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Multimodal Emotion Perception in Borderline Personality Disorder

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by

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Abstract

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Borderline personality disorder (BPD) is a chronic disorder characterized by pervasive difficulties in the emotion regulation system. While it is clear that individuals with BPD frequently exhibit intense emotional reactions, lack abilities to effectively manage such emotions, and often engage in serious maladaptive behaviors as a consequence of intense emotions, many aspects of the process by which this sequence occurs are not well understood. One crucial aspect of emotion regulation is the processing and perception of cues from the environment. To date, processing of emotional cues in individuals with BPD has been understudied. Therefore, the purpose of this paper is twofold.   First, a thorough overview of the literature on the development of both emotion regulation and emotion processing will be presented. Next, theories linking emotion processing, emotion regulation and the development of BPD will be critically analyzed. Finally, a study designed to investigate perception and processing in individuals with BPD versus a healthy control group will be presented, and the results will be discussed.   This study presented is the first identified study to examine emotion perception in BPD using a unitary measure of facial and auditory emotion perception, and to then compare the emotion perception measure to a measure of social perception.

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Chapter 1: Introduction

Borderline personality disorder (BPD) is a prevalent, chronic, and often debilitating

disorder (APA, 2000; Linehan, 1993). Diagnostic criteria of BPD include a pervasive pattern of

at least five of the following: frantic efforts to avoid abandonment, a pattern of instability in

relationships, unstable self-image, impulsivity, recurrent suicidal behavior, labile mood, chronic

feelings of emptiness, difficulty controlling anger, and dissociative symptoms when under stress

(APA, 2000, 2013). As the characteristics imply, those with BPD are typically living chaotic,

crisis-ridden lives that are often described as unbearable. The symptom picture can vary widely

(Digre, Reece, Johnson & Thomas, 2009), such that some researchers have suggested that there

are BPD sub-types with varying degrees of psychopathology such as: internalizing -

dysregulated, externalizing - dysregulated, and histrionic - impulsive (Zittel Conklin, Westen, &

Bradley, 2006).

The conceptualization of BPD has been fraught with controversy. For instance, different

theoretical conceptualizations postulate quite varied hypotheses about the core

psychopathological constructs that are believed to underlie the disorder. Some have attributed

behavioral patterns observed in borderline patients to faulty internal object representations

(Kernberg, 1967, 1975, 1976), or to faulty (Fonagy, Target, & Gergely, 2000) or disorganized

attachment (Judd & McGlashan, 2003), and more recently as a disorder of emotion dysregulation

(Linehan, 1993).

One theory that has received a lot of attention and resonates well with the diagnostic

picture of BPD is Linehan's biosocial theory (1993). According to Linehan (1993), BPD is

primarily a disorder of emotion dysregulation and emerges from interactions between individuals

with biological vulnerabilities and specific environmental influences. This theory is based on

biosocial underpinnings, and identifies emotion regulation difficulties as being at the core of the disorder. The dysfunction proposed by Linehan (1993) is one of broad dysregulation across all aspects of emotional responding. Consequences of this dysregulation are a heightened emotional sensitivity, an inability to regulate intense emotional responses, and a slow return to emotional baseline. When emotion dysregulation regularly occurs, it can lead to dysfunctional response patterns during emotionally difficult events (Crowell, Beauchaine, & Linehan, 2009; Linehan, 1993). Over time, the result is that many individuals with BPD experience either extreme emotional responses or a blunting of emotional responses (in emotionally charged situations; Wagner & Linehan, 1999).

In addition, Linehan (1993) proposed that a precursor to the development of BPD and emotion dysregulation occurs within an invalidating environment. An invalidating environment can be characterized by an intolerance of the expression of emotions, which is often coupled with intermittent reinforcement of extreme expressions of emotion (Crowell, Beauchaine, & Linehan, 2009). When a child is raised in this type of environment, according to Linehan (1993), it is communicated to the child that such emotional displays are unwarranted and that emotions should be coped with internally and without parental support. Consequently, the child does not learn how to understand, label, regulate, or tolerate emotional responses and instead learns to oscillate between emotional inhibition and extreme emotional lability (Crowell, Beauchaine, & Linehan, 2009; Linehan, 1993).

In Linehan's model, many of the problem behaviors observed in individuals diagnosed with BPD such as impulsive behaviors, interpersonal problems, dissociative behaviors, and self-injurious behaviors are understood as attempts to modulate extreme emotions; additionally they can also be a means of inducing emotional experience when none exists (e.g. wanting to feel

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'real'; Wagner & Linehan, 1999; Westen, 1991). Furthermore, inaccurate appraisal of interpersonal interactions may fuel interpersonal instability (e.g. assumption of abandonment; alternating extreme views of others or love/hate) thus leading to emotional reactivity and continuing the emotion dysregulation cycle. Consequently, emotion identification and regulation are key targets of intervention in psychotherapeutic treatment for BPD (Linehan, 1993).

As stated above, emotion regulation is understood to be core pathology in BPD, yet much remains to be learned about how and why individuals with BPD have difficulty managing emotions effectively. Therefore, this paper will first review the literature on the childhood development of emotion regulation. Next, one of the first steps in emotion regulation, social information processing, will be reviewed, with a particular focus on the interpretation, or perception of emotional cues. The paper will then return to BPD, and a link between the development of emotion regulation, emotion processing, and the disorder will be offered. Finally, a research study will be presented with the aim of examining differences in emotion processing between individuals with BPD and healthy controls.

Chapter 2: Literature Review

Emotion Regulation

This section reviews the existing literature on emotion regulation. According to Thompson (1994) "Emotion regulation consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions; especially their intensive and temporal features, to accomplish one's goals" (p. 27).   The term "emotion regulation" does not necessarily refer to one's ability to *change* their emotion (e.g. anger to happiness), but rather one's ability to alter the dynamic of a given emotion (Thompson & Meyer, 2007). In other words, individuals use emotion regulation to maintain or modify the intensity, escalation, or extent of an emotional response. Emotion regulation can be contrasted with the term "emotion dysregulation" which has been defined by Linehan and colleagues (2007) as "the inability, even when one's best efforts are applied, to change or regulate emotional cues, experiences, actions, verbal responses, and/or non-verbal expressions under normative conditions" (Linehan, Bohus, & Lynch, 2007, p. 583). Thompson (1991) notes that the degree to which individuals use emotion regulation strategies depends on their goals for the situation, despite whether their goals are shared by others. Therefore, people in seemingly similar situations may react very differently. Thompson and Meyer (2007) caution against viewing differential use of emotion regulation strategies as either inherently optimal or maladaptive, and instead suggested considering emotion regulation strategies as means to an end. This can be contrasted with Linehan's (1993) position that problematic behavior (including suicidality) can be attributed, at least in part, to emotion regulation deficits in individuals. Thus, individuals may not employ emotion regulation strategies either because they do not have such strategies in their behavioral repertoires, or because using them is not required or desirable, given their goals for

any given social situation. Before proceeding further, it will be useful to examine the basic processes understood by researchers to constitute emotion regulation.

Emotion regulation can be either a conscious or an automatic process; it can be conceptualized to exist on a continuum from conscious and effortful to unconscious and effortless. According to Gross and Thompson (2007), one learns from both internal responses and from their environment both how and when to regulate their emotions. Therefore, those in an individual's early environment are believed to be very influential in the development of emotion regulation skills. Researchers have identified several contributing factors, both internal and environmental, that lead to the development of emotion regulation. Because these contributing factors are ongoing moderators of differences in emotion management, individuals reach adulthood with a wide array of abilities in emotion regulation. Unfortunately, as will be discussed below, some internal and environmental factors can put children at risk for under-developed emotion regulation abilities, or in some cases affect-dysregulated psychopathology (Thompson & Meyer, 2007).

Development. The development of emotion regulation is heavily reliant on outside influences, but the influence of neurobiological development cannot be ignored (Thompson & Meyer, 2007). Researchers have generally identified the overall temperament of the child, the prefrontal cortex (including the excretion of cortisol), and the growth of cognitive processes (including the ability to understand emotion), as internal factors related to the development of emotion regulation (Thompson, 1994). As Gunnar and Vazquez (2006) have noted, all of these factors interact with the external environment, including parental and peer influences, creating a tightly intertwined relationship that leads to the development of emotion regulation. For instance, if children are not protected from overwhelming stress in their environment,

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neurohormonal stress systems can become sensitive in ways that can make the child biologically

vulnerable to ongoing problems in stress, or emotion regulation (Gunnar & Vazquez, 2006).

However, the temperament of the child, which is thought to be determined even prior to

exposure to stress, can play a role in the child's reaction to stress (Halberstadt, Denham &

Dunsmore, 2001). Therefore, researchers have some difficulty pinpointing the neurological

influences verses the environmental influences on emotional development. Both will be

discussed extensively here.

Internal influences. *Neurobiology.* Gunnar and Quevedo (2007) explain how, from a

purely biological perspective, people can differ in their vulnerabilities or resilience to stressful

events, and how vulnerabilities to stress can make one prone to developing problems with

emotion regulation. They first explain the role of the sympathetic-adrenomedullary (SAM)

system and the hypothalamic-pituitary-adremocortical (HPA) system. In general, the SAM

releases adrenaline and activates the fight/flight response. The role of HPA is much more

complex, but includes the production of cortisol, the primary hormone that is produced in

response to psychological stress (Flinn & England, 1995). Gunnar and Quevedo (2007) have

identified that HPA supports acute fight/flight responses, but suppresses the impact of the

reactions to such situations, which in simpler terms can be referred to as emotion regulation. The

researchers state that the SAM and HPA systems are centrally connected by limbic brain circuits

and involve the amygdala, hippocampus, and orbital/medial prefrontal cortex. Together, these

brain circuits are all involved in responding to psychosocial stressors (Gunnar & Quevedo,

2007). In the short term, rises in cortisol levels for the activation of the fight or flight response,

supports healthy functioning. When the system is activated repetitively or when cortisol levels

are consistently elevated, the body is more vulnerable to both physical and mental problems (Flinn & England, 1995; Gunnar & Quevedo, 2007).

