPD is not inevitably analogous. Instead, sociocognitive impairments in BPD are nuanced, they are specific to the different components of social cognition, and functioning in some areas vary depending on developmental age and stage of disorder. The review highlights that functioning in some aspects of social cognition are not the same for young people and adults with BPD (i.e., facial emotion recognition, state rejection sensitivity, sensitivity to facial emotional expressions) (e.g., Daros et al., 2013; Jovev et al., 2011; K. A. Lawrence et al., 2011; Lowyck et al., 2015; Lynch et al., 2006; Renneberg et al., 2012; Robin et al., 2012; von Ceumern-Lindenstjerna et al., 2007), but that functioning in other aspects is similar (i.e., emotional contagion) (e.g., Dziobek et al., 2011; Kalpakci et al., 2016).

Specifically, facial emotion recognition appears to be intact in young people with BPD (Robin et al., 2012; von Ceumern-Lindenstjerna et al., 2007) but seems to deteriorate as individuals with BPD progress into adulthood (Daros et al., 2013). Sensitivity to facial emotional expressions seems to be impaired in both young people and adults with BPD, but the quality of this impairment differs across age groups. That is, young people with BPD are hyposensitive to expressions of social threat (i.e., anger, disgust, fear) (Jovev et al., 2011; Robin et al., 2012), whereas adult patients with BPD and healthy controls in their mid to late twenties do not differ (Domes et al., 2008; Domes et al., 2011; Lowyck et al., 2015), and older BPD patients (in their mid-thirties) are hypersensitive to negative emotional expressions generally (Lynch et al., 2006). With regards to rejection sensitivity, older and younger adults with BPD report heightened trait and state rejection sensitivity (e.g., Berenson et al., 2011; Berenson et al., 2016; R. C. Brown et al., 2017; De Panfilis et al., 2015; Jobst et al., 2014; Staebler, Helbing, et al., 2011). However, the only study assessing state rejection sensitivity in youth with BPD found greater self-reported negative affect at all time points (baseline, reactivity to negative images, and recovery), suggesting consistently heightened negative affect, rather than heightened sensitivity to rejection per se (K. A. Lawrence et al., 2011). Finally, emotional contagion, a component of affective empathy, appears to be similarly heightened in both young people and adults with BPD (Dziobek et al., 2011; Kalpakci et al., 2016; New et al., 2012; Petersen et al., 2016).

The review also identified that several critical areas of social cognition lack comparable data across the developmental periods of interest (i.e., adolescence through adulthood). These include attentional bias to emotional stimuli, cognitive empathy, and the unconscious simulation and empathic concern components of affective empathy. Thus, precluding speculation about the developmental trajectory of these aspects of social cognition in BPD. Dysfunction in each of these areas is theorised to underpin social difficulties in BPD (Arntz, 2014; Beck, 2014; Dinsdale & Crespi, 2013; Harari et al., 2010; Herpertz et al., 2014; Jeung & Herpertz, 2014; Linehan, 1993). It is therefore critical to understand functioning in each of these areas over the course of BPD in order to inform targeted intervention, particularly during the predominant period of first onset for BPD, which is adolescence and young adulthood (Chanen & Kaess, 2012; Fonagy et al., 2015; Kaess et al., 2014). The period spanning adolescence and young adulthood is a sensitive period for the development and consolidation of these processes, and a critical period for the implementation of interventions targeting social cognition (Blakemore & Mills, 2014).

Compared with social cognition, fewer studies have explored the habitual use, and the effective application, of emotion regulation strategies (e.g., distraction, cognitive reappraisal, suppression, mindfulness/acceptance), in people with BPD, compared with healthy controls. Nevertheless, the available empirical evidence indicates that adult patients with BPD, and adults with high or threshold BPD features in non-clinical settings, report greater habitual use of suppression strategies and less use of cognitive reappraisal, distraction, and acceptance/mindfulness strategies, compared with healthy adults/adults with low BPD features (Beblo et al., 2013; Carvalho Fernando et al., 2014; Chapman et al., 2017; C. Sauer et al., 2016). In addition, they can effectively apply various emotion regulation strategies to regulate negative affect (Baczkowski et al., 2016; Chapman et al., 2017; Fitzpatrick & Kuo, 2016; Koenigsberg, Fan, et al., 2009; Kuo et al., 2016; S. Lang et al., 2012; Marissen et al., 2010; Schulze et al., 2011).

The review also identified that emotion regulation research focused on young people with BPD is very limited. Indeed, no studies were identified that compared young people with BPD in clinical settings with healthy young people. Only a handful of studies including university students, or young adults recruited from the community, with BPD features were identified. Findings from these studies are less consistent than those with older adults with BPD/BPD features, and suggest greater habitual use of suppression strategies (Chapman et al., 2013; P. J. Geiger et al., 2014), distraction and cognitive reappraisal (Chapman et al., 2013), less habitual use of acceptance strategies (Chapman et al., 2013), and similar likelihood to choose cognitive reappraisal (Kuo et al., 2017), for young adults with high BPD features, compared with those with low BPD features. Regarding the effective application of emotion regulation strategies, non-clinical young adults recruited from the community/universities, who either met BPD criteria or had high BPD features, could apply suppression and mindfulness, to regulate negative affect as effectively as those who did not meet BPD criteria or had lower BPD features (Chapman et al., 2009; Ruocco, Medaglia, Ayaz, et al., 2010). In addition, BPD features did not differentiate the effectiveness of either distraction or cognitive reappraisal strategies in an undergraduate sample of young adults (Kuo et al., 2017).

Thus, it appears that habitual use of suppression in non-clinical young adult community/student populations with BPD features is not as marked as it is in older adults with BPD/high BPD features. Similar to findings with older adults with BPD/high BPD features, suppression and mindfulness is also effective for younger adults with BPD features in regulating negative affect. However, these observations are based on a handful of studies, all of which used non-clinical samples of young adults. Therefore, generalisations to clinical populations, and to young people outside of university settings and outside that age-group, are limited. Given the current lack of research with young people with BPD recruited from clinical settings, it is difficult to describe the developmental trajectory of emotion regulation in BPD between adolescence and adulthood.

7.2.3 Future directions for social cognition and emotion regulation BPD research.

The literature reviews spanning Chapters 2 and 3 demonstrate that it is inaccurate, and potentially misleading, to assume that social cognition and emotion regulation findings based on adult BPD samples apply equally to young people with the disorder. Instead, the reviews suggest that developmental age, and stage of disorder, might both contribute to a different profile of functioning for young people, relative to adults, with BPD. Therefore, future research exploring social cognition and emotion regulation in BPD should give greater consideration to the role that developmental age and stage of disorder might play, and indeed, how these factors might interact.

Attention to developmental age and stage of disorder is particularly relevant at the onset of BPD, which typically occurs between early adolescence and young adulthood (Biskin, 2015; Chanen, 2015; Chanen & McCutcheon, 2013). This is because this same period of development is critical for the development, and consolidation, of social cognition and emotion regulation processes (Ahmed et al., 2015; Blakemore & Mills, 2014; Brizio et al., 2015; Klapwijk et al., 2013; Riediger & Klipker, 2014). Social cognition and emotion regulation are thought to underpin the chronic and pervasive interpersonal dysfunction experienced by individuals with BPD (Carpenter & Trull, 2013; Crowell et al., 2009; Jeung & Herpertz, 2014; Linehan, 1993; Roepke et al., 2013). Therefore, understanding social cognition and emotion regulation processes in young people, particularly those relatively early in the course of the disorder, will assist in untangling what abnormalities might be due to BPD specific factors, from those factors that might arise later, and which might be associated with age, stage of BPD, and/or chronicity.

A developmental approach will also enable a better understanding of the course of impairment. This knowledge will help to ascertain whether there are critical periods for early intervention for some aspects of socioemotional functioning in BPD. This will, in turn, facilitate the development of targeted interventions that can be offered in a timely manner, and which can specifically aim to prevent chronic interpersonal difficulties. If interventions for BPD are to have greater impact on the long-term negative effects of interpersonal dysfunction and associated functional impairment, greater attention needs to be given to early interventions that target the specific difficulties observed at the onset of BPD (Chanen & Thompson, 2018).

To be able to develop and deliver evidence-based, targeted early interventions, the specific presentation of BPD at the onset of the disorder needs to be better understood. Indeed, the present reviews, and a growing literature (Chanen, 2017), show that BPD in young people is neither akin to BPD in adults, nor a variant of normal development. Therefore, it is recommended that early interventions with youth with BPD carefully consider normative developmental processes, as well as stage of disorder.

To address the current gap in research focused across different developmental ages and stages of BPD, both cross-sectional research, as well as longitudinal research, is needed. This research could assist to track the presentation of social cognition and emotion regulation in BPD, relative to healthy peers, over the course of development and the disorder's trajectory. In addition, it is strongly recommended that future published studies provide improved details regarding participant characteristics with regards to age, and stage of disorder. Based on the reviews in Chapters 2 and 3, it is evident that many studies, for example, do not provide age range, which makes it very difficult to extrapolate developmental periods.

Most studies also provide very little information regarding stage of disorder, if any at all, and most do not currently label stage of disorder. Information such as specificity and severity of symptoms, setting (e.g., acute inpatient vs non-acute inpatient vs outpatient), and information about chronicity (e.g., first/second episode, or unremitting disorder) would assist in characterising samples regarding the stage of disorder (see Chanen et al., 2016, for a proposed staging model of BPD). Better still, studies could use a staging model of BPD, such as that proposed by Chanen et al. (2016), in order to facilitate comparison between studies (whether narrative or statistical). Currently, as discussed in Chapters 2 and 3, developmental age and stage of disorder are confounded in most reviews, and what is observed in adults with BPD is assumed to apply equally to youth (and vice versa). While the current thesis does not claim to have teased these issues apart, the reviews highlight the need to consider these issues when trying to understand socioemotional processing in BPD.

Definitional consistency will also facilitate a broader and more coherent conversation about the trajectory of social cognition and emotion regulation in BPD. To improve consistency between studies it is recommended that future research base operational parameters of developmental periods on universally accepted definitions, such as those proposed by the World Health Organisation (World Health Organisation, 2014). Common parameters will facilitate the comparison of populations across studies in future narrative or systematic reviews, or meta-analyses.