Certain environmental factors play a role in either the healthy development of this intricate system or how much the system gets taxed or worn down. As mentioned, cortisol is produced by the HPA circuit and plays an essential role in the regulation and support of human functioning (Gunnar & Quevedo, 2007). Researchers have monitored cortisol levels over time, typically through saliva samples, and compared the levels to the environmental stressors of children (Flinn & England, 1995; Gunnar & Quevedo, 2007). Numerous longitudinal studies (Dettling, Gunnar & Donzella, 1999; Dettling & Parker, 2000; Flinn & England, 1995; Gunnar, Sebanc, Tout, Donzella, & van Dulmen, 2003; McBurnett, Lahey, Rathouz & Loeber, 2000) demonstrate that abnormal cortisol levels can cause wear and tear on the 'stress regulation' system, making one more vulnerable to stress regulation difficulties during childhood and into adolescence and adulthood.

As has been mentioned by several researchers before them, Gunnar and Quevedo (2007) also affirm that the primary source of stress and also the most powerful buffers against harmful stressors are the primary caregivers in a child's life. For instance, in a longitudinal study conducted over two years by Gunnar and colleagues (1996), differences in cortisol levels were found between 73 children who had formed secure attachments to their caregivers, and those who had not. In this study, attachment to caregivers (mainly mothers) was determined by the Strange Situation, developed by Ainsworth and Wittig (1969). Cortisol levels were measured through saliva samples.

Briefly, the Strange Situation includes the observation of a parent (instructed to be passive) with their child who is allowed to explore the room. A stranger enters the room and

speaks with the mother and then approaches the child for a brief interaction and leaves. The parent leaves the child alone in the room shortly thereafter, and then returns after a few moments to comfort the child. The response of the child upon reuniting is reportedly an indication of the level of attachment between the mother and child (Ainsworth, 1969). For the experimental portion of the Gunnar and Quevedo (2007) study, infants and toddlers, who were with their caregivers, were presented with a distressing situation (standard care inoculations at 2, 4, 6 and 15 months), and their cortisol levels were measured before and after. Those with secure attachments did not have a rise in cortisol levels, whereas those with insecure attachments did. Furthermore, those with secure attachments did not have rises in cortisol levels, even when they were crying to elicit soothing from their caregivers (a signal of being in distress). Therefore, the authors suggest that a secure attachment has a direct relation to the manner in which children respond to distressing situations and the levels of cortisol they produce to handle such situations (Gunnar et al., 1996).

Studies such as this suggest that children who have insecure attachments have ongoing elevations in cortisol, possibly due to an increased sensitivity to their unstable environment, which causes wear and tear to the HPA system. As mentioned, HPA is thought to be directly involved in the emotion regulation process, as mediated by cortisol levels, and ongoing stress to this system may cause one to become more vulnerable to stress (Gunnar & Quevedo, 2007).

Beyond the role of primary caregivers, family dynamics are also putative factors in cortisol reactivity. Upon longitudinal observation of 247 children, Flinn and England (1995) found that children exposed to traumatic family events and severe caretaking problems had chronic changes in cortisol levels over time. The researchers collected cortisol levels through twice daily saliva samples for 6 days a month over a four month period, for seven years (i.e. 24

days a year over 7 years). Flinn and England (1995) found that children who were raised in stressful environments (e.g. fighting, arguments, belittling) exhibited high levels of cortisol throughout their childhood. The researchers also documented an interesting finding in infants specifically. Those children who were poorly taken care of as infants (e.g. neglected, abandoned by their mother, exposed to parental alcoholism) exhibited either extremely low cortisol levels with occasional high spikes, *or* chronically high levels. Flinn and England (1995) explained that in their sample, chronically low cortisol levels were associated with antisocial and delinquent tendencies in the children, and chronically high levels were associated with anxiety and withdrawal, as the children got older.

In support of the aggression/delinquency finding, a study conducted by McBurnett and colleagues (2000) also found a relationship between cortisol levels and aggression in boys. Twice over four years, saliva samples were collected from 38 boys who had been referred to clinics for "aggression and disruptive behavior." The authors found that low cortisol levels were associated with persistent early onset aggression. Those boys who had low cortisol concentrations at both collections reportedly exhibited triple the number of aggressive symptoms in comparison to those boys who had higher concentrations of cortisol at either collection time (McBurnett et al., 2000).

As children move into more social environments such as day-care and/or school, new stressors emerge and can affect a still developing stress regulation system. Peer interactions can be a significant stressor, especially when social skills have not yet been solidified (Gunnar & Quevedo, 2007). In child care settings, researchers have reported that children with high cortisol levels are also those who are observed to be less socially competent and less able to regulate negative emotions and aggression (Gunnar & Quevedo, 2007). For instance, Dettling and

colleagues (2000) found that both quality of care and child temperament can affect cortisol levels. Using observational rating scales in the environment, and parental and preschool teacher reports as a measure of child temperament, three groups of 20 children (in-home childcare; no outside childcare; and center childcare) were monitored for both the attention the child received and the stimulation the environment provided. The researchers determined that children's cortisol patterns over the day correlated significantly with the amount of attention and stimulation provided by the childcare provider or setting. Children in out-of- home settings that were determined by the raters to provide relatively more focused attention and stimulation, did not have changes in cortisol between home and childcare, while those in settings with relatively less attention and stimulation exhibited higher levels of cortisol production while at the childcare facility. Children whose child care was provided in home did exhibit normal fluctuations in cortisol levels; higher in the morning with decreases in the afternoon (Dettling et al., 2000).

Patterns of cortisol production at childcare were also correlated with child temperament. Dettling and colleagues (2000) found inverse cortisol production (i.e. larger increases in cortisol from morning to afternoon) for children who had been described as having a more emotionally negative temperament, and for those children with less self-control. These cortisol patterns were not the same as those found when the same group of children were at home, suggesting that the influence of the childcare setting caused a stress to the emotional and self-regulation system of the children (Dettling et al., 2000)

Other studies have examined cortisol and peer status of children. In comparison to "liked children," those who are rejected by their peers as early as the preschool years have been observed to have elevations in cortisol levels (Gunnar et al., 2003). The interaction between peer rejection, temperament, and cortisol levels was examined by Gunnar and colleagues (2003).

Preschool teachers completed questionnaires regarding the temperament and aggressiveness of 82 of their students. The researchers collected saliva samples during two five-week periods in the fall and spring. To measure peer rejection, the researchers interviewed each student and had them select three classmates from class photos whom they "especially like" and "really don't like very much." The researchers found that children with poor behavioral control had more aggressive temperaments, and that aggressive children were more likely to be rejected by their peers. Rejected children in turn, exhibited higher cortisol levels. Thus, according to the authors, peer rejection and aggressive temperament are indirectly related to higher cortisol levels (Gunnar et al., 2003).

The findings discussed here illuminate the interaction between biology and environment, whereby peer rejection is associated with aggression and poor emotion regulation, and high cortisol levels are thought to influence the vulnerability to emotional stress (Gunnar & Quevedo, 2007; Gunnar et al., 2003). As has been mentioned here, another internal influence on the ability to emotionally regulate is temperament. While it has proven to be difficult to decipher, researchers have attempted to determine which types of temperament, if any, play a role in whether children become effective at self regulating their emotions.

Temperament. A study conducted by Calkins and Johnson (1998) examined the role of temperament and maternal reactions in toddler's ability to regulate their emotions during unstructured 'free play', teaching tasks with their mother (showing the child how to use a shape sorter), and frustration tasks. The frustration tasks included taking away a toy and putting it in a closed plastic container, showing the child a snack but denying them the food for two minutes, sitting the child in a highchair to wait for a toy for five minutes, and taking a toy from the toddler and putting it behind a glass barrier.

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In seventy-three eighteen- month-old toddlers, the authors assessed individual differences in emotion regulation in relation to physiological arousal, temperamental frustration distress, and maternal reaction to the distress and emotion regulation of their child. They also attempted to determine whether a relationship between all three could predict adaptive or non-adaptive emotion regulation behaviors (Calkins & Johnson, 1998).

Physiological arousal was monitored through heart rate; frustration distress was monitored in 10-second intervals and included monitoring of fussing or crying (latency, frequency, duration, and intensity level 1-5); regulatory behaviors were also monitored at 10-second intervals and included self-comforting, mother-orientation (retreating), distraction, aggression/venting, and constructive coping. Three types of maternal interaction were scored, including frequency of positive guidance (positive expressions, physical affection, and support/guidance), negative control (e.g. negative verbal expressions, physical control, and verbal control), and preemptive interference (not allowing the child to decipher the task on their own; Calkins & Johnson, 1998).

Calkins and Johnson (1998) did not find a direct relation between the physiological arousal (as measured by heart rate) of the toddler and distress. In other words, in this study, heart rate alone was not a predictor of distress in toddlers.   The authors did find a relationship between distress and emotion regulation behaviors, whereby the toddlers who exhibited distress tended to also act aggressively during the frustration tasks. The authors postulate that those toddlers who became distressed may not have yet developed effective coping mechanisms because they had not yet been exposed to situations at home that caused distress, or they may have been prone to becoming more easily frustrated. On the contrary, those children who were not distressed may not have found the tasks frustrating, or may have had opportunities to develop

emotion regulation strategies prior to the experiment. In addition, the authors determined that once distressed, toddlers' abilities to implement emotion regulation were reduced (Calkins & Johnson, 1998). In other words, when distress was not targeted early on, the ability to regulate emotions became inhibited and less likely to occur for the toddler.