Further consideration also needs to be given to the role, relevance and meaning of findings of studies that rely on non-clinical populations and generalise those findings to clinical BPD populations. For example, many of the studies reviewed in Chapter 3, which focused on emotion regulation in BPD, relied on non-clinical populations, such as university students. Individuals with BPD suffer stigma (Knaak et al., 2015), iatrogenic harm (Chanen & McCutcheon, 2013; Chanen, Velakoulis, et al., 2008; Newton-Howes et al., 2015), and consequences associated with BPD chronicity (Chanen & Thompson, 2018; Skodol et al., 2002; Zanarini et al., 1998b). They also present with high rates of comorbidity (Kaess et al., 2013; Skodol et al., 2002; Zanarini et al., 1998b) and medication use (Bender et al., 2001; Zanarini et al., 2001). None of these factors can be accounted for by studies that recruit non-clinical populations. The impact of these factors is tightly intertwined with the experience of the disorder, and therefore, clinical and non-clinical populations are not interchangeable.

Nevertheless, non-clinical studies do meaningfully contribute to the broader conversation by raising relevant questions and have the practical benefit of being able to be completed in a timely manner. By contrast, clinical BPD populations pose various obstacles for researchers, many of which are consequences of the disorder. For example, acute inpatient admissions, and unstable life-circumstances, can interfere with study protocol completion. These factors are prohibitive, limit achieving suitable participant numbers that afford sufficient statistical power, and hinder completion of studies within a reasonable time-frame. Notwithstanding these challenges, research with clinical BPD populations is important because it enables improved generalisability of findings to the actual populations targeted by interventions.

In summary, the reviews highlight that when trying to understand social cognition and emotion regulation in BPD, it is inappropriate and potentially misleading to assume that findings from BPD studies that span different developmental ages and stages of disorder are interchangeable. These assumptions could ultimately result in misplaced formulations of socioemotional functioning in BPD, which in turn can misinform interventions. In order to be able to develop well informed early, targeted, interventions that aim to prevent chronic interpersonal dysfunction in BPD, future research is needed that attends to socioemotional processing across the different developmental ages and stages of BPD, and that addresses the various remaining gaps.

7.3 Empirical Studies: Summary of Main Findings

Studies 1 and 2 aimed to further current understanding of socioemotional functioning in youth early in the course of BPD.

7.3.1 Rapid facial mimicry in youth with BPD: Main findings.

Study 1 (Chapter 5) represents the first empirical assessment of the unconscious simulation component of affective empathy in BPD. Findings revealed that rapid facial mimicry, an index of unconscious simulation processes involved in affective empathy, is preserved in youth with first presentation BPD, relative to their neurotypical peers. Thus, although it has been argued that abnormalities in unconscious simulation processes might underlie heightened emotional contagion in people with BPD (Herpertz et al., 2014), the current findings suggest that this does not appear to be the case in youth with first presentation BPD.

7.3.2 Emotion regulation in youth with first presentation BPD: Main findings.

Study 2 (Chapter 6) represents the first empirical assessment of the effectiveness with which youth with first presentation BPD can apply expressive suppression and cognitive reappraisal emotion regulation strategies, to regulate negative and positive affect (as indexed by facial expression and self-reported affect), in response to valenced stimuli. In addition, this ability was assessed in a standard laboratory context and in the context of social rejection.

In summary, the current findings suggest that the ability to apply emotion regulation strategies is largely preserved in youth with first presentation BPD. Youth with first presentation BPD were mostly similar to their healthy counterparts with respect to their ability to apply expressive suppression and cognitive reappraisal to regulate both positive and negative affect. Two key differences, however, did emerge. First, relative to healthy youth, cognitive reappraisal was ineffective in the regulation of the expression of negative emotions for youth with first presentation BPD, in the context of social rejection only. Indeed, cognitive reappraisal heightened their negative facial expression in the context of social rejection. Second, relative to their healthy counterparts, BPD youth exhibited a persistent pattern of blunted facial and self-reported positive affect, across the different instructions and contexts.

7.4 Empirical Studies: Implications and Future Directions

7.4.1 Rapid facial mimicry in youth with first presentation BPD: Implications and future directions.

That rapid facial mimicry is apparently preserved in youth with first presentation BPD contradicts theoretical explanations suggesting that heightened emotional contagion in BPD (Dziobek et al., 2011; Kalpakci et al., 2016; New et al., 2012; Petersen et al., 2016) is underpinned by abnormalities in unconscious simulation processes (Herpertz & Bertsch, 2014; Herpertz et al., 2014; In-Albon et al., 2013). It seems that, at least in youth with first presentation BPD, unconscious simulation processes are preserved, and thus are neither the cause of heightened emotional contagion in this group, nor an underlying factor leading to emotion regulation or interpersonal impairments in this group, as has been proposed (Herpertz & Bertsch, 2014; Herpertz et al., 2014; In-Albon et al., 2013).

Future research should therefore explore alternative explanations for the heightened emotional contagion evident in BPD (Dziobek et al., 2011; Kalpakci et al., 2016; New et al., 2012; Petersen et al., 2016). This could include exploration of the influence of other sociocognitive processes that have been found to be affected in young people with BPD. Research with young people with BPD indicates that relative to psychiatric controls, cognitive empathy, as measured by mentalising and social perspective taking tasks, is disturbed in both early (Jennings et al., 2012) and later stage (Sharp et al., 2013; Sharp et al., 2011) BPD. Young people with BPD also have difficulty consciously disengaging from generally negative and neutral emotional facial expressions, compared with their healthy peers (Jovev et al., 2012; von Ceumern-Lindenstjerna et al., 2010b). It is possible that emotional contagion is heightened via the misinterpretation of social situations (through hypermentalisation and immature perspective taking) and increased rumination and stress (through trouble disengaging from distressing emotional situations). The interaction of these processes, therefore, needs further research attention.

In addition, future research should explore whether unconscious simulation processes are also intact in youth with later stage BPD and in adults with BPD at different stages of disorder. If unconscious simulation is also found to be intact in those groups, then it could be that abnormal (i.e., grossly heightened or negatively biased) unconscious mimetic processes do not underlie heightened emotional contagion in BPD at all, contrary to some theoretical proposals (Herpertz & Bertsch, 2014; Herpertz et al., 2014; In-Albon et al., 2013). Thus, alternative explanations, as suggested above, will need to be explored. If, however, unconscious simulation processes are found to be abnormal in adults with BPD, or in late-stage youth with BPD, then it might be that non-specific factors associated with chronicity or severity are implicated in the development of abnormal unconscious mimetic processes over the course of the disorder. If this is the case, then alternative factors underlying heightened emotional contagion need to be better understood in order to be able to target them in treatment.

7.4.2 Emotion regulation in youth with first presentation BPD: Implications and future directions.

7.4.2.1 Emotion regulation ability is largely preserved in youth with first presentation BPD.

The findings of Study 2 suggest that, contrary to theoretical predictions of difficulties applying emotion regulation strategies in BPD (Carpenter & Trull, 2013), youth with first presentation BPD do not experience gross difficulties applying emotion regulation strategies per se. Instead, emotion regulation ability in youth with first presentation BPD was largely preserved. Indeed, they were more alike than different compared with their healthy peers in terms of their ability to regulate both the behavioural expression and subjective experience of negative and positive emotions, across contexts. This predominant similarity has important implications for how emotion regulation is understood in youth early in the trajectory of the disorder. That is, it should not be assumed that they do not have *access* to effective emotion regulation strategies.

Given that the period of development spanning adolescence and early adulthood is a key period for the development and consolidation of emotion regulation (Ahmed et al., 2015), this might be a key time to focus on emotion regulation in youth with first presentation BPD. The broader emotion regulation literature points to the benefits of flexible access to the various emotion regulation strategies, and the ability to select the most appropriate strategy for a range of situations (Aldao et al., 2010; Aldao et al., 2015; Aldao & Tull, 2015; Bonanno & Burton, 2013; Dixon-Gordon et al., 2015; Gross, 2015; Haines et al., 2016). Future research is needed that explores the ability of youth with first presentation BPD to effectively apply the various other emotion regulation strategies, such as acceptance and distraction.

Early intervention research could harness these new findings by evaluating whether providing psychoeducation that assists youth with first presentation BPD identify, understand and strengthen the strategies they already have at their disposal has a positive impact on mental health and psychosocial outcomes. Early interventions could, for example, assist young people with first presentation BPD to identify the types of situations within which different strategies might be beneficial or counterproductive, and could facilitate practicing a range of strategies and developing a repertoire that is most adaptive and promotes functional interpersonal relationships.

Intervention research specifically focused on awareness and development of emotion regulation skills is sparse but promising. Compas et al. (2014) identified several studies that evaluated outcomes following interventions that taught young people emotion regulation skills. The emotion regulation skills taught across these studies included, for example, emotion awareness (Suveg, Sood, Comer, & Kendall, 2009), acceptance (Compas et al., 2009; Fresco, Mennin, Heimberg, & Ritter, 2013), and cognitive restructuring (Compas et al., 2009). Findings are promising, with improvements, for example, in emotional awareness in youth with anxiety disorders (Suveg et al., 2009), and reduced psychopathology for children with depressed parents who received targeted preventative intervention, compared to those who did not (Compas et al., 2009).

There is also reason to believe that psychological interventions more generally, that is, not just those that exclusively target emotion regulation, have a positive impact on emotion regulation. A recent review of the impact of various psychological interventions, including interventions specifically focused on emotion regulation (e.g., Emotion Regulation Group Therapy, Cognitive Behaviour Therapy with Emotion Regulation Skills, Integrative Training of Emotional Competencies) as well as other evidence based psychological interventions (e.g., Acceptance and Commitment Therapy, Dialectical Behaviour Therapy, Cognitive Behaviour Therapy) on emotion regulation outcomes across various disorders (e.g., BPD and depression) indicated broad positive emotion regulation outcomes in 64 out of the 67 studies included (Sloan et al., 2017). The authors recommended the need for future intervention research to assess interventions that specifically target emotion regulation, and which may be added as adjuncts to existing treatments or offered as standalone interventions (Sloan et al., 2017).

7.4.2.2 Cognitive reappraisal is counterproductive in the regulation of negative emotional expression in the context of social rejection.

While youth with first presentation BPD predominantly demonstrated similar emotion regulation ability compared with healthy youth across contexts, cognitive reappraisal, specifically, was counterproductive in the regulation of the behavioural expression of negative emotions in the context of social rejection. Indeed, when youth with first presentation BPD applied cognitive reappraisal in the context of social rejection, their negative facial affect was amplified, compared with the standard laboratory context, and with healthy youth. This raises the question of whether cognitive reappraisal is contraindicated for youth with first presentation BPD or whether they can learn to use it effectively.