Distress of the toddler was also related to the mother's interaction style. The toddlers whose mothers intervened early to assist them in free-play tasks were found to be more easily distressed in the frustration tasks. Those mothers who provided positive feedback and guidance during unstructured play tasks (i.e. no behavioral intervention) had toddlers who implemented constructive coping behaviors during frustration tasks. Interestingly, the authors also found that the more negative and controlling the mother was during play, the less distressed the child was during frustration tasks (Calkins & Johnson, 1998).

Considering these results, Calkins and Johnson (1998) theorized that mothers who do too much for their children may be doing so to avoid emotional outbursts, which may be a characteristic of the child's personality. Furthermore, they suggest that early intervention during tasks not only inhibits the child learning new tasks, but also inhibits the learning of emotion regulation. This inhibiting in turn, fuels a low tolerance for frustration when the child becomes more independent and no longer has their mother to rely on (Calkins & Johnson, 1998). Both positive and negative verbal expressions, according to Calkins and Johnson (1998), may serve to encourage the child to develop self-control.

Eisenberg and colleagues (1996) explain that individual differences in emotional reactivity (including ego resiliency and ego control), are often referred to as temperament in the literature, and are thought to influence the degree and type of emotional responding. These researchers assessed several types of regulation and ego resiliency in a study of 199 children

(102 boys) in grades from kindergarten through third. A secondary goal of the research study was to examine baseline facial and physiological reactivity to a distressful stimulus.

For this research, Eisenberg and colleagues (1996) operationalized resiliency as "the dynamic capacity of individuals to modify their modal level of ego control (regulation) as a function of the demands of the environment" (p. 143). According to this definition, there are two ends of the continuum, high ego resiliency, and ego brittleness. Ego control as mentioned within this definition, is itself defined as "the threshold of operating characteristic of an individual with regard to the expression of containment of impulses, feelings, and desires" (Eisenberg et al., 1996, p.143). According to the authors, ego control is also on a continuum, and includes over-control and under-control (Eisenberg et al., 1996). Neither over- nor under-control is optimal however, but instead, moderate levels are reportedly most effective for social competence. Concerning temperament, Eisenberg and colleagues (1996) expected children with high negative emotionality and low regulation to be prone to behavior problems, and children with high or optimal regulation, regardless of their emotionality, to not exhibit behavior problems.

Eisenberg and colleagues (1996) measured emotionality in children by adult reports, physiologically, and through children's facial expressions. Upon arrival to the research lab, the child was connected to electrodes to measure heart rate and skin conductance. As a baseline measure of physiological activity, the child was shown a film about dolphins that was originally created for use as a meditation video. After the dolphin film, another video was shown which first depicts a girl at home playing in her room, and then a fire starts from the lamp and the girl is seriously burned. This film was used to elicit distress reactions in the child. Mean heart rate was coded for both the dolphin and distress film. Facial expressions for sadness, distress, and gaze aversion were coded every 20 seconds through the entire first film and during the distress

sequence of the second film. The primary parent and the child's teacher completed measures to assess children's problem behaviors, regulation, and emotionality. The secondary parent (typically the father) completed measures of their child's problem behavior and emotional intensity.

Regulation was measured by parent and teacher questionnaire, and behaviorally in children. Parents and teachers completed measures of ego resiliency and control that included approximately 50 scaled items such as 'Is inhibited or constricted' and 'Is resourceful in initiating activities' (Block & Block, 1969). For behavioral observation of regulation, children were instructed to try and complete a puzzle without looking at it. For this task, the puzzle was hidden behind a cloth and inside of a transparent box that the children had to reach into to complete the puzzle. The children could cheat by lifting the cloth that hides the puzzle pieces. They were told that they would receive a prize if they completed the task within five minutes, and a timer was set in the room for the child to start when they began the puzzle. They were instructed to ring a bell if they finished before the timer went off. While doing the puzzle task, observers marked how long they worked on the puzzle without cheating, and how long they lifted the cloth to look at the puzzle (Eisenberg et al., 1996).

In their analyses, researchers determined that reported problem behaviors tended to be associated with low attentional control, low ego control, and lower scores on the puzzle task. Ego resiliency was negatively related to behavior problems. This means then, according to the authors' spectrum of resiliency, that the more *ego brittle* the child, the more problem behaviors the child exhibited. According to Eisenberg et al. (1996), when a child has ego brittleness, they are less flexible in their environment, and have a tendency to become disorganized when under stress.

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As expected, children viewed as high in negative emotionality were rated by all reporters as relatively high in problem behaviors. Further, teachers' and fathers' (but not mothers') reports of conduct problems were also associated with reports of high positive emotional intensity, although this finding was somewhat weaker than for measures of negative emotionality. In general, children rated high in emotional intensity were viewed as high in problem behaviors. These results conclude that children who are reactive in general may have more difficulty than other children behaving in an appropriate manner (Eisenberg et al., 1996).

The authors reported that regulation was a strong buffer against negative emotionality, especially for children with higher degrees negative emotionality. Thus, although regulation by itself generally predicted low levels of problem behavior, regulation ability was seemingly particularly important for children who experience frequent and intense negative emotion (Eisenberg et al., 1996).

Physiologically speaking, children who exhibited relatively high heart rate and facial distress during the baseline period tended to be relatively low in problem behavior. These children were also observed to make quick, small gaze aversions from the distress sequence. Eisenberg and colleagues (1996) postulated that these finding indicate the usefulness of shifting attention as a useful mode of emotion regulation. The findings in this study were consistent with the view that individual differences in regulation and emotionality, separately and in combination, predict externalizing problem behaviors children. Overall, children high in attentional and behavioral regulation, as well as resiliency, were viewed as lower in problem behavior.

In general, it appears as though temperament plays a role in the development of emotion regulation. However, the research cannot accurately decipher the strength of the influence

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without taking into consideration the environmental influences, which will be discussed further a bit later. First, another internal influence that interplays with temperament and the environment is children's cognitive abilities.

Cognitions. As children develop, their cognitive abilities change and expand. Cognitive abilities are considered to be another important factor impacting emotional development. As children internalize cognitive appraisals offered by others, they begin to evaluate their own feelings in comparable ways, and thus learn how to regulate their emotions. Saarni (1979) notes that the development of understanding how and when to regulate the display of emotions depends on both social experiences, whereby children learn the rules of interpersonal behavior, and cognitive capacity, which is necessary to predict how one will be perceived by others. Therefore, when a child is in an environment where interpersonal relationships are not positive, these are the lessons they are internalizing and adapting for use in their lives. In addition, when children are given mixed messages regarding emotional displays, they may find it more difficult to manage their feelings and to decide cognitively what needs to be done in any given situation (Thompson & Meyer, 2007).

Use of display rules. One of the primary constructs hypothesized to underlie emotion regulation in children is that of display rules. Knowledge of emotional expression can be systematically measured through studies that test the use of display rules. The first study identified to use the term 'display rules' and introduce the concept was one conducted by Ekman, Sorenson, and Friesen in 1969. Display rules are defined as "procedures learned early in life for the management of affect displays and include de-intensifying, intensifying, neutralizing, or masking an affect display. These rules prescribe what to do about the display of each affect in different social settings; they vary with the social role and demographic characteristics…"

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(Ekman et al., 1969, p.87). In other words, 'display rules' are guides which determine how one

regulates their emotions, and are used when one wants to express an emotion that is different

than what they are feeling inside (Gnepp & Hess, 1986). Several examples of display rules are

offered by Saarni (1979); for instance, intensifying may be evoked when one opens an

undesirable gift in the presence of others yet facially expresses positive affect to please the gift

giver. De-intensifying, or minimization of affect may occur when it is considered socially

inappropriate to express such affect, such as excitement upon receiving good news in light of

another's misfortune. One may neutralize their affect when receiving criticism or being scolded

in public, such as in school or at work. Lastly, Saarni (1979) argued that masking of emotions

may be done when the feeling is anger but the situation does not socially or culturally allow for

the anger to be expressed, such as when a directive is given by a superordinate who is expecting

enthusiasm.

Cognitively, making the decision of which display rule to employ develops throughout

childhood (Saarni, 1979; Gnepp & Hess, 1986; Harris, Olthof & Terwogt, 1981), along with the

ability to control the degree to which one's internal emotional experiences match their emotional

expressions (Saarni, 1979).   In other words, as children learn display rules, they also learn that

their internal and external affect don't necessarily have to match (Saarni, 1979). Several studies

conducted to research this concept are described below (Gnepp & Hess, 1986; Harris, Olthof &

Terwogt, 1981; Saarni, 1979).

Saarni (1979) was the first to research the development and use of display rules in

children. The goal of her study was to determine whether there was an age effect in the

utilization of display rules, the nature of reasoning which display rule is used, the

implementation of display rules, whether additional people involved had an effect in the choice

of display rule, and whether display rules were used more frequently after prompting (Saarni, 1979). The author presented three groups of ten girls and ten boys, with average ages of 6.7, 8.6, and 10.7 years old, with four scenarios of a child and one other person engaging in a conflict or stressful situation (e.g., boasting about skating abilities and then falling down; Saarni, 1979). To examine the influence of the person involved in the scenario, the author provided two variations of each scenario; one included a familiar peer or adult, and the other an unfamiliar. The scenarios were depicted over four photographs, with the last photograph showing the target child turned away so as not to see their facial expression. The subjects were asked to choose the facial expression for the target child from four pictures, of which one depicted a neutral expression, one matched the expression of the child in the next to last photograph, one had an expression that represented the normal emotion expected in the situation, and one that was incongruent to the situation. Each child was asked the reasoning for their choice, why it was appropriate for the situation, and if there were other emotional expressions that could have been chosen and why. Analysis included the number of spontaneously given display rules, number of display rules offered after prompting, reasoning behind implementing a display rule (when one was offered), and a descriptive of why a facial expression was chosen (despite use of display rules). The analysis of reasoning was divided into four subgroups including 'maintaining self-esteem,' 'avoiding further trouble or worse consequences,' 'maintaining a relationship' (e.g. you wouldn't want to hurt your friend's feelings) and 'maintenance of norm' (e.g. it's impolite to show you feel that way). Complexity of reasoning was scored on a continuum from 1 to 5, with 1 representing a random choice of facial expression (e.g. "I don't know why I picked it") and 5 representing the choice of a facial expression discrepant to what the subject identified the child as feeling, i.e. they implemented a display rule.