Whether cognitive reappraisal can be effective in the context of social rejection for this group is a critical question because cognitive reappraisal it typically considered to be an adaptive emotion regulation strategy (Denny et al., 2015; McRae, 2016; Thiruchselvam et al., 2011) and is central to cognitive behavioural interventions (Beck, 2014; Goldin et al., 2012; Troy et al., 2010). Therefore, future research will need to determine whether cognitive reappraisal can be learnt to be used effectively by youth with first presentation BPD in the acute context of social rejection or not. Alternatively, other strategies need to be considered and their effectiveness in the context of social rejection needs to be assessed.

Cognitive reappraisal is involved in both traditional forms of cognitive restructuring that serve to reframe and reinterpret stimuli (the strategy instructed in the current study), as well as in the reappraisal of one's emotional responses via acceptance strategies that encourage the individual to not judge, but instead accept, their emotions (Webb et al., 2012). Acceptance strategies are also used widely, including with children and young people, despite little being understood of the effectiveness of this strategy in this age group, and much of the research focus to date being on adults (Burke, 2010; Zenner et al., 2014). Future research should thus seek to determine whether different forms of cognitive reappraisal (including acceptance strategies) can be coached/taught to be effective in the context of social rejection for youth with first presentation BPD. In the absence of such evidence, it is recommended that psychological interventions use cognitive reappraisal strategies with caution for youth with first presentation BPD when being applied in the context of social rejection. For example, psychoeducation to increase awareness of the potential utility and pitfalls of cognitive reappraisal, and in particular its limited effectiveness when feeling acutely socially rejected, could be provided.

If cognitive reappraisal cannot be learnt by youth with first presentation BPD to be effectively applied in the context of social rejection, then alternative strategies will need to be considered and evaluated. Recent advances in the emotion regulation literature have highlighted the value of greater flexibility with regards to access and implementation of various strategies depending on factors such as timing and context, and there is growing acknowledgement that emotion regulation strategies are neither adaptive nor maladaptive, but instead, that each has its place and functional relevance (Aldao et al., 2010; Aldao et al., 2015; Aldao & Tull, 2015; Bonanno & Burton, 2013; Dixon-Gordon et al., 2015; Gross, 2015).

For instance, the current findings indicate that expressive suppression was effective for both groups in regulating the expression of negative emotion. Consistent with research suggesting that suppression strategies, and in particular expressive suppression, have short-term benefits in the regulation of anger (Chapman et al., 2009; Desatnik et al., 2017; Germain & Kangas, 2015), expressive suppression could have a place in the immediate regulation of the behavioural expression of negative, and in particular aggressive, emotions for youth with first presentation BPD in the context of social rejection. The regulation of emotional responses, including the behavioural expression of negative emotions, can be invaluable in social situations (Eisenberg et al., 2000; Gross, 2014; Gross & John, 2003; Halberstadt et al., 2001; John & Gross, 2004). Being able to, for example, temporarily control ones urges to express anger behaviourally by applying expressive suppression specifically, could be used as a circuit-breaker that enables individuals to step away from a challenging situation. Once away from the situation, alternative strategies might be able to be applied, such as cognitive reappraisal, to process and better understand the event in hindsight.

However, research evidence indicates that chronic use of suppression strategies is associated with poorer long-term outcomes (Aldao et al., 2010; Gross & John, 2003; Gross & Thompson, 2007; Webb et al., 2012). Therefore, if expressive suppression is to be used as a short-term strategy, it should be done so with caution. For example, rather than offering training in expressive suppression strategies per se, psychoeducation regarding what expressive suppression is and what it looks like in practice could be provided, thereby increasing conscious awareness of its use, and facilitating conscious control and choice in terms of when expressive suppression might be temporarily useful. Adults with BPD (Beblo et al., 2013; Carvalho Fernando et al., 2014) and young people with BPD features (Chapman et al., 2013; P. J. Geiger et al., 2014) are already more likely to habitually use suppression strategies compared with other strategies, and are more likely to use suppression than neurotypical individuals. However, it is likely that they are not consciously aware of the regulatory choices they are making, of their short- and long-term consequences, or of the various alternative regulation strategies available to them.

Future research is clearly needed to explore other emotion regulation strategies that might be effective for youth with first presentation BPD in the context of social rejection. These strategies include, for example, acceptance and distraction, and other strategies along the continuum of emotion regulation offered by Gross's process model of emotion regulation, such as situation selection and attentional deployment (Gross, 1998a, 2014; Gross & Thompson, 2007).

7.4.2.3 The context of social rejection needs to be considered in emotion regulation research and treatments for youth with first presentation BPD.

While emotion regulation (e.g., Beblo et al., 2013; Carpenter & Trull, 2013; Crowell et al., 2009; S. Lang et al., 2012; C. Sauer et al., 2016) and rejection sensitivity (e.g., Beeney et al., 2014; Gunderson & Lyons-Ruth, 2008; Renneberg et al., 2012) have separately received significant theoretical and research attention in the BPD literature, these constructs have rarely overlapped in experimental research. However, recent advances in the emotion regulation literature suggest that context is a key consideration when trying to gain a comprehensive understanding of emotion regulation ability (Aldao et al., 2010; Aldao et al., 2015; Aldao & Tull, 2015; Bonanno & Burton, 2013; Dixon-Gordon et al., 2015; Gross, 2015). It is not sufficient to consider emotion regulation strategies without giving due attention to the various factors that might interact to make each strategy situationally appropriate or inappropriate, functional or dysfunctional.

Compared with the standard laboratory context, the context of social rejection is much more ecologically valid for individuals with BPD (Knaak et al., 2015; Lam et al., 2016; Markham, 2003). Therefore, the reduced ability to regulate behavioural expressions of negative emotions in this context has major implications for interpersonal functioning for this group (Berenson et al., 2011; Gunderson, 2007; Whisman & Schonbrun, 2009). Thus, to better understand emotion regulation in individuals with BPD, this study indicates that future research should attend to the context within which emotion regulation strategies are applied, in particular the context of social rejection. The broader emotion regulation literature is beginning to explore the role of the various emotion regulation strategies in this context (e.g., Hales, Wesselmann, & Williams, 2016; Molet, Macquet, Lefebvre, & Williams, 2013; Wesselmann, Ren, Swim, & Williams, 2013). However, this research is also in its infancy and much remains to be understood of the benefits and drawbacks of applying different emotion regulation strategies in this context (Riva, 2016).

Future research evaluating the application of emotion regulation strategies in BPD populations, therefore, should consider the context of social rejection. This could be done by, for example, combining emotion regulation paradigms with social rejection paradigms as was done in the current study. Alternatively, given that individuals with BPD experience high levels of social rejection in their daily lives (Gunderson, 2007; Knaak et al., 2015; Lam et al., 2016), ecological momentary assessment or ambulatory assessment might facilitate the ability to capture emotion regulation in the context of social rejection in the daily lives of individuals with BPD. These methodologies lend greater ecological validity and could facilitate greater understanding of the overlap between emotion regulation and relevant contexts. A recent study involving a community sample (not a BPD study), for example, used ecological momentary assessment to explore the impact of cognitive reappraisal in the context of situations that were perceived as either more or less controllable (Haines et al., 2016). Such a methodology could be modified to assess emotion regulation in situations where either more or less social rejection occurs/is perceived.

Based on the current findings, treatments with youth with first presentation BPD could aim to improve insight regarding the impact of social rejection on emotion regulation. Social rejection (including its perception) could be framed in therapy as a trigger that leads to reduced effectiveness of cognitive reappraisal. Increased awareness of internal or environmental triggers (which are referred to by different names in different psychotherapies, including ‘traps’ or ‘prompting events’) is a key component of various psychotherapies, including, for example, Cognitive Behavioural Therapy, Cognitive Analytic Therapy, and Dialectical Behaviour Therapy (Beck, 2014; Linehan, 2017; Ryle, 1997). Thus, psychoeducation regarding the possibility that acute social rejection can be a trigger for temporarily reduced effectiveness of cognitive reappraisal could easily be incorporated into such therapies.

Of course, it is also possible that the context of social rejection is but one social or stressful situation that interferes with the effective application of emotion regulation strategies in BPD. Future research should also explore different situations and contexts that might impact the effective application of different emotion regulation strategies for individuals with BPD.

7.4.2.4 Positive affect is pervasively blunted in youth with first presentation BPD, but its regulation is intact.

The most salient, though incidental, finding with respect to positive affect was the pervasive blunting, across indices and contexts, observed for youth with first presentation BPD, relative to their healthy peers. But importantly, like their healthy peers, youth with first presentation BDP were also able to actively regulate their positive affect across contexts. There is promising new research in the broader emotion regulation literature indicating benefits of both selectively down-regulating, and up-regulating positive affect. Intentional and selective down-regulation of positive affect has been shown to improve attention, judgement, and interpersonal functioning (Kashdan et al., 2015), and to promote cohesion in interdependent relationships (Le & Impett, 2013). Up-regulation of positive emotions, on the other hand, is considered a promising avenue for improving engagement and memory (Martin & Ochsner, 2016). Thus, future research with BPD populations should not disregard the notable and pervasively blunted positive affect in youth with first presentation BPD, and could, for example, explore whether there are any benefits of up-regulating positive affect for this group.

7.5 Strengths and Limitations of this Thesis

7.5.1 Strengths and limitations of the reviews.

It should be noted that the constructs that were included in Chapter 2, and the emotion regulation strategies selected for consideration in Chapter 3, are not exhaustive. Nevertheless, they do represent the most studied areas of social cognition and emotion regulation in BPD. The scope and the narrative approach, nevertheless, enabled the identification of various inconsistencies that appear to be the result of grouping everyone with BPD together without consideration of developmental age or stage of disorder. By attending to this often-overlooked issue, the current thesis was able to speculate about possible developmental patterns in the development/course of sociocognitive and emotion regulation impairments in BPD, and was able to identify gaps in our understanding of the course of these processes in BPD, which has, in turn, enabled recommendations for future research.

7.5.2 Strengths and limitations of empirical studies.

A number of specific strengths and limitations have already been addressed in each empirical chapter. Here, attention is given to broader strengths and limitations of the empirical studies.

The current study focused on youth with first presentation BPD specifically, therefore the current findings cannot be generalised to youth with later stage BPD, or to adults with BPD. However, the focus on youth with first presentation BPD is a critical feature of the current thesis that adds unique value to current understanding of socioemotional functioning in the early stages of BPD. This is important because, despite significant advances in the treatment of BPD over the past several decades (Bateman, Gunderson, & Mulder, 2015), severe, pervasive, and debilitating interpersonal dysfunction across various contexts persists for individuals with BPD (Bateman et al., 2015; Gunderson et al., 2011; Lis & Bohus, 2013; Wilson et al., 2017). A focus on early intervention, particularly with youth with early stage BPD, has the potential to reduce and prevent the long-term damaging effects of severe BPD and its secondary consequences, such as psychosocial disability (Chanen & Kaess, 2012; Chanen & Thompson, 2018; Fonagy et al., 2015; Kaess et al., 2014). Social cognition and emotion regulation, two critical processes considered central to healthy interpersonal functioning (Adolphs, 2001; Brothers, 2002; Eisenberg et al., 2000; Gross, 2002; Southam-Gerow & Kendall, 2002), are thought to underlie interpersonal dysfunction in BPD (Jeung & Herpertz, 2014; Linehan, 1993; Putnam & Silk, 2005; Roepke et al., 2013). Moreover, the period between adolescence and young adulthood is a sensitive period critical for the development and consolidation of these processes (Ahmed et al., 2015; Blakemore & Mills, 2014). Because this might be a critical time for early intervention focused on social cognition and emotion regulation for youth with first presentation BPD, this thesis focused on this period and thus the empirical studies make a critical contribution to understanding these processes in youth early in the course of BPD specifically.

Future research could expand on the current findings by analysing the effect of age on rapid facial mimicry ability and emotion regulation ability. The current thesis emphasised the importance of understanding the developmental trajectory of social cognition and emotion regulation in BPD. To this end, the reviews synthesised relevant findings to date from a developmental perspective, and the empirical studies were a first step towards understanding these mechanisms in youth (as defined by the World Health Organisation, 2014) early in the trajectory of BPD compared with typically developing peers. To better understand the effect of age over the course of BPD, future research should include cross-sectional and longitudinal studies that compare individuals across various developmental periods, including early adolescence, late adolescence, young adulthood, and later adulthood. Such studies could assist to better understand mechanisms that might be involved in changed sociocogntive and emotion regulation functioning sometime between early adolescence and later adulthood in individuals with BPD. Given the challenges of recruiting and retaining individuals with BPD in research studies, longitudinal and cross-sectional that explores developmental trajectories as suggested here would likely require collaboration across centres.

Given that the experimental procedures for Studies 1 and 2 were undertaken by each participant within the same testing session, lasting approximately 1.5 to 2 hours, it is possible that fatigue could have impacted results. Indeed, it has been reported that EMG facial responses are particularly vulnerable to the effects of fatigue, which typically leads to reduced facial muscle activity (Abd-Elfattah, Abdelazeim, & Elshennawy, 2015). Being the final task, emotion regulation in the context of social rejection would arguably have been the most likely to have been affected. However, this does not appear to have been an issue in Study 2, as an increase in corrugator facial EMG response was recorded (rather than a decrease), which is a pattern better explained by the impact of context. The blunted positive facial and self-reported affect observed for youth with first presentation BPD, relative to healthy youth, was also unlikely due to fatigue, as this effect was observed across both contexts, and not just in the later context of social rejection.

Another potential limitation is the risk of order effects. Participants attended a single 1.5 to 2-hour testing session during which the emotion regulation task in the standard laboratory context was administered before the emotion regulation task in the social rejection context. The potential for order effects were considered, however, given that it was necessary to limit the testing time and keep the number of sessions to 1 in order to reduce participant burden and reduce attrition it was necessary to present the standard condition before the social rejection condition. Had the two conditions been counterbalanced, there would have been no way of ensuring that feelings associated with the rejection condition would not have been carried over into the standard condition. To reduce the risk of order effects future research could counterbalance the standard and the social rejection conditions and administer each of them a couple of weeks apart rather than during the same testing session.

Finally, the current research elected to include BPD participants with various comorbidities. The presence of comorbidities can cloud interpretations, making it difficult to clearly differentiate which outcomes are due to BPD and which to other disorders. However, high rates of comorbidity in BPD are typical rather than rare (Grant et al., 2008; Kaess et al., 2013; Lenzenweger et al., 2007). Therefore, the findings of the current research more accurately capture a clinically representative sample of youth with first presentation BPD, and are thus more generalisable (Ha et al., 2014; Kaess et al., 2013; Skodol et al., 2002). In addition, the current thesis did not seek to elucidate factors unique to BPD. Instead, the focus was developmental. Thus, both the reviews and empirical studies considered socioemotional functioning in BPD relative to typical development in non-clinical populations.

Whether socioemotional functioning differs for BPD compared with other clinical disorders could be explored by future research by including a clinical control group. Based on the current findings of pervasively blunted positive affect, it is recommended that future research include a depressed clinical control group. Individuals with anxiety disorders, such as social anxiety disorder, might also be of interest as a clinical control group due to the high rates of comorbidity with BPD (Zanarini et al., 1998a) and evidence of socioemotional difficulties (Caouette et al., 2014; Seefeldt, Krämer, Tuschen-Caffier, & Heinrichs, 2014; Thai, Taber-Thomas, & Pérez-Edgar, 2016). To date, neither rapid facial mimicry nor the impact of social rejection on the ability to apply specific emotion regulation strategies have been explored in either of these populations.

7.6 Overall Conclusions

This thesis makes a novel and important contribution to our understanding of two key factors thought to underlie interpersonal dysfunction in BPD: social cognition and emotion regulation. First, this thesis demonstrated that while there might be similarities, there are also important differences between young people and adults with BPD in terms of their sociocognitive functioning and emotion regulation abilities. As such, this thesis raises the possibility that these differences could be a function of developmental age or stage of disorder, or a complex interaction of both. Therefore, it is recommended that future research not continue to overlook the potential role of age and stage by assuming that all findings arising from adult BPD research applies equally to youth, and vice versa. Similar caution is advised when interpreting findings pertaining to young people with early- versus late-stage BPD. Second, the empirical studies demonstrated that, relative to their healthy peers, unconscious simulation processes and emotion regulation ability are largely preserved in youth with first presentation BPD. These findings contradict theoretical models of BPD, which implicate heightened unconscious motor simulation (Herpertz & Bertsch, 2014; Herpertz et al., 2014), and a lack of access to effective emotion regulation strategies (Carpenter & Trull, 2013), in the negative behavioural, emotional and interpersonal difficulties observed in individuals with BPD. However, the context of social rejection did cause unique emotion regulation difficulties for youth with first presentation BPD, which were not evident in their neurotypical peers. In light of these findings, the context of social rejection should be taken into account when trying to understand and treat interpersonal dysfunction in youth with first presentation BPD. Indeed, well-established components of cognitive behavioural interventions might be counterproductive in the challenging, but commonly experienced, context of social rejection for this group.

Overall, this thesis has broad implications for how we understand socioemotional functioning in BPD across different ages and stages of disorder, and has specific implications for our understanding of, and targeted early intervention efforts regarding, affective empathy and emotion regulation early in the trajectory of BPD. Ultimately, better understanding and early targeted treatment of social cognition and emotion regulation impairment evident in youth in earlier stages of BPD has the potential to reduce the chronic and debilitating impact of interpersonal dysfunction over a lifetime.

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Appendices

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Appendix A. Description of Cognitive and Affective Empathy Tasks Used in Previous BPD Research

Task	Cognitive Empathy	Affective Empathy	Task description	Operationalisation & scoring
Advanced Theory of Mind Test (or Strange Stories) (Happé, 1994)	✓		24 short vignettes accompanied by a picture (cartoon) and two test questions ('was it true, what x said?' and 'why did x say that?'); 12 story types: lie, white lie, joke, pretend, misunderstanding, persuade, appearance/reality, figure of speech, sarcasm, forget, double bluff, and contrary emotions.	Answers to questions about vignettes: Arntz (2009) rated answers as incorrect (0 points), partially correct or implicit answer (1 point), or complete and explicit answer (2 points)
Basic Empathy Scale (Jolliffe & Farrington, 2006a)	✓	✓	20-item self-report questionnaire. Cognitive empathy (9 items; e.g., "I find it hard to know when my friends are frightened") and affective empathy (11 items; e.g., "I don't become sad when I see other people crying") subscales.	Items are rated on a 5-point Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). High scores indicate greater empathy. The ratings are added to yield a score for each subscale.
Expression Attribution Test (EAT) (Langdon, Coltheart, & Ward, 2006)	✓		Assesses affective theory of mind. Five cartoon strips, with 3-5 frames each. One to two characters are shown in a situation that would induce a predictable emotional state (e.g., happy or disappointed). The characters' faces are blank, and participants choose the correct expression from a set of cards.	Percentage of emotions accurately identified.
False Belief Picture Sequencing Task (Langdon & Coltheart, 1999)	✓		Assesses cognitive understanding of false beliefs. Participants complete ten sets of four-card cartoon sequences. They are instructed to "arrange them in the correct order so they make a logical sequence of events". Three story types: social scripts assess social script reasoning (x 2), mechanical stories assess cause and effect reasoning (x 2), and false belief stories assess ability to infer mistaken belief (x 4).	Mean scores for the three story types calculated.