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Saarni (1979) found that the ten-year-olds surpassed the six and eight year-olds in their number of spontaneously given display rules, their complexity of reasoning, and their use of norm maintenance in their reason for using a display rule. Six- and eight-year-olds only implemented display rules about 25% of the time, while ten-year-olds used display rules 50% the time. When display rules were used, all three age groups reported use in order to avoid negative consequences for themselves more than they reported use to maintain a relationship or prosocial norms. Saarni (1979) offers that the small percentage of display rules implemented by the two younger age groups may be a representation of a lack of knowledge of display rules, or, it could be a representation of a lack of knowledge of the ability to regulate facial expressions (which could also represent the *inability* at that age to regulate facial expressions). In addition, Saarni (1979) postulated that children develop use of self-protective display rules much earlier than prosocial display rules. However, one limitation to these findings is that three of four of the stories given elicited self-protective display rules.

To further research the development of emotions and the use of display rules, Harris and colleagues (1987) surveyed 72 children that were divided into three age groups (6- 11- and 15-years-old). Specifically, across age groups, they compared the ability to identify emotions, the strategies used to regulate emotions (i.e. maintain self-control), and the children's perspective on the effects their emotions have on cognitive processes. Each child was interviewed separately and asked two sets of questions; one pertaining to happiness and the other pertaining to either anger or fear (split within groups). In response to the questions eliciting the identification of when and how an emotion is felt, the researchers found that the number of children who identify situational cues (e.g. Q: When are you happy? A: When it's my birthday) decreases with age, while the number offering mental cues (e.g. internal thought verifies thinking everything is fine)

increases (Harris et al., 1987). In other words, the six year olds were typically not able to

identify internal aspects of emotion, which possibly is an indication, according to the authors,

that they have a harder time realizing that outward expression is not always an indication of inner

feeling. Two questions given to the subjects targeted this hypothesis. The answers the children

gave alerted researchers that the two older groups were better able to provide reasons of how and

why they or someone else might be able to mask their emotion. Furthermore, the researchers

concluded that the older children realized the detection of their emotion depends on how they

behave in a situation (Harris et al., 1987).

When the children were asked if it were possible to pretend an emotion, and how they

would do this if they wanted, all age groups stated they could pretend another emotion by their

actions or facial expressions. When asked whether they could actually change their emotional

state, the youngest group attributed that only a change in situation could alter their emotion,

whereas the two older groups proposed using cognitive strategies, such as redirecting thoughts,

as a means to change their emotion.

Lastly, Harris and colleagues asked the subjects about the effects their emotions have on

how other people perceive them and how they perceive others. All age groups acknowledged

that people seem nicer when one is experiencing a positive rather than negative emotion, and that

happiness typically has a positive effect on person perception and task performance. To the

contrary, the children mention that negative affect has a negative effect (Harris et al., 1987). In

summary, Harris and colleagues suggest that for younger children, emotions are identified in

themselves and others by situation (e.g. birthday, fight) and behavioral reactions (e.g. laughing,

crying), and for older children, cognitive strategies are incorporated in their identification.

Gnepp and Hess (1986) conducted a study that found results in agreement with both Saarni (1979) and Harris, Olthof and Terwogt (1981). In their study of 1st, 3rd and 5th graders (18 boys and 18 girls in each group), the researchers compared the development of display rule knowledge, and how and when prosocial versus protective display rules are utilized. Each child was read eight brief affect-laden scenarios from one of three conditions; alone (child in story is alone), audience (child in story is with at least one other person), or prompted audience (the child is with others but wants to mask their emotion). The scenarios used were borrowed from the Saarni (1979) research study described earlier. After the scenario, the subjects were asked what response the child in the story would give, what their facial expression would be, and why they would give both of these responses. The subjects were given drawings of five facial expressions to choose from (happy, sad, angry, afraid, and neutral). Gnepp and Hess (1986) decided on five categories by which to code responses: unregulated emotional reaction, where the child expressed true feelings with no indication that social norms may be appropriate (e.g. sadness upon receiving a disappointing gift); emotional reaction does not require regulation, where the child expresses true feelings and it is not necessary to conceal them (e.g. happy to receive a gift, even if it's not exactly what was wanted); motivated expression of true emotion, where true expression was given due to a prosocial or self-protective reason (e.g. should always tell the truth); display rule, where the child's expression did not reflect his true feelings, but masked it for prosocial or self-protective reasons (e.g. pretending to like a gift to not hurt the givers feelings); and coping, where the expression did not reflect the child's true feelings and the purpose of masking was to help the child feel better (e.g. she would feel better if she pretended she was happy).

Consistent with previous studies (e.g. Saarni, 1979), Gnepp and Hess (1986) found an age-related increase in the ability to use and describe display rules. They found the ability to use display rules increased steadily from 1st to 5th grade, with a plateau in use between 5th and 10th grade. As expected, children in the 'alone' condition were marked to express their true emotion 80% of the time, suggesting that the subjects were aware of the social expectations to control their emotions when around others, as made evident by their answers using display rules or coping.

Of the 96 children who included the use of display rules in their answers, 85 indicated verbal more often than facial display rules (i.e. noting what the child would say in the scenario to mask an emotion as opposed to how they would change their facial expression). The authors explain that this may be due to more verbal reinforcement than expression. In other words, children are redirected or coached in what to say more readily than they are told how to look, and most likely learn facial expression display rules through observation rather than redirection (Gnepp & Hess, 1986). In addition, subjects utilized display rules more in situations that involved prosocial means as opposed to self-protective. Gnepp and Hess (1986) explained that these findings make sense in light of the fact that children are often coached on how to modify their expressive behaviors to protect other's feelings, but are often left to their own devices to learn how to manage their own emotions.

Overall, the authors found that first graders steadily reported facial expressions that were congruent with the emotion in the scenario and only have minimal understanding of verbal display rules, and do not use them regularly. By third grade, the use of verbal display rules has increased significantly, but facial expressions still match the true emotion elicited in the scenario. By Fifth grade verbal display rules have developed even further, as well as an understanding of

the ability to change one's facial expression, but the use of facial display rules were still not employed on a consistent basis. By tenth grade however, there was not much change in the subject's suggestion of using verbal display rules or facial display rules, suggesting that the learning curve for display rules reached its cap sometime around the age of eleven (Gnepp and Hess, 1986).

In conclusion, for emotion regulation to occur in development, cognitive strategies, particularly the use of display rules, must be employed. The learning of display rules, while a cognitive component, is highly influenced by environmental factors. Environmental influences in fact, are a crucial aspect in the development of emotion regulation. The internal influences may determine how regulation is learned, but the environment is what offers material for learning. Several environmental influences are discussed below.

Environmental influences. As previously noted, parental influences and family environments are considered to play an enormous role in the development of emotion regulation abilities (e.g. Eisenberg, Cumberland & Spinrad, 1998; Eisenberg et al., 2003; Thompson & Calkins, 1996; Thompson & Meyer, 2007). The ways in which parents respond to their children's emotions, and the ways in which parents emotionally express themselves, are thought to either undermine or facilitate the development of emotion regulation (Eisenberg et al., 1999). For instance, research has found that during infancy, emotion regulation is in part dependent on the parent's timely response and level of sensitivity to the child's need for intervention (Gable & Isabella, 1992; Kogan & Carter, 1996). Furthermore, as Thompson and Meyer (2007) suggest, parents can structure children's experiences to make emotional demands predictable and manageable. They have observed for instance, that emotion regulation becomes more readily apparent when parents construct daily routines that include a consideration for their children's

temperament, activity level, and tolerance for stimulation (Thompson & Meyer, 2007). In the

environment, Thompson and Meyer (2007) have agreed that parents can foster emotional

development by making attempts to distract children from events that may be too frightening or

distressing; assisting in problem solving when the child becomes too frustrated; and helping the

child with cognitive restructuring when he or she becomes aggravated (e.g. reminding the child

"It's just a game"). By being role models of emotion regulation, parents inadvertently teach their

children ways to respond emotionally (Thompson & Meyer, 2007).

Thompson and Meyer (2007) generalize that children who are raised in environments that

support positive emotional expression, and where emotion regulation is modeled, typically learn

emotion regulation skills. For instance, research suggests that when parents display positive

emotions, and respond supportively and sympathetically to their children's emotions, the

children learn adaptive ways of coping with their emotions not only in the immediate situation

but for ones to come (Gross & Thompson, 2007). In addition, constructive responses can affirm

a child's feelings, which provide social support in coping with the situation (Thompson &

Meyer, 2007).

Implications during infancy. Research demonstrates development of emotion regulation

skills as early as infancy. Those in the field of emotional development have indicated several

ways in which parents have the ability to foster the development of emotion regulation skills.

Researchers have documented that mothers who positively facilitate their infant's arousal during

face-to-face play are structuring and modeling emotion regulation (Gable & Isabella, 1992;

Kogan & Carter, 1996). Furthermore, the reactions to cues given by the infant to stop playing or

to increase the activity, can inadvertently teach emotion regulation skills through the feedback

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they receive via supportive or insensitive responses to their behaviors (Thompson & Meyer, 2007).