Appendix A. continued

Task	**Cognitive Empathy**	**Affective Empathy**	**Task description**	**Operationalisation & scoring**
Faux-Pas task (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999)	✓	✓	Participants listen to or read 20 stories that might contain a social faux pas. They are asked about whether a character said something awkward (i.e., whether a faux pas was committed). If a faux pas is correctly identified, participants are asked about 1) whether the person committing the faux pas was aware or unaware that they had said something inappropriate (intentionality); and 2) about emotional attribution indicating understanding that the person hearing the faux pas might have felt insulted or hurt (emotional attribution).	Questions following vignettes: Total score of 20. 1 point for each correctly identified faux pas and for non-faux pas stories correctly rejected. Intentionality and emotional attribution are scored out of 10
Interpersonal Negotiation Strategies Interview (INSI) (Schultz, Yeates, & Selman, 1989)	✓		Assesses social perspective taking. Six hypothetical vignettes involving situations of interpersonal conflict across various social relationships (employer, parent, friend). In the Jennings et al. (2012) study, themes were either neutral or BPD relevant (abandonment, mistrust/abuse, deprivation). Participants are asked about their negotiation strategies, across 4 functional steps (defining problem, generating strategies, selecting and implementing strategy, evaluating response and outcomes) and responses are scored.	Strategies are scored from *egocentric* (level 0- involve impulsive and physical behaviours to achieve goals and avoid harm) through to *third person/mutual* (level 3- require consideration and integration of the needs of the self and the other). A mean score is allocated for each functional step within each vignette. Scores for vignettes averaged to yield social perspective taking score.
Interpersonal Reactivity Index (IRI) (Davis, 1980, 1983)	✓	✓	28-item self-report questionnaire. Four subscales assessing cognitive empathy: Perspective Taking (PT; tendency to spontaneously adopt the psychological point of view of others) and Fantasy Scale (FS; tendency to transpose oneself imaginatively into the feelings and actions of fictitious characters); and affective empathy: Empathic Concern (EC; feelings of sympathy and concern for unfortunate others), and Personal Distress (PD; feelings of personal anxiety and unease in tense interpersonal settings)	Self-report questionnaire: Participants rate how well the item describes them on a 0-4 five-point scale (0 = 'does not describe me well'; 4 = 'describes me very well')

Appendix A. continued

Task	**Cognitive Empathy**	**Affective Empathy**	**Task description**	**Operationalisation & scoring**
Joke Appreciation Task (Langdon, Ward, & Coltheart, 2010)	✓		Originally designed to assess cognitive TOM in schizophrenia. Participants are presented with six TOM jokes, in the form of a cartoon, that require participants to understand the ignorance or false belief of the cartoon character. Another six non-mental state control jokes are also presented. These jokes are based on physical humour.	Responses are audio-taped and scored 0–3.
Ladisich (1988) novel task	✓ (?)		Two existing self-report questionnaires were used as the basis for calculating empathy scores: Giessen-Test (GT) (Beckmann & Richter, 1972): 40-items based on psychoanalytic theory (e.g., “ I think I tend to seek 3210123 avoid the company of others”); 7-point Likert scale; 6 sub-scales (Social Response, Dominance, Self-Control, Underlying Mood, Permeability, Social Potency); Unpleasant Personality Hierarchy Test (UPHT) (developed for Ladisich study):21-items, 3 subscales, describing personality features (e.g., “People who always contradict others”) which are ranked from most to least unpleasant feature.	Questionnaire rating of self and other: Overall empathy score was calculated first separately for the GT and UPHT by subtracting patient prediction of other self-rating (what patient predicted others would rate themselves) from actual other self-rating (actual rating other patient gave to self). These difference scores were then added to arrive at a total empathy score
Mental States Attribution Task (MSAT) (Brüne, 2005)	✓		Two components: 1) MSAT-S (sequencing): Six cartoon picture stories, with two representing each of 3 types of scenarios (cooperation between two characters, one character cheating the other character, cooperation of two characters at the cost of a third). Each story had 4 cards and individuals logically sequence cartoon pictures into coherent stories. 2) MSAT-Q (questions): participants are then asked 23 mentalizing questions about the character’s beliefs and intentions	Correct card sequencing order: 2 points each for the first and fourth correctly sequenced cards, and 1 point each for the 2econd and fourth correctly sequences cards. Answers to questions about vignettes: 1 point per correct answer

Appendix A. continued

Task	**Cognitive Empathy**	**Affective Empathy**	**Task description**	**Operationalisation & scoring**
Movie for Social Cognition (MASC) (Dziobek et al., 2006)	✓		Individuals watch a 15-minute film about four characters getting together for a dinner party. The video is paused 45 times and each time participants are given multiple choice questions (option of four answers) about the emotions, thoughts, and mental states of the characters. Only one answer is correct and the other three are wrong. Wrong answers are categorised into 'overmentalising' (excessively attributing intentions or personal meaning), 'reduced TOM' (capable of mentalising but person does it incorrectly), and 'no TOM' (lack of mentalising ability)	Multiple choice questions about film: Correct response = 1-point, incorrect response = 0-points; 15 items assess interpretation of emotions; 14 that of intentions; and 4 that of thoughts
Multifaceted Empathy Test (MET) (Dziobek et al., 2008)	✓	✓	Photographs showing 23 pairs of pictures with people in emotionally charged situations. Participants select correct mental state from a list of 4 (cognitive empathy). Participants are then given feedback about the correct mental state. They are then asked to rate how strongly they felt the mental state (e.g., anxiety) while viewing the characters on a 9-point analogue scale (affective empathy).	Cognitive empathy- Correct responses are scores as one point. Affective empathy- Overall score as well as separate scores for positive and negatively valanced pictures are calculated.
Reading the Mind in the Eyes (RMET) (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001)	✓		Individuals infer mental states from 36 black and white photographs of the eye-area of the face. Participants choose one word out of 4 presented to them, 3 of which are distracters. A glossary is provided.	Select correct mental state (multiple choice): A total score out of 36 is given. Items can also be categorised into positive valence (8), negative (12) and neutral (16)

Notes. TOM = theory of mind

Appendix B-1. Melbourne Health Human Research Ethics Committee Study Approval Letter

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MELBOURNE HEALTH

OFFICE FOR RESEARCH

MELBOURNE HEALTH HUMAN RESEARCH ETHICS COMMITTEE
ETHICAL APPROVAL OF A RESEARCH PROJECT

A/Prof Andrew Chanen
Orygen, The National Centre of Excellence in Youth Mental Health
Locked Bag 10
PARKVILLE VIC 3052

6th January 2015

Dear A/Prof Chanen,

MH Project Number: 2014.190

Project Title: How feelings are understood and managed by young women with borderline personality disorder and major depressive disorder.

HREC Approval Date: 5th January 2015

I am pleased to advise that the above project has received ethical approval.

Participating Sites:

- Orygen, The National Centre of Excellence in Youth Mental Health
- Orygen Youth Health Clinical Program
- Headspace Sunshine
- Australian Catholic University

Approved Documents:

- Protocol dated 16th December 2014
- Participant Information and Consent Form Version 2 dated 16th December 2014
- Parent or Guardian Information and Consent Form Version 2 dated 16th December 2014
- Appendix A – Debriefing Part A
- Appendix B – Debriefing Part B
- Appendix C – Debriefing Part C
- Case Report Form dated 29th October 2014
- Hospital Anxiety and Depression Scale (HADS)

Other Noted Documents:

- Executive Summary

Site Specific Assessment:

Please note: You cannot commence this study until you have completed all the requirements of the Site Specific Assessment and have received the "Approval to Conduct a Research Project at Melbourne Health" certificate.

Conditions of Ethics Approval:

The Melbourne Health HREC operates and is constituted in accordance with the National Statement on Ethical Conduct in Human Research 2007.

In order to comply with the National Statement on Ethical Conduct in Human Research 2007, Guidelines for Good Clinical Research Practice and Melbourne Health Research Policies and Guidelines you are required to:

- Submit a copy of this letter to the Radiation Safety Officer (RSO) at Melbourne Health, for addition of the project to the Licence for Research Involving Human Volunteers held by the Department of Human Services Radiation Safety Section Radiation Safety Licence (if your project involves exposure to ionising radiation). Note: You cannot commence the project until you have received notification from the RSO that the project has been added to the Licence;
- Notify the HREC of the actual start date of the project;
- Submit to the HREC for approval any proposed amendments to the project including any proposed changes to the Protocol, Participant Information and Consent Form/s and the Investigator Brochure;
- Notify the HREC of any adverse events in accordance with the Melbourne Health *Guidelines for Monitoring and Reporting of Safety in Clinical Trials Involving Therapeutic Products and Other Clinical Research, July 2009;*
- Notify the HREC of any unforseen events;
- Notify the HREC of your inability to continue as Principal Investigator or any other change in research personnel involved in the project;
- Notify the HREC if a decision is taken to end the study prior to the expected date of completion or failure to commence the study within 12 months of the HREC approval date;
- Notify the HREC of any other matters which may impact the conduct of the project.
- If the study is a clinical trial, Melbourne Health requires registration of clinical trials in a public trials registry at or before the time of first patient enrolment as a condition of consideration for publication, in accordance with ICMJE http://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/clinical-trial-registration.html

Reporting

You are required to submit to the HREC:

- An Annual Progress Report every 12 months (or more frequently as requested by the reviewing HREC) for the duration of the project. This report is due on the anniversary of HREC approval. Continuation of ethics approval is contingent on submission of an annual report in a timely manner; and
- A comprehensive Final Report upon completion of the project.

The HREC may conduct an audit of the project at any time.

Please refer to the Office for Research website to access forms such as the Amendment Form, Annual Report/Final Report Form, Guidelines for Monitoring and Reporting of Safety in Clinical Trials Guidelines and Adverse Event Report Forms, and other information and news concerning research at Melbourne Health:
http://www.mh.org.au/www/342/1001127/displayarticle/1001352.html

A list of those HREC members present at the review of this project can be obtained from the above website.

Yours sincerely

JT

Ms. Jessica Turner
Manager - Human Research Ethics Committee

The Melbourne Health HREC operates and is constituted in accordance with the National Statement on Ethical Conduct in Human Research 2007.

Appendix B-2. Australian Catholic University Research Ethics Committee Study Approval Email

From: Kylie Pashley on behalf of Res Ethics
Sent: Tuesday, February 24, 2015 4:14 PM
To: Peter Rendell
Cc: Gill Terrett; Res Ethics
Subject: 201500037R Registration of External Ethics Approval

Dear Peter,

Principal Investigator: Prof Peter Rendell
Co-Investigators: Dr Gill Terrett, Ruby Warber, Louise Margaret Tempany, Prof Andrew Chanen, Dr Martina Jovev, Dr Jennifer Betts, Elizabeth Pizarro-Campagna
Ethics Register Number: 201500037R
Project Title: How feelings are understood and managed by young women with borderline personality disorder and major depressive disorder.
Risk Level: Multi Site
Date Approved: 24/02/2015
Ethics Clearance End Date: 31/03/2017

The Australian Catholic University Human Research Ethics Committee has considered your application for registration of an externally approved ethics protocol and notes that this application has received ethics approval from Melbourne Health [Reference: 2014.190].

The ACU HREC accepts the ethics approval with no additional requirements, save that ACU HREC is informed of any modifications of the research proposal and that copies of all progress reports and any other documents be forwarded to it. Any complaints involving ACU staff must also be notified to ACU HREC (National Statement 5.3.3)

We wish you well in this research project.

Regards,

Kylie Pashley
on behalf of ACU HREC Chair, Dr Nadia Crittenden
Ethics Officer | Research Services
Office of the Deputy Vice Chancellor (Research)
res.ethics@acu.edu.au

Appendix C-1. Participant Recruitment Information Letter and Consent Form – Adult Participant

Participant Information and Consent Form (PICF)
Version #3 Dated 09/02/2015
Protocol number: 2014.190
Site: Orygen, The National Centre of Excellence in Youth Mental Health (Orygen)

Full Project Title:
How feelings are understood and managed by young people with borderline personality disorder and major depressive disorder.

Principal Investigator	*Professor Andrew Chanen*
Associate Investigators	*Professor Peter Rendell, Dr Gill Terrett, Dr Martina Jovev, Dr Jennifer Kay Betts*
Students	*Elizabeth Pizarro, Ruby Warber, Louise Tempany*

Part 1 What does my participation involve?

1 Introduction

You are invited to take part in this research project because you participated in the STRESS study and said you might like to take part in other studies.

This form tells you about the research project and explains what is involved. This should help you decide if you want to take part in the research or not.

Please read this form carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not to take part you might want to talk about it with a relative, friend or local health worker.

Participation in this research is voluntary. If you don't wish to take part, you don't have to.

If you decide you want to take part in the research project, you will be asked to sign the consent section. By signing it you are telling us that you:
• Understand what you have read
• Consent to take part in the research project
• Consent to be involved in the research described
• Consent to the use of your personal and health information as described.

You will be given a copy of this Participant Information and Consent Form to keep.

2 What is the purpose of this research?

The main goal of this study is to understand Borderline Personality Disorder (BPD) and Major Depressive Disorder (MDD) better so that we can develop helpful treatments for young people with these difficulties.

We know that people with BPD have difficulties with their relationships and that having MDD can lead to relationship problems. We need to know more about why this happens.

This research will help us understand two processes that might play a role in these relationship difficulties:

1. Trouble feeling what someone else feels. This is called *affective empathy*; and
2. Trouble handling one's emotions. This is called *emotion regulation*.

If we can understand affective empathy and emotion regulation better in young people with BPD and MDD we think this will help us develop treatments that address these issues. This is important because we know that treating mental health problems early helps to prevent more serious problems later on.

3 What does participation in this research involve?

If you agree to take part in this study you will be invited to complete three tasks during a 90 minute appointment at Australian Catholic University (ACU) in Fitzroy. You can choose to be transported by car by the researcher or you can make your own way there if you prefer.

We will ask you to complete two questionnaires. The first questionnaire asks about how you felt over the past week. It has 14 items and you will complete this once. The other questionnaire has 10 items and asks about how you feel at that moment. We will ask you to fill this in a few times throughout the tasks. We will also place small sensors on the skin of your face and arm. The sensors are smaller than the nail on your pinkie finger and do not cause pain. These sensors will tell us about sweat gland activity.

The three tasks we will ask you to complete are:

1) Task 1- We will show you photos of faces showing different feelings. While you do this the sensors will quietly collect information about your sweat gland activity.
2) Task 2 - We will show you different pictures that might make you feel good or bad. For example, there are pictures of people or things that might make you feel happy and other pictures that might make you feel sad. We will give you instructions to control your feelings while you look at the pictures. We have made sure that inappropriate or very negative pictures are not included. You will be asked to fill in the questionnaire about how you are feeling at that moment, and the sensors will quietly continue to collect information about your sweat gland activity.
3) Task 3- During this task you will be taking part in a nationwide investigation of Internet-based chat-room communication among young people. A photo will be taken for your temporary online profile for the study. You will view profiles of other young people participating in the study. Those peers will also view your profile. You will each choose who you want to chat to online. While the online chat is set up (it will take a few minutes as the peers are based at another university), Task 2 needs to be repeated to ensure we have accurate data, and then the actual online chat will take place.

So that we can make sure that the information we collect with the sensors is accurate, you will be video recorded throughout the tasks. This is needed because the sensors we are using are very sensitive to any movements. The recording will help us check if the information we get from the sensors is due to something like you sneezing and so we can decide not to use that bit of information.

We also ask your permission to use the information collected during the STRESS study. This includes, for example, information about your age and any mental health issues you might have. If we can get this information from the STRESS study this means we don't have to ask you the same questions twice.

4 Other relevant information about the research project

Although participants will be recruited from the STRESS study, it is not a follow-on study from that project and is therefore unrelated.

5 Do I have to take part in this research project?

Participation in any research project is voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

If you do decide to take part, you will be given this Participant Information and Consent Form to sign and you will be given a copy to keep.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine care, your relationship with professional staff or your relationship with Orygen, or OYHCP.

6 What are the possible benefits of taking part?

We cannot guarantee or promise that you will receive any benefits from this research. But we do think that you will find the tasks engaging and interesting.

We expect that that the long term effects of this study will benefit individuals with BPD and MDD by increasing our understanding of the factors contributing to difficulties experienced by people with BPD or MDD. We hope that this will inform treatment of the disorders.

7 What are the possible risks and disadvantages of taking part?

Psychological distress
There are no physical risks involved in participating in this study. But it is possible that some participants might find the tasks stressful or uncomfortable.

The pictures and questionnaires used in this study have been used in many studies with young people including people with BPD and MDD. These pictures and questionnaires are not known to cause harm or bad effects.

The sensors have also been used with young people and with people with BPD and MDD. The sensors have not been found to cause stress in the past and we do not expect that young people in this study will find the sensors problematic. The sensors are small, easy to place and remove, and not known to cause any pain or discomfort to participants.

Task 3, the online chatroom task, might be stressful to some people because of its social nature. However, we expect that any stress caused by the task will be small. We also expect that the level of stress the task will cause will be similar to the day-to-day stress people might experience in their usual social interactions. This task was developed for young people, has been used with healthy young people and young people with anxiety disorders, and has not been found to cause harm. It has not been used with young people with BPD. However, similar tasks have been used with young people with depression and BPD and have not been found to cause adverse effects.

8 What if I withdraw from this research project?

If you do consent to participate, you may withdraw at any time. If you decide to withdraw from the project, please notify a member of the research team before you withdraw. A member of the research team will inform you if there are any special requirements linked to withdrawing.

If you decide to leave the research project, the researchers will not collect additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want your data to be included, you must tell the researchers when you withdraw from the research project.

9 Could this research project be stopped unexpectedly?

This research project may be stopped unexpectedly for a variety of reasons, including a serious adverse event. You will be notified by mail if the project was stopped due to such an event.

10 What happens when the research project ends?

If you would like, a summary of the results of the project can be sent to you when the data is analysed and the results of the study have been published.

Part 2 How is the research project being conducted?

11 What will happen to information about me?

The information we collect will remain confidential, subject to mandatory legal requirements. Only the principal investigator, Prof Andrew Chanen and members of the research team listed on this form will have direct access to information collected for this project.

All the information collected will be stored electronically on computer files, electronic databases or paper-based files, during and after the project. In order to ensure privacy, each participant will be given a code and the information we collect will only be labelled with these codes. Participant names and contact details will not be stored with the other information. Participant names and contact details will be kept at Orygen in a separate password protected computer file.

The electronic data collected at ACU will be kept at ACU in a computer database only accessible with an electronic password. Paper-based questionnaire data will be kept in a locked filing cabinet, in a locked office at ACU. A copy of the electronic and questionnaire data will be provided to Orygen. This will be kept in a password-protected electronic database at Orygen.

The STRESS study information will be kept at Orygen in an electronic database only accessible via password. Paper-based STRESS data will be kept in a locked filing cabinet, in a locked building at Orygen. A copy of electronic STRESS data will be provided to ACU, and it will be stored in a password-protected database at ACU. This data will not have any names or other identifying information. It will only be labelled with a code.

The video recordings of participants (described in Section 3 earlier on in this form) will only be used to make sure the data collected by the sensors is accurate. While this checking is happening the video recordings will be stored as media files in a password protected computer. Once this checking is complete, these media files will be deleted. The profile photo taken for Task 3 (described in Section 3 earlier on in this form) will only be kept while you complete the tasks. It will be deleted as soon as the tasks are completed and before you leave the session at

ACU. This Participant Information and Consent Forms (PICF) will be kept separate from any other information we collect. It will be kept in a locked filing cabinet, in a locked office at ACU. All other information will be kept for at least 7 years after the results of the research are published.

By signing the consent form you consent to the research team collecting and using the information collected about you for the research project. In addition, in the consent section of this form, you will be given the option of consenting for your information to be used for future projects. You will also be given the option of consenting to be contacted for future research. Any information obtained in connection with this research project that can identify you will remain confidential.

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that you cannot be identified. This will be done by only using combined group data for publications and presentations.

In accordance with relevant Australian and/or Victorian privacy and other relevant laws, you have the right to request access to the information about you that is collected and stored by the research team. You also have the right to request that any information with which you disagree be corrected. Please inform the research team member named at the end of this document if you would like to access your information.

Any information obtained for the purpose of this research project and for the future research described that can identify you will be treated as confidential and securely stored. It will be disclosed only with your permission, or as required by law.

12 Complaints and compensation

If you suffer an injury as a result of participating in this research project, hospital care and treatment will be provided by the public health service at no extra cost to you if you elect to be treated as a public patient.

There are no costs associated with participating in this research project, nor will you or the participant be paid. However, you will be reimbursed a fixed amount of $50 for any expenses associated with the research project visit.

13 Who is organising and funding the research?

This is a joint project between Orygen and ACU. It will include a primary PhD project, and two smaller minor Master student subprojects. The results of this research will be used by the student researchers Elizabeth Pizarro to obtain a Doctor of Philosophy degree, Ruby Warber to obtain a Master of Clinical Psychology degree, and Louise Tempany to obtain a Master of Clinical Psychology degree. The student researchers will be supervised by Professor Andrew Chanen (Orygen), Professor Peter Rendell (ACU), Dr Gill Terrett (ACU), and Dr Martina Jovev (Orygen).

Each organisation will fund different aspects of the project.

14 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the HREC of Melbourne Health. This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007). This statement has been developed to protect the interests of people who agree to participate in human research studies.