A study conducted by Lamb and Milkin (1986), that included either mothers or unfamiliar women responding to an infant's cry, found that at one month, infants began to soothe themselves just prior to being picked-up (caregiver in site), and that by six months of age, infants in distress were able to somewhat calm themselves upon hearing footstep's approaching. They also found that by five months, if they were not picked-up, their cries became increasingly louder. The researchers concluded that infants quickly learn social expectations related to distress and soothing, and when this expectation is violated, they become confused and more upset (Lamb & Malkin, 1986), especially considering they have not learned another form of regulation upon which to rely. Thompson and Meyer (2007) have stated that inconsistencies in the structure of when an adult responds (i.e. sometimes soothing, sometimes walking past, sometimes entering the room and leaving), will typically influence how easily infants soothe to the adult or to the anticipation of the adult's approach.

In a study of 32 infant-mother couplings, Gable and Isabella (1992) examined the relationship between maternal interactions with their infants, and resulting abilities of the infant to regulate their arousal. The researchers monitored mother-child interaction over two 3-minute video taped sessions at one and four months of age. In the first segment of each session, mothers were instructed to play with their infants as they normally would, and for the second video they were instructed to keep their infants attention, to get them excited, and to try to make them smile. The infants were rated on state, physical activity, head orientation, gaze behavior, facial expressions, vocalizations, and fussiness. The mothers were rated on ten items including most of the infant behaviors and also silence during infant gaze aversion, infantile/imitative behaviors,

contingent responses, and game playing (Gable & Isabella, 1992). Infant arousal regulation was defined as measured by infant head orientation, gaze behavior, and facial expressions. Gable and Isabella (1992) found that the infants whose mothers were more attentive and interactive with them at age one-month were better able to regulate their own arousal at age four-months. In other words, the authors were able to predict that mothers who provided appropriate levels of stimulation had infants who exhibited more positive affect and were able to spend more time gazing at their mothers. Gable and Isabella (1992) conclude that that maternal interaction during the first four months of life set the groundwork for emotion regulation.

A similar study conducted by Kogan and Carter (1996) looked further into the relationship between attachment and emotion regulation of infants at four months of age and then again at one year. As part of a larger study, 29 mothers and infants were observed, and in particular, the reengagement of the mother and child was of interest. For the experiment, when the infants were four months of age, the mothers were asked to play with their child for five minutes as they normally would. After five minutes the mothers were instructed to stop all social interaction and remain still with a neutral face while looking eye to eye with their infant, for two minutes or after 60-seconds of continuous crying. At this point, the mothers were instructed to resume normal play. As a measure of attachment, when the infants were 12-months old, the dyad returned to the lab and participated in the Strange Situation task (Ainsworth & Wittig, 1969; described previously). Kogan and Carter (1996) measured gaze, affect, emotional availability, reengagement behaviors, and attachment. Their findings supported the theoretical assumption that the mother's sensitivity towards her child is related to the coping strategies that the infant employs during stressful situations. Specifically, the researchers determined that the infants became less positive, more negative, and averted their gaze away from their mothers

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during the still-face, middle portion of the segment filmed at four months. This finding

confirmed that the researchers were successful at eliciting stress for the infant before allowing

reengagement by the mother.

During the reengagement at four months (the second play period), the infants' negativity

and gaze aversion significantly decreased, but did not return to the same positive levels observed

during the first play phase. Furthermore, Kogan and Carter (1998) determined a relationship

between more emotionally available mothers and decreased negativity during the second play

phase. In other words, the infants whose mothers were more emotionally available were more

quickly able to decrease negativity and return to a play state. The researchers noted that in the

dyads that included relatively more sensitive mothers, the infants reengaged by looking at their

mother, making positive or neutral vocalizations, smiling, or reaching, and exhibited low levels

of avoidant or resistant behaviors. On the other hand, in dyads characterized by relatively low

maternal sensitivity, infants were observed to be either avoidant to reengage (e.g., gaze aversion

or delayed responsiveness), resistant (e.g., persistent negativity or unsoothability), or a

combination of the two (Kogan & Carter, 1998).

Kogan and Carter (1998) only commented briefly regarding the relationship between

their findings at four months and predictability at twelve months. They observed some

continuity and association between the infant's capacity to self-regulate at four months and at

twelve months. They concluded that an infant's ability to soothe or be soothed after a stressful

event is a critical adaptive tool and indicative of the mother-child relationship.

In sum, the body of research on infants and emotion regulation suggest that mothers who

provide ample stimulation for their very young infants, including being attentive and interactive,

are laying the foundations of healthy emotional development (Gable & Isabella, 1992; Kogan &

Carter, 1998; Lamb & Milkin, 1986; Thompson & Mayer, 2007). Additionally, infants who form a positive attachment with their mother, which can partly be attributed to the mother's sensitivity to her child's needs, are more prone to self-soothe, as well as accept soothing, after stressful events (Gable & Isabella, 1992; Kogan & Carter, 1998). Emotional development and regulation have just begun in infancy however, and the opportunities to build emotion regulation development continue throughout childhood.

Implications during toddlerhood. The development that begins during infancy carries into toddlerhood, when the child is more independent and therefore needs to gain more control over their emotions. At the same time, parents are developing a management style, which also influences the development of emotion regulation (Gross & Thompson, 2007). With the knowledge that each emotional expression or response changes the situation, and elicits another response, it is easy to see that the opportunities to teach children effective and appropriate emotion regulation strategies are endless (Gross & Thompson, 2007).

Several studies conducted by Eisenberg and colleagues have focused on the effects of parents' reactions to children's emotions. In 1994, a study was published by Eisenberg and colleagues that examined six specific reactions parents may have to their child's emotion, and related them to the social functioning of the child. Three reactions were considered to be negative**:** minimizing the child's negative emotion, punitive reactions, and parental distress reactions (e.g. showing discomfort). Three were considered to be positive: encouragement of expressing emotion, emotion-focused reactions (i.e., comforting), and problem-focused reactions in which the child is encouraged to, or helped to, deal with the problem (1994; Eisenberg, Fabes, Carlo, & Karbon, 1992).

Based on their research, some more of which will be described below, Eisenberg and colleagues (1994; 1996; 1999) have adopted the perspective that deficiencies in emotion regulation result in part from exposure to conflict in the home. They argue that being exposed to conflict, such as arguing or violence, undermines emotion regulation development, including arousal and adjustment (Eisenberg et al., 1996). Furthermore, they found that after repeated associations between their emotions and negative reactions, many children gradually learn to hide their emotions, but continue to feel anxious when in emotionally charged environments (Eisenberg et al., 1999).

According to Eisenberg and many others, high levels of ongoing emotional intensity in childhood are believed to result in unregulated and inappropriate behavior (Dunn & Brown, 1994; Eisenberg et al., 1996, 1999; Gottman, Katz, & Hoven, 1996). When emotional reactions of children are left unattended to by parents, children do not learn that their behavior is inappropriate or socially unacceptable; these behaviors may lead to long-term deficits in interpersonal abilities (Eisenberg et al., 1992). Furthermore, Eisenberg, Fabes, and Murphy (1996) suggest that children who receive unsupportive reactions to negative emotions, such as a punitive, belittling, or minimizing response, are likely to remain emotionally aroused and become, or remain, dysregulated in their behavioral response. On the other hand, when parents consistently attempt to suppress their children's emotions and reactions, the child's view of the negative situation is left unresolved, so that in the future, when similar situations arise, the negative emotion once again resurfaces without a strategy for dealing with it (Eisenberg et al., 1992, 1996, 1999). Therefore, research concludes that the development of socially *competent* behavior may be a balance between parental encouragement and regulation of the expression of

emotion rather than parental efforts to simply suppress children's expression of negative emotion (Eisenberg et al., 1996).

One study conducted by Eisenberg and colleagues (1996) assessed reactions to negative emotions in 148 third through sixth graders from three different schools. The purpose was to examine the relation between parental emotion-related reactions and children's social competence, as defined by the authors to include socially appropriate behavior, peer acceptance (as reported by adults), constructive coping, and prosocial behavior.

To answer their questions, the research team administered the bulk of the measures to the primary parent (in all but five cases the mother) to gauge the parent's reaction to their child's negative emotions, and in general, the child's emotionality, coping, and social functioning. In addition, fathers also completed a measure of their child's negative emotionality to determine differences between parental reaction styles and the report of the child's behavior (Eisenberg et al., 1996). Teachers were administered many of the same measures as the primary parent including those to gauge negative emotionality, coping abilities, and social functioning (social skills and peer acceptance) in the classroom.

To observe the child's degree of prosocial behavior, the researchers created a scenario whereby the child had the opportunity to assist or ignore a crying infant. While the researcher was meeting with the child to administer questionnaires in one room, a recording of a crying infant was played into a 2-way baby monitor from another room. The receiving end of the monitor was in the room with the child and researcher, and when the crying was heard, the researcher apologized and explained that at the last minute she had to help out a friend and take care of their baby for a few hours. It was the baby's naptime and the experimenter was trying to leave the child to sleep. During the two minutes of varying intensities of crying, the experimenter

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attempted to soothe the baby through the monitor, and asked the child to assist. For each subject, after the first incident of crying has subsided, the experimenter explains she has to go down the hall to retrieve a forgotten questionnaire. Upon leaving, the experimenter informs the subject that if the baby starts crying they can feel free to turn off the monitor or attempt to soothe them on their own. At this point, the two minute segment of crying is played again, and via hidden video, the number of seconds the child talks to the baby through the monitor, as well as the number of seconds the child has the monitor turned off were recorded. In addition, children were rated on whether their tone with the baby was comforting, irritated or angry (Eisenberg et al., 1996).

The authors drew several pieces of information from the study. First, they found differences between maternal and paternal reactions to negative emotions. Mothers scored high on supportive reactions to their child's negative emotion whereas fathers scored higher on punitive and minimizing reactions. Eisenberg and colleagues (1999) suggest that this finding supports the gender stereotype that emotion socialization or comforting is more appropriate for mothers than fathers. Secondly, a link was found between mother's who reported minimizing, avoiding, or punitive reactions to children's negative emotions, and low levels of socially appropriate behavior, productive coping, and teacher-reported popularity in their children. However, the researchers did not find a correlation between maternal reports of distressed or upset reactions and children's coping or social competence (Eisenberg et al., 1999).

In addition, the authors found that parental perceptions of their child's negative emotionality were associated with the child's behavioral reactions. Specifically, mothers who perceived their children as high in negative emotionality most commonly reported frequent use of minimizing reactions and infrequent use of problem-focused reactions. For both boys and girls

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there was a positive correlation between fathers' perceptions of their children's negative emotionality and distressed and punitive reactions, and for boys specifically, father's minimized emotional responses and offered only low levels of problem-focused reactions. Generally, the researchers did not find an association between parents' reports of their emotion-related reactions or teachers' reports of children's negative emotionality, suggesting that parents develop their own perception of their child's negative emotionality (Eisenberg et al., 1999).

Lastly, for the measure of prosocial behavior, parental reports of emotion-related reactions were associated with children's comforting of the crying infant. For girls whose mother's reported moderate levels of encouragement of the *expression of emotion*, a high degree of comforting (of the infant) was found. On the other hand, for boys, maternal encouragement of problem-focused reactions to handling negative emotions resulted in higher quantity (time spent soothing) and/or quality (what they said to soothe) of their sons' comforting the infant. Thus, Eisenberg and colleagues (1999) suggest that supportive and problem-focused maternal reactions may foster boys' sensitivity to others' negative emotions, whereas, for girls, moderate maternal encouragement of expressivity may be optimal for emotional development. The researchers further state, that girls who are encouraged to express moderate but *not high* levels of emotion, are perhaps learning to regulate their emotion by learning that moderate levels are more socially acceptable and thus avoid over-arousal.

Another study conducted by Eisenberg and colleagues (1999) was longitudinal and looked specifically at the relation between parental negative reactions to their child's negative emotions, and the child's resulting behavior. Since researchers were observing this relationship over time, they were also interested to in whether parental reactions would become more negative in adolescence, when conflict between parents and children is typically more frequent.

The study included data from 94 children, their parents, and their teachers. The first data collection was when the child was in kindergarten, followed by assessments two, four, and six years later. At each assessment point, measures of social functioning, regulation, and negative emotionality were administered. One parent (most often the mother) was asked to describe how their child would react in twelve stress- or negative affect- inducing scenarios (e.g. being nervous about public embarrassment, being scared to receive an injection). The parent was given a score from 1-7 on three levels of their hypothetical reaction to each situation including: parental distress reactions (the degree of negative emotion), punitive responses, and minimization responses (including devaluing the problem). In addition, both parents and teachers were asked to complete a child's observed behavior checklist (Eisenberg et al., 1999). At assessment points two, four, and six years later, the child's emotional intensity levels were also assessed according to measures completed by both parents and teachers. Also at these later time points, parents completed measures of their child's regulation abilities, including attention focusing and behavioral control (e.g. impulsivity, inhibition control).

As the authors predicted, parental reactions that were unsupportive, especially those that were punitive, resulted in externalizing problem behavior and inappropriate social behavior in children. Children's externalizing emotion at ages 6-8 marginally predicted parental negative reactions at ages 8-10. In addition, punitive reactions at age 8-10 predicted children's parent-reported externalizing negative emotion at age 10-12. Thus, as children approached early adolescence, the authors found that unsupportive reactions to negative emotion expression contributed to further negative behavioral reactions in children (Eisenberg et al., 1999).

Eisenberg and colleagues (1999) found a moderate correlation between parents who reported punitive or distress reactions and children with observable problem behaviors by age 8-

10 or 10- 12, even when mothers usually provided data on their reactions and fathers provided information on problem behaviors. Non-supportive parental reactions were correlated with low social functioning at school (problem behavior and low socially appropriate behavior).

Reports of early problem behavior (age 6-8) predicted punitive or distress reactions by parents at age 10-12. In fact, the authors found a bidirectional response, whereby some of the late problem behavior was predicted by punitive or distress reactions at the earlier assessment points (Eisenberg et al., 1999). The research team postulates that parents who become easily distressed or upset by their child's negative emotions could have a negative impact on their child's regulation because in these situations, the parent may disengage themselves in order to de-stress themselves, rather than help their children learn to manage emotions (Eisenberg et al., 1999)

This area of research has consistently demonstrated that parents' negative reactions to children's experience of emotions generally found to be associated with negative emotional competence in children (Dunn & Brown, 1994; Eisenberg et al., 1996, 1999; Gottman, Katz, & Hoven, 1997). On the other hand, supportive parental reactions to children's negative emotions may facilitate children's ability to regulate emotion and to learn about others' needs in emotion-laden situations (Eisenberg et al., 1994, 1999).

To summarize, when parents are demeaning, punitive, or indifferent to their children's emotions, children may not learn the most appropriate coping strategies, or worse, they may learn to believe that their emotions are irrelevant. (Eisenberg, Cumberland, & Spinrad, 1998; Gross & Thompson, 2007; Thompson & Meyer, 2007). These types of responses also add stress to the challenges of how to regulate emotions. Critical or punitive reactions can send several signals to the child. First, the child may understand criticism to mean that their emotional

expression is not appropriate to the situation. Secondly, they may interpret a demeaning response to mean that they are not competent to know the 'right' emotion for the situation. Lastly, a child may interpret a dismissive response to mean that their parent or caretaker does not care about their emotional response to the situation (Thompson & Meyer, 2007). In fact, when others are critical, demeaning, or dismissive, it can exacerbate the emotions the child is trying to manage by often arousing further emotion. Also, the opportunity for learning adaptive modes of emotion regulation, or even discussing one's feelings with the other person, is lost. Studies indicate that how parents respond, supportively or unsupportively, to children's emotions, and the behaviors that result, predict children's emotion-related coping in later assessments (Thompson & Meyer, 2007). In addition, the ways in which parents express their emotions are also internalized by children for future reference.

Parental emotional expressivity. Modeling of emotional expressivity, as opposed to responding to a child's emotional expressivity (as described above) is another influence on emotion regulation development. According to Eisenberg et al. (2001), there is reason to believe that children whose parents express more positive emotion around them and do not express frequent hostile or hurtful emotions (e.g., disappointment in the child) will be particularly likely to be well regulated. General emotional expressivity by parents can also influence the development of emotion regulation. This type of influence is different than a direct reaction to a child's emotions, as was discussed above. In an article outlining the development of an instrument to measure emotional expressivity within the family, e*xpressivity* was been defined by Halberstadt and colleagues (1995) as "a persistent pattern or style in exhibiting nonverbal and verbal expressions that often but not always appear to be emotion related; this pattern or style is usually measured in terms of frequency of occurrence" (Halberstadt, Cassidy, Stifter, Parke, &

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Fox, 1995, p. 93). According to a meta-analysis of family and children's emotion expressiveness, conducted by Halberstadt and Eaton (2002), parental emotional expressivity is typically measured in one of two ways; by the parent's expression of emotion while interacting with their child, or as the parent's general tendency to express emotion in interactions with the family. The latter is more related to parenting styles, and tends to reflect the emotional tone for the home (Halberstadt & Eaton, 2002).

In a study of 46 boys, 34 girls, and their parents, Denham and colleagues (2000) researched the emotional and behavioral aspects of parents' emotions (happiness and anger) and parenting styles (proactive and reactive vs. restrictive) as they related to children's externalizing behavior problems, including their ability to emotionally regulate. In order to obtain a full range of behaviors amongst the sample, the researchers not only recruited based on age but for children who were 'hard to manage.' There were three assessment points. At the first, the children were in preschool or kindergarten, the second was after the child had completed first grade, and the third was between third and fourth grade. Emotional factors were assessed through observing parent–child interactions and obtaining parents reports of their children's levels of hostility. Behavioral factors were assessed via observation of parent–child interactions and maternal reports of child-rearing styles (Denham et al., 2000).

Observed interactions included the mother, father, and child playing two competitive board games together, and fifteen minutes of free time, sharing a snack in between the games. In addition, three interactions involved the mother and child only. The first was to complete a puzzle together, the second was to develop a story together based on a picture book depicting disruptive behavior in a fancy restaurant, and the third was for the mother to elicit emotion memories from the child. Raters coded maternal and paternal behavior patterns including

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supportive presence, limit setting, allowance of autonomy, negative affect, quality of instructions, and confidence.   In addition, a separate coding consisted of ratings of maternal and paternal expressions of anger and happiness. The parents were also asked to complete written measures of their child's hostility, as well as questionnaires that assessed their parenting styles and negative affect (Denham et al., 2000).

First, in all but one case, multiple regressions indicated that later externalizing problems were able to be predicted from parenting variables, and were found for children with initially high externalizing scores. Second, negative parenting variables, such as anger or hostility, were especially strong predictors of later externalizing problems in their children, and especially for those who scored high in the initial assessment of behavior problems. In fact, parental anger was the most prominent predictor across reporters (i.e., mother or teacher) and time periods. This finding further supports that when parents' negative emotions are dysregulating, they can effect a child's social and emotional development, such as their ability to behaviorally regulate their emotions. Third, positive parenting variables, such as proactive parenting (observed) and maternal proactive parenting styles (reported), strongly predicted fewer behavior problems in the later assessments for children that scored high in behavior problems at earlier time points. Improvement across time in these children was consistently linked with parenting behaviors that provided positive support, structure, and an environment with less anger and hostility. In sum, parenting factors, especially mother's anger and proactive parenting styles, were notably important in predicting behavior problems in those children showing more difficulty initially (Denham et al., 2000). The authors also note that combined, these findings support the idea that parents' emotions and behaviors contribute to both risk *and* resiliency in children initially at risk for behavior problems. Therefore, this study indicates that with more effective parenting styles,

children's behavior problems can be remedied, at least to some extent, and therefore, their ability to learn emotion regulation evolves and can change direction over time.