15 Further information and who to contact

The person you may need to contact will depend on the nature of your query. If you want any further information concerning this project or if the participant has any problems which may be related to involvement in the project, you can contact the researcher on 03 9342 2800 or any of the following people:

Research contact person

Name	Professor Andrew Chanen
Position	Deputy Director of Research, Orygen, The National Centre of Excellence in Youth Mental Health
Telephone	03 9342 2800
Email	andrew.chanen@mh.org.au

Reviewing HREC approving this research and HREC Executive Officer details

Reviewing HREC name	Melbourne Health Human Research Ethics Committee
HREC Executive Officer	Ms Jessica Turner
Telephone	03 9342 7602
Email	Jessica.Turner@mh.org.au

Appendix C-2. Parent or Guardian Recruitment Information Letter and Consent Form – Child (15-17 years) Participant

Parent or Guardian Information and Consent Form (PICF)
Version #3 Dated 09/02/2015
Protocol number: 2014.190
Site: Orygen, The National Centre of Excellence in Youth Mental Health (Orygen)

Full Project Title:
How feelings are understood and managed by young people with borderline personality disorder and major depressive disorder.

Principal Investigator	*Professor Andrew Chanen*
Associate Investigators	*Professor Peter Rendell, Dr Gill Terrett, Dr Martina Jovev, Dr Jennifer Kay Betts*
Students	*Elizabeth Pizarro, Ruby Warber, Louise Tempany*

Part 1 What does the young person's participation involve?

1 Introduction

This is an invitation for the young person in your care to take part in this research project. They have been invited because they participated in the STRESS study and because they said they may be interested in participating in other studies.

This form tells you about the research project. It explains what is involved.. This should help you decide if you want the young person to take part in the research or not.

Please read this form carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not the young person can take part, you might want to talk about it with a relative, friend or local health worker.

Participation in this research is voluntary. If you do not wish the young person in your care to take part, they do not have to.

If you decide you want the young person to take part in the research project, you will be asked to sign the consent section. By signing it you are telling us that you:
• Understand what you have read
• Consent to the young person taking part in the research project
• Consent to the young person being involved in the research described
• Consent to the use of the young person's personal and health information as described.

You will be given a copy of this Participant Information and Consent Form to keep.

2 What is the purpose of this research?

The main goal of this study is to understand Borderline Personality Disorder (BPD) and Major Depressive Disorder (MDD) better so that we can develop helpful treatments for young people with these difficulties.

We know that people with BPD have difficulties with their relationships and that having MDD can lead to relationship problems. We need to know more about why this happens.

This research will help us understand two processes that might play a role in these relationship difficulties:

1. Trouble feeling what someone else feels. This is called *affective empathy*; and
2. Trouble handling one's emotions. This is called *emotion regulation*.

If we can understand affective empathy and emotion regulation better in young people with BPD and MDD we think this will help us develop treatments that address these issues. This is important because we know that treating mental health problems early helps to prevent more serious problems later on.

3 What does participation in this research involve?

If the young person is interested in taking part in this study they will be invited to complete three tasks during a 90 minute appointment at Australian Catholic University (ACU) in Fitzroy. They can choose to be transported by car by the researcher or they can make their own way there if they prefer.

We will ask the young person to complete two questionnaires. The first questionnaire asks about how they felt over the past week. It has 14 items and they will complete this once. The other questionnaire has 10 items and asks about how they feel at that moment. We will ask them to fill this in a few times throughout the tasks. We will also place small sensors on the skin of their face and arm. The sensors are smaller than the nail on your pinkie finger and do not cause pain. These sensors will tell us about sweat gland activity.

The three tasks we will ask them to complete are:

1) Task 1- We will show the young person photos of faces showing different feelings. While they do this the sensors will quietly collect information about their sweat gland activity.
2) Task 2 - We will show the young person different pictures that might make them feel good or bad. For example, there are pictures of people or things that might make them feel happy and other pictures that might make them feel sad. We will give them instructions to control their feelings while they look at the pictures. We have made sure that inappropriate or very negative pictures are not included. The young person will be asked to fill in the questionnaire about how they are feeling at that moment, and the sensors will quietly continue to collect information about their sweat gland activity.
3) Task 3- During this task the young person will be taking part in a nationwide investigation of Internet-based chat-room communication among young people. A photo will be taken for their temporary online profile for the study. They will view profiles of other young people participating in the study. Those peers will also view their profile. They will each choose who they want to chat to online. While the online chat is set up (it will take a few minutes as the peers are based at another university), Task 2 needs to be repeated to ensure we have accurate data, and then the actual online chat will take place.

So that we can make sure that the information we collect with the sensors is accurate, the young person will be video recorded throughout the tasks. This is needed because the sensors we are using are very sensitive to any movements. The recording will help us check if the information we get from the sensors is due to something like the young person sneezing and so we can decide not to use that bit of information.

We also ask your permission to use the information collected during the STRESS study. This includes, for example, information about the young person's age and any mental health issues they might have. If we can get this information from the STRESS study this means we don't have to ask the same questions twice.

4 Other relevant information about the research project

Although participants will be recruited from the STRESS study, it is not a follow-on study from that project and is therefore unrelated.

5 Does the young person have to take part in this research project?

Participation in any research project is voluntary. If you do not wish for the young person to take part, they do not have to. If you decide that they can take part and later change your mind, you are free to withdraw the young person from the project at any stage.

If you do decide that the young person can take part, you will be given this Participant Information and Consent Form to sign and you will be given a copy to keep.

Your decision that the young person can or cannot take part, or that they can take part and then be withdrawn, will not affect their routine care, relationship with professional staff or relationship with Orygen, or OYHCP.

6 What are the possible benefits of taking part?

We cannot guarantee or promise that the young person will receive any benefits from this research. But we do think that the young person will find the tasks engaging and interesting.

We expect that that the long term effects of this study will benefit individuals with BPD and MDD by increasing our understanding of the factors contributing to difficulties experienced by people with BPD or MDD. We hope that this will inform treatment of the disorders.

7 What are the possible risks and disadvantages of taking part?

Psychological distress
There are no physical risks involved in participating in this study. But it is possible that some participants might find the tasks stressful or uncomfortable.

The pictures and questionnaires used in this study have been used in many studies with young people including people with BPD and MDD. These pictures and questionnaires are not known to cause harm or bad effects.

The sensors have also been used with young people and with people with BPD and MDD. The sensors have not been found to cause stress in the past and we do not expect that young people in this study will find the sensors problematic. The sensors are small, easy to place and remove, and not known to cause any pain or discomfort to participants.

Task 3, the online chatroom task, might be stressful to some people because of its social nature. However, we expect that any stress caused by the task will be small. We also expect that the level of stress the task will cause will be similar to the day-to-day stress people might experience in their usual social interactions. This task was developed for young people and has been used with healthy young people and young people with anxiety disorders, and has not been found to cause harm. It has not been used with young people with BPD. However, similar tasks have been used with young people with depression and BPD and have not been found to cause adverse effects.

8 What if I withdraw the young person from this research project?

If you do consent for the young person to participate, you may withdraw them at any time. If you decide to withdraw the participant from the project, please notify a member of the research team before withdrawal. A member of the research team will inform you if there are any special requirements linked to withdrawing.

If you decide that the participant is to leave the research project, the researchers will not collect additional personal information, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with law. You should be aware that data collected up to the time of withdrawal will form part of the research project results. If you do not want the participant's data to be included, you must tell the researchers when withdrawing from the research project.

9 Could this research project be stopped unexpectedly?

This research project may be stopped unexpectedly for a variety of reasons, including a serious adverse event. You will be notified by mail if the project was stopped due to such an event.

10 What happens when the research project ends?

If you would like, a summary of the results of the project can be sent to you and the young person when the data is analysed and the results of the study have been published.

Part 2 How is the research project being conducted?

11 What will happen to information about the young person?

The information we collect will remain confidential, subject to mandatory legal requirements. Only the principal investigator, Prof Andrew Chanen and members of the research team listed on this form will have direct access to information collected for this project.

All the information collected will be stored electronically on computer files, electronic databases or paper-based files, during and after the project. In order to ensure privacy, each participant will be given a code and the information we collect will only be labelled with these codes. Participant names and contact details will not be stored with the other information. Participant names and contact details will be kept at Orygen in a separate password protected computer file.

The electronic data collected at ACU will be kept at ACU in a computer database only accessible with an electronic password. Paper-based questionnaire data will be kept in a locked filing cabinet, in a locked office at ACU. A copy of the electronic and questionnaire data will be provided to Orygen. This will be kept in a password-protected electronic database at Orygen.

The STRESS study information will be kept at Orygen in an electronic database only accessible via password. Paper-based STRESS data will be kept in a locked filing cabinet, in a locked building at Orygen. A copy of electronic STRESS data will be provided to ACU, and it will be stored in a password-protected database at ACU. This data will not have any names or other identifying information. It will only be labelled with a code.

The video recordings of participants (described in Section 3 earlier on in this form) will only be used to make sure the data collected by the sensors is accurate. While this checking is happening the video recordings will be stored as media files in a password protected computer. Once this checking is complete, these media files will be deleted. The profile photo taken for Task 3 (described in Section 3 earlier on in this form) will only be kept while you complete the tasks. It will be deleted as soon as the tasks are completed and before you leave the session at ACU. This Participant Information and Consent Forms (PICF) will be kept separate from any other information we collect. It will be kept in a locked filing cabinet, in a locked office at ACU. All other information will be kept for at least 7 years after the results of the research are published.

By signing the consent form you consent to the research team collecting and using the information collected about the young person for the research project. In addition, in the consent section of this form, you will be given the option of consenting for the young person's information to be used for future projects. You will also be given the option of consenting for the young person to be contacted for future research. Any information obtained in connection with this research project that can identify the young person will remain confidential.

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that the young person cannot be identified. This will be done by only using combined group data for publications and presentations.

In accordance with relevant Australian and/or Victorian privacy and other relevant laws, you have the right to request access to the information about the young person that is collected and stored by the research team. You also have the right to request that any information with which you disagree be corrected. Please inform the research team member named at the end of this document if you would like to access the young person's information.

Any information obtained for the purpose of this research project and for the future research described that can identify you will be treated as confidential and securely stored. It will be disclosed only with your permission, or as required by law.

12 Complaints and compensation

If the young person suffers an injury as a result of participating in this research project, hospital care and treatment will be provided by the public health service at no extra cost to you if you elect for the young person to be treated as a public patient.

There are no costs associated with participating in this research project, nor will you or the participant be paid. However, the young person will be reimbursed a fixed amount of $50 for any expenses associated with the research project visit.