In an article published in 1998, Eisenberg, Cumberland, and Spinrad posited that parents' emotional expressivity may affect children's abilities to self-regulate, and may in turn affect their social competence and adjustment. Eisenberg and colleagues (2001) attempted to test this hypothesis several years later, for both positive and negative parental expressivity. The authors tested a model to explain the effects of positive and negative parental expressivity (Eisenberg et al., 2001). They hypothesized that positive parental expressivity would be associated with adequate emotion regulation in children. On the other hand, the authors predicted that negative parental expressivity, especially hostile expression, or negative expression that was a result of the child being irritating, disappointing, or upsetting to the parent, would be associated with inadequate emotion regulation. Furthermore, the authors predicted emotion regulation to mediate the relationship between parental positive expressivity and both high levels of social competence and low levels of adjustment (especially externalizing behavior). The model tested found that maternal expressivity could predict children's adjustment and social competence, which in turn could predict children's regulation.

The study included children between the ages of 4.5 and 8-years-old, their parents and teachers. The researchers selectively screened children to determine those who had externalizing or internalizing behavior problems. This was done through a phone administration of a brief screen of the Child Behavior Checklist (CBCL; Achenbach, 1991). Out of a pool of 315 children, all children with T scores of 60 or above on either externalizing or internalizing behavior problems (or both) were asked to participate, with scores of 60-63 being viewed as moderate risk for behavior problems. Eighty children had T scores for externalizing behavior above 63,

whereas 70 had scores for internalizing behavior above 63. The children identified as having behavior problems were matched with non-problem children of the same sex and race (when possible), with similar socioeconomic class, and of the same age (Eisenberg et al., 2001).

As a measure of the child's regulation, Eisenberg and colleagues (2001) asked the child to complete the 'hidden puzzle task' (described earlier in this paper; Eisenberg et al., 1996). During this task, persistence in completing the puzzle within the allotted time was used as an observed index of emotional control. Questionnaires were distributed to mothers and teachers as an additional measure of children's regulation, including indices of attention focusing, attention shifting, and inhibitory control. Additionally, mothers and teachers completed the CBCL (Achenbach, 1991). The Aggressive Behavior and Delinquent Behavior subscales were combined and used as a measure of externalizing behavior, and the Withdrawn, Anxious/Depressed, and Somatic Complaints subscales were used as a measure of internalizing behavior. Mothers and teachers also completed a scale developed by the authors (1996) as a measure of their child's social competence, including socially appropriate behavior and popularity.

A second task was administered as a measure of the mother's expressivity (Eisenberg et al., 2001). For the second task, the mother was asked to join the child to help them complete another puzzle. For this task, mothers sat on the side of the table where they could visually observe the puzzle pieces they were allowed to verbally instruct the child (as the puzzle pieces were not visible to the child) to help them complete the puzzle. During this task the mothers' emotion and behavior with their child was coded every thirty seconds for both positive and negative affect according to their tone of voice and facial expressions. In addition, each mother reported her own emotional expressiveness with her family by completing the Self-

Expressiveness in the Family Questionnaire (Halberstadt et al., 1995). On this scale, subjects are asked to rate on a 9-point scale the frequency with which they express emotions in typical family settings.

The authors used structural equation modeling to test whether children's regulation mediated the association between mothers' expressivity and children's adjustment and social competence. The model included observed maternal affect, mother self-reported expressivity, regulation, both externalizing and internalizing behaviors, and social competence. In general, the authors determined that mothers' expressions of positive and negative emotion, both in interactions with their children and more generally in the family, affect children's social competence and adjustment. In addition, Eisenberg and colleagues (2001) suggest that according to their model, it is plausible that children's regulation serves as a mediator of the effects of maternal emotional expressivity, and that children's social competence and externalizing problems with peers can have some effect on children's regulation. This model suggests that emotional arousal experienced in children as a result of their parents' frequent or intense negative emotions may increase the vulnerability to become hyperaroused in emotionally evocative situations. Overarousal in turn may make it difficult for the child to regulate their attention, emotions, and behavior, and may result in a negative emotional response from their parent (Eisenberg et al. 2001). Additionally, exposure to maternal negative emotion may also disrupt the ability to learn coping strategies, and may reduce the child's motivation to regulate in general, by exposing the child to a model of dysregulation. When this is the behavior exhibited in their environment, Eisenberg and colleagues (2001) suggest that children may come to believe that such unregulated patterns of emotion are socially appropriate, and possibly effective.

The studies presented here add to the growing body of evidence that parents' expression of emotion is related to their children's socio-emotional competence (Denham et al., 2000; Eisenberg et al., 1998; Eisenberg et al., 2001).   Parental expressivity may also contribute to children's abilities to interpret and understand others' emotional reactions and to their beliefs about how much and what types of emotional expressions are appropriate and effective in social interactions. Such knowledge may foster both self-regulation and social skills (Denham et al., 2000; Eisenberg et al., 1998). Furthermore, heightened expression of negative affect by parents may reflect their own dysregulation and can serve as a model for children's imitation or contribute in other ways to children's dysregulation (Eisenberg et al., 2001).

A second line of related research examined not how expressive parental emotion is influential, but rather the difference between types of emotions exhibited. While Eisenberg and colleagues (1998) suggest that it is difficult to distinguish between the effects of parental negative emotion in general, and parental negative emotion directed specifically at their child, they determined that mothers who expressed "negative emotion directed at their children may be particularly likely to undermine their regulation and behavior" (Eisenberg et al., 2003; p. 16). In their review of the literature, Thompson and Meyer (2007) suggested that the effects of emotion expressivity by parents may lie in the type of negative emotion. They theorized that children raised in an environment where "negative dominant" emotions (e.g. anger and hostility) are normal will be less likely to develop effective emotion regulation because these emotions elicit fear; a relatively more heightened response that can cause more vulnerability to ongoing dysregulation (as discussed in the *internal effects* section of this paper). On the other hand, those children who are raised in environments where "negative submissive" emotions (e.g. sadness and distress) are the norm, will most likely not have as heightened a response, and therefore may not

be as vulnerable. As noted by Thompson and Meyer (2007) and others (e.g. see Eisenberg et al, 2001) it is most likely useful for children to be exposed to occasional non-hostile negative emotions as a means to learn that negative emotions can be safely expressed and managed.

Overall, theorists have observed that children are more likely to have a limited understanding of emotion, and a limited knowledge of how to control their emotions when they are raised in environments that are less sensitive or that are inconsistent (Eisenberg et al., 2003; Thompson & Meyer, 2007). Stress that is chronic and severe, such as the stress experienced by children in emotionally or physically neglectful situations, and in overly punitive or critical environments, will be expressed in all levels of a person's vital activity, as emotional development affects all levels (Gunnar & Vazquez, 2007).   More specifically, Eisenberg and colleagues (1998) have suggested that children, who receive negative or no response to their negative emotions, are likely to remain in a negative emotional state. From this perspective, children in these situations can become more easily emotionally dysregulated, either by displaying heightened levels of negative emotionality or, alternatively, by suppressing their negative emotional expression (Thompson & Meyer, 2007).   Living in environments such as these both add stress, and undermine the child's opportunity to learn more adaptive forms of coping with their emotions, whereas over-involvement may limit a child's ability to integrate emotion regulation 'skills.' In these contexts a child's emotional behavior can contribute to the risk for developing psychopathology involving emotion dysregulation (Thompson & Meyer, 2007). In fact, emotion regulation difficulties are observed in several mental diseases including mood disorders, psychotic disorders, and personality disorders. One such disorder that involves clear deficiencies in emotion regulation is BPD.

In conclusion, there are numerous influences on the development of emotion regulation. As will be described below, there are many steps that lead to one having to regulate emotions. In other words, for emotion regulation to exist, an emotion has to be created and processed. Therefore, the processing of emotion is one aspect leading to the utilization of (or lack of) emotion regulation skills. In the next section, this step in emotion regulation will be thoroughly reviewed.

Emotion Processing and Perception

Emotion regulation has been thoroughly reviewed here, including all of the influences on its development. The second goal of this paper is to explain the current literature on the processing of emotion. Further, the paper will explain how it relates to the development of difficulties in emotion regulation. According to theorists, the processing of information, which often includes emotions, occurs within a series of steps, and prior to the response, or regulation of, emotion. In fact, in the theories that pose steps of information processing, emotion regulation is the common last step (Crick & Dodge, 1994; Halberstadt, Denham, & Dunsmore, 2001; Mayer & Salovey, 1997; Saarni, 1999). Considering the review of all of the influences on the development of emotion regulation, it is plausible that what occurs during the steps of processing also influence the emotional response. For instance, faulty information processing of a situation can result in misguided reactions. Therefore, in order to fully understand, it is important to consider the role of emotion processing in emotion regulation. However, thus far, processing has not been thoroughly researched in terms of its impact on the development of emotion regulation.

Development. It can be agreed that the ability to communicate effectively and to have mutually rewarding, positive relationships relies at least in part on our ability to interpret other's emotional responses (Bland, Williams, Scharer & Manning, 2004; Eronen, Nurmi, & Harvey,

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1999; Keltner & Kring, 1998). In fact, perception and expression of emotional information are integral components of human experience and behavior, as they are essential for effective social interaction (Halberstadt, Denham, & Dunsmore, 2001; Schaffer, Gregory, Froming, Levy, & Ekman, 2006). People rely on their emotional experiences to assess the conditions of their relationships, and likewise, mood or emotion states influence the evaluation of relationship satisfaction. For instance, as noted in a review article by Keltner and Kring (1998), residual anger can negatively influence ongoing interactions, and underlying fear can influence the misperception of a risk associated with social interactions. Two developmental theories have posited that the functionality of emotional processing in social situations is dependent on the accuracy of the appraisal of the situation, the allocation of priorities among multiple goals in the situation, and the selection of proper responses to the situation (Lemerise & Arsenio, 2000; Parrott, 2001).