13 Who is organising and funding the research?

This is a joint project between Orygen and ACU. It will include a primary PhD project, and two smaller minor Master student subprojects. The results of this research will be used by the student researchers Elizabeth Pizarro to obtain a Doctor of Philosophy degree, Ruby Warber to obtain a Master of Clinical Psychology degree, and Louise Tempany to obtain a Master of Clinical Psychology degree. The student researchers will be supervised by Professor Andrew Chanen (Orygen), Professor Peter Rendell (ACU), Dr Gill Terrett (ACU), and Dr Martina Jovev (Orygen).

Each organisation will fund different aspects of the project.

14 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the HREC of Melbourne Health. This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007). This statement has been developed to protect the interests of people who agree to participate in human research studies.

15 Further information and who to contact

The person you may need to contact will depend on the nature of your query. If you want any further information concerning this project or if the participant has any problems which may be related to involvement in the project, you can contact the researcher on 03 9342 2800 or any of the following people:

Research contact person

Name	Professor Andrew Chanen
Position	Deputy Director of Research, Orygen, The National Centre of Excellence in Youth Mental Health
Telephone	03 9342 2800
Email	andrew.chanen@mh.org.au

Reviewing HREC approving this research and HREC Executive Officer details

Reviewing HREC name	Melbourne Health Human Research Ethics Committee
HREC Executive Officer	Ms Jessica Turner
Telephone	03 9342 7602
Email	Jessica.Turner@mh.org.au

Appendix D. Demographics and Background Questionnaire

Study ID# ________________ Date: ________________

DEMOGRAPHICS

To be administered at baseline for clinical groups
To be administered at screening for HC group

Sex:	1 male 2 female	-9 missing -3 not applicable
Age at intake to study:	________ -9 missing	
Date of birth:	___/_____/_____	
Religion: *(can ask client which category)*	1 Buddhism 2 Christianity 3 Hinduism 4 Islam 5 Judaism	6 Other religion (specify ________________) 7 No religion -9 missing -3 not applicable
Main language spoken at home during childhood:	1 English 2 Italian 3 Greek 4 A Chinese language 5 Arabic 6 Vietnamese 7 Spanish	8 German 9 Hindi 10 Macedonian 11 Other (specify __________________) -9 missing -3 not applicable
Postcode of residential address:	________ -9 missing	-3 not applicable
Client's social disadvantage rank: *(code at data entry)*	1 low 2 medium 3 high	-9 missing -3 not applicable
Client's country of birth:	1 Australia 2 United Kingdom 3 New Zealand 4 China 5 Italy 6 Vietnam 7 India	8 Philippines 9 Greece 10 Germany 11 Other (specify __________________) -9 missing -3 not applicable
Are you an indigenous Australian?	1 Yes, Aboriginal 2 Yes, Torres Strait Islander -9 missing	3 Yes, Aboriginal and Torres Strait Islander 4 No -3 not applicable

If migrated, year of arrival in Australia:	______________________ 1 Participant did not know -9 missing	 -3 not applicable
Biological mother's country of birth:	1 Australia 2 United Kingdom 3 New Zealand 4 China 5 Italy 6 Vietnam 7 India	8 Philippines 9 Greece 10 Germany 11 Other (specify ___________________) -9 missing -3 not applicable
Biological father's country of birth:	1 Australia 2 United Kingdom 3 New Zealand 4 China 5 Italy 6 Vietnam 7 India	8 Philippines 9 Greece 10 Germany 11 Other (specify ___________________) -9 missing -3 not applicable
Client's marital status:	1 Never married; currently not in a relationship 2 Never married; currently in a relationship	3 Widowed 4 Divorced 5 Separated 6 Married -9 missing -3 not applicable
Number of children:	_____ -9 missing	 -3 not applicable
Currently living with (please circle all appropriate):	1 Biological Mother 2 Biological Father 3 Stepfather 4 Stepmother 5 Adoptive Parents 6 Foster Parents 7 Siblings 8 Other relatives 9 Other non-relatives	10 Residential Placement 11 Husband/Partner 12 Children 13 Alone 14 Other (specify ___________) -9 missing -3 not applicable

Client's type of accommodation:	1 Crisis Accommodation 2 Hotel 3 Rented Flat/House 4 Rented room 5 Own Flat/House 6 With family of origin 7 Psychiatric ward 8 Supported residential service 9 Half-way house	10 Hostel-type accommodation 11 Group home 12 Homeless 13 Rooming house 14 Boarding house 15 Caravan 16 Other (specify:______________) -9 missing -3 not applicable
Client's current work status (review past month): *(How many hours does the client work per week?)*	1 Full-time gainful employment (31 hours/week or more) 2 homemaker or student 3a part-time gainful employment (11 to 30 hours/ week) 3b part-time gainful employment (10 or less hours/ week) 4 retired 5 full- or part-time volunteer work 6 on medical or psychiatric leave of absence 7 unemployed, whether or not expected to work -9 missing -3 not applicable	
If client is working, current primary occupation:	____________________ -9 missing	-3 not applicable
Client's occupational classification: (code at data entry)	1 Managers 2 Professionals 3 Technicians and Trades Workers 4 Community and Personal Service Workers -3 not applicable	5 Clerical and Administrative Workers 6 Sales Workers 7 Machinery Operators and Drivers 8 Labourers -9 missing
Client's main financial support:	1 Parents 2 Employed full time 3 Employed part time 4 Employed casual 5 Youth Allowance 6 New Start	7 Parenting payment 8 Disability Payment 9 Other (specify ______________) -9 missing -3 not applicable
Main caregiver 1's current primary occupation:	____________________ 1 Not currently working	

who was bread-winner in the family?	-9 missing	-3 not applicable
Main caregiver 1's occupational classification: *(code at data entry)*	1 Managers 2 Professionals 3 Technicians and Trades Workers 4 Community and Personal Service Workers 5 Clerical and Administrative Workers	6 Sales Workers 7 Machinery Operators and Drivers 8 Labourers -9 missing -3 not applicable
Main caregiver 2's current primary occupation:	____________________ 1 Not currently working -9 missing	-3 not applicable
Main caregiver 2's occupational classification: *(code at data entry)*	1 Managers 2 Professionals 3 Technicians and Trades Workers 4 Community and Personal Service Workers 5 Clerical and Administrative Workers	6 Sales Workers 7 Machinery Operators and Drivers 8 Labourers -9 missing -3 not applicable
Client's highest level completed at secondary school: *(MUST have completed and passed this level)*	1 Year 12 or equivalent 2 Year 11 or equivalent 3 Year 10 or equivalent 4 Year 9 or equivalent	5 Year 8 or below 6 Did not go to school -9 missing -3 not applicable
Client's highest level of further education: *(MUST have completed and passed this level)*	1 Postgraduate degree 2 Graduate Diploma/Graduate Certificate 3 Bachelor Degree 4 Advanced Diploma/Diploma	5 Certificate Level 6 Other specify ________________) -9 missing -3 not applicable
Main caregiver 1's highest level of secondary schooling: *(MUST have completed and passed this level)*	1 Year 12 or equivalent 2 Year 11 or equivalent 3 Year 10 or equivalent 4 Year 9 or equivalent	5 Year 8 or below 6 Did not go to school -9 missing -3 not applicable
Main caregiver 1's highest level of further education: *(MUST have completed and passed this level)*	1 Postgraduate degree 2 Graduate Diploma/ Graduate Certificate 3 Bachelor Degree 4 Advanced Diploma/Diploma	5 Certificate Level 6 Other specify ________________) -9 missing -3 not applicable

Main caregiver 2's highest level of secondary schooling: *(MUST have completed and passed this level)*	1 Year 12 or equivalent 2 Year 11 or equivalent 3 Year 10 or equivalent 4 Year 9 or equivalent	5 Year 8 or below 6 Did not go to school -9 missing -3 not applicable
Main caregiver 2's highest level of further education: *(MUST have completed and passed this level)*	1 Postgraduate degree 2 Graduate Diploma/Graduate Certificate 3 Bachelor Degree 4 Advanced Diploma/Diploma	5 Certificate Level 6 Other specify ________________) -9 missing -3 not applicable

Appendix E. Debriefing Script

This script was read out to participants at the completion of the experimental tasks. Participants were able to ask further questions about the study and/or the experiment.

"What I am about to tell you is important. Please don't share this information with other people who might participate in this study.

During this experiment we attached sensors to your skin and told you that these sensors measured sweat gland activity. The sensors were actually measuring the movement of your face muscles. These muscle movements give us information about your emotional expression. We did not tell you this initially because when people are aware that facial muscle movement or emotional expression is being measured they might change their expression. We wished we could tell you sooner and apologise that we led you to believe the sensors were measuring sweat gland activity.

We are now also able to tell you that during the Chatroom task you were only interacting with a computer. None of the young people you saw in the pictures were actually involved in the task. NO OTHER REAL PEOPLE saw your picture or rated you, and you will not chat with another person.

We are interested in understanding how being judged by other people affects young people with mental health issues. In order for us to do this, we needed you to believe you were going to chat with another person because people act differently if they think they are being rated by a person instead of a computer. Also, because this is an experiment, we needed to create interactions that were the same for each participant. If we used real peers, we would not be able to ensure that interactions would be the same each time. And finally, it would be very difficult for us to arrange for an interaction with so many other young people. Therefore, doing this with the computer makes it possible. We wished we could tell you sooner and apologise we led you to believe you would be interacting with real people.

The only thing that we ask is that you do not share this information with other young people who might participate in the study because it is very important that everyone in our study believes that the EMG measures sweat gland activity and that there are real people involved in the Chatroom task. If some people know that they are interacting with a computer and others do not, then our study would not tell us anything and the results would be invalid. If you have any questions or worries, please let us know- we would like very much to discuss this with you and do what we can to make sure you are comfortable with this. Also, even though you should not talk about this with any other young people your age or at school, you should feel free to talk about this with your parents or any mental health professional you may be working with (for example, you can talk about it with your case manager or psychologist at OYHCP).

Do you have any questions?”

Appendix F. Response to Debriefing Form

Thank you for taking part in the study entitled: “How feelings are understood and managed by young people with borderline personality disorder”

We would really like to hear about how you found our explanation of the experiment once it was finished. We have two questions we would like for you to answer anonymously (so please do not write your name or any other identifying information on this questionnaire).

Question 1

What did you think and feel about the way the experiment was explained to you after it finished?

Question 2

How did you feel after the experiment was explained to you?

Please fold this completed form and place in the envelope provided.

Thank you!

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