Just as has been explained in the development of emotion regulation, according to Thompson and Meyer (2007), children begin to learn how others perceive emotions through their parent's emotional signals to events. Especially when events are ambiguous or confusing, children observe their parents' facial expressions and listen to their vocal tone to determine the emotionality of a situation (e.g. is their tone raised because they are angry or excited?).

Beyond facial expressions, it is theorized that each time an adult labels a child's behavior with an emotion term, or a child observes the emotion term being used to label someone else's behavior, the child stores several pieces of information, including the psychological situation and environment in which the label was used, the behavioral responses that correspond to the label, as well as the regulation strategies implemented (Wranik, Barrett, & Salovey, 2007). All of this new information is integrated with past information that is already stored in memory. In

addition, since emotions are dynamic processes involving numerous sensorimotor components

(e.g. physiological activation and facial and vocal behaviors), the child acquires a plethora of

exemplars of what different emotions "feel like" and "look like" and stores these as fuzzy

categories (Wranik et al., 2007). As with emotion regulation, the development of emotional

processing is important to understand in order to fully conceptualize the entire process of

emotional responding. The theories of processing, as well as research related to this area, are

presented below, followed by a summary of processing development research.

      Theories of Emotion and Social Information Processing. Based on their research

regarding emotion regulation, several theorists have developed models to explain the

development of emotional or social competence. These theories, while labeled differently, all

have two common steps within them-- a step of emotional processing, and a step of emotional

response (Crick & Dodge, 1994; Halberstadt, Denham & Dunsmore, 2001; Mayer & Salovey,

1997; Saarni, 1999). The theories are removed from literal brain processes; with an

understanding that there is a fundamental difference between the way the brain operates and the

way one can explain these operations (Halberstadt et al., 2001). In fact, neural connectivist

researchers have noted that because information processing occurs within such a small time

frame, it is far from clear whether the steps in neural models of information processing coincide

with models of cognitive processing (Smolensky, 1988). The theories being offered here have

come to be known as 'on-line,' as they relate to conceptual real time brain activities that have

thus far been very hard to link directly to the intangible substrate neural activities with which

they most likely coincide (Crick & Dodge, 1995; Halberstadt et al., 2001; Lemerise & Arsenio,

2000). In conjunction with the connectivist researchers, all of the recent theories of information

processing recognize that processing most likely occurs in simultaneous parallel paths, with

individuals engaging in multiple processes at the same time (Crick & Dodge, 1994; Lemerise & Aresenio, 2000; Halberstadt et al., 2001; Smolensky, 1988). The theories described here mainly stem from the research that has documented the development of emotion regulation. These theories offer explanation of a process that ultimately leads to the expression of emotion. Hypothetically, if problems within the steps towards emotion regulation were to be identified, interventions could be created to ultimately influence effective emotional expression.

Emotional competence. Saarni (1999) has proposed a theory of emotion processing including eight skills, or steps, that lead to 'emotional competence.' Saarni (1999) has noted, that when one achieves emotional competence one is able to demonstrate "one's self-efficacy in emotion-eliciting transactions, which are invariably social in nature" (p. 2). Emotional competence is explained to be a simultaneous interaction including applying knowledge about emotions, regulating such emotions, and negotiating interpersonal exchanges. Saarni (1999) has posited that culture plays a large role in this theory, whereby all of one's responses to emotional stimuli are based on "cultural messages we have absorbed about the meaning of social transactions, of relationships, and even our self definitions" (p.2).

According to Saarni (1999), the eight skills of emotional competence include: 1) awareness of own emotional state, 2) recognition of other's emotion, 3) use of emotion and expression language, 4) ability to be empathic, 5) realization that inner state and outer expression in self or others does not always correspond 6) coping adaptively with aversive or distressing emotions by using self-regulatory strategies, 7) awareness that relationships are largely defined by emotional communication and 8) emotional efficacy: feeling in control and accepting of one's own emotional experiences (Saarni, 1999). While theoretically the

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importance of process is emphasized, an explanation of how the proposed eight skills develop or interact with each other is not clearly explained by the theory.

Emotional intelligence. Mayer and Salovey (1997) applied their concept of emotional intelligence to a theory of processing and regulation of emotion. The authors define emotional intelligence as "the capacity to process emotional information accurately and efficiently, including that information relevant to the recognition, construction, and regulation of emotion in oneself and others" (p. 197). The authors theorize that the generation, perception, and regulation of emotions play a large role in positive emotional growth and adaptation. In addition, they note that emotions facilitate thinking and therefore, regulation of emotions will promote intellectual growth (Mayer & Salovey, 1997). The authors identify four abilities: 1) perceiving and appraising others' and one's own emotions, 2) accessing and generating emotions to assist a thought, 3) recognizing and analyzing emotion in others, and 4) regulating emotion, to promote emotional and intellectual growth. While Mayer and Salovey (1997) do acknowledge perception and processing of other's emotion, their model, unlike Saarni's (1999), is focused internally on self-awareness, and on emotions enhancing thought by thinking intelligently about one's own and other's emotions. This theory is to suggest therefore, that one with more intellectual abilities should have better ability to process and regulate emotions, and one may logically be able to realize that these two components do not necessarily coincide.

Reformulated theory of information processing. Crick and Dodge (1994) reformulated a model of information processing originally created by Dodge (1991). Their goal was to reflect a convergence between developmental, clinical, and cognitive psychological theory. In this reformulated model, they acknowledge the likelihood of parallel processing, as introduced by connectivist theorists (Smolensky, 1988), in contrast to Dodge's original model that simply

depicted a linear process. Crick and Dodge's (1994) reformulated model depicts a feedback loop and cyclical structure, whereby theoretically, processing is continuous and simultaneous, yet following a logical path from a particular stimulus (e.g. provocation by a peer) to a behavioral response (e.g. retaliation).

According to Crick and Dodge (1994), an individual enters a situation with both genetically predisposed traits (e.g. intelligence, temperament) and stored information from past experiences (e.g. memory of past emotional reactions). In any given environment, a person receives an overwhelming amount of information (or cues), both relevant and irrelevant, which is used to process the situation and respond. Crick and Dodge (1994) proposed six steps to the processing and response to these cues. The steps of the reformulated model include: 1) encoding of external and internal cues, 2) interpretation and mental representation of those cues, 3) clarification or selection of a goal, 4) response access or construction, 5) response decision, and 6) behavioral enactment.

As noted, the main focus of this paper is to consider the steps of processing that involve perception of another's emotions and the self-regulation of emotion. In the Crick and Dodge (1994) model, steps 1, 2, 5, and 6 are relevant. During steps one and two, encoding and interpretation of social cues occurs. According to Crick and Dodge (1994), encoding includes simply absorbing cues from the environment. Some of the Crick and Dodge theory development is based on previous work by Kahneman (1973) who conceptualized that there are two dimensions of attentional behavior when absorbing cues: intensity and selectivity. Kahneman (1973) proposed that the intensity of attention refers to the number of processing resources used to decipher cues, and the selectivity of attention refers to the degree to which codes are encoded—with some being encoded more completely and accurately than others. This nosology

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was also adopted by Crick and Dodge (1994). In this model, some cues are readily encoded with little attention because of their familiarity (such as 'reading' a friend's expressions during conversation), whereas encoding of other cues are more attention demanding (such as 'reading' a new supervisor's expressions during a meeting). In his first model, Dodge (1991) proposed that during the encoding phase, it is likely that facial information has greater salience than other cues because of the wealth of information provided by facial expressions. He further theorized that when meeting someone new, both intensity and selectivity of attention are likely heightened as the individual is encoding new information. Subsequent research studies have elaborated on this view.

Both in the original (Dodge, 1991) and in the reformulated model (Crick & Dodge, 1994), the second step in emotion processing is referred to as interpretation. According to the authors, during this step, cues are matched to the possible interpretations available in memory (or a novel interpretation is generated), and through an almost instantaneous decision tree, information is given meaning. For instance, in an example offered by Dodge (1991), this model suggests that if a child is playing a game with peers and one peer moves his piece out of turn, the child encodes the peer's cues (moving the piece out of turn), and the encoding will lead to an interpretation, which could either be that the peer is "cheating" or that the peer made a "mistake." The interpretation that is made will be based on previous information or situations to which the interpreter has been exposed (Crick & Dodge, 1994; Dodge, 1991), and will thus influence the next outcome in the situation.

Crick and Dodge (1994) acknowledge that individuals often fail to adequately encode information and this can negatively impact interpretation. Based on the theory that processing occurs simultaneously, when a miss-encode happens, the process loop begins again (Smolensky,

1988). According to Crick and Dodge (1994), while re-encoding is happening, the person may experience a sense of perplexity or enhanced concentration, and when the interaction requires a quick response, the interpreter will default their decision to whatever exists in memory, despite its accuracy to the situation.

During the third step in emotion processing, immediately following an interpretation of the situation, Crick and Dodge (1994) propose that children select a goal or desired outcome for the situation (e.g., staying out of trouble, getting even with a provocateur, making a friend, getting a toy). The authors state that goals are focused arousal states that function to orient the person towards producing desired outcomes. Following in step four, it is hypothesized that children access from memory past responses to the situation and whether they should be used again, or, if the situation is novel, they may formulate a new response to the social cues. According to Crick and Dodge (1994) there are several things that are considered in these very brief moments. For instance, they hypothesize that one considers the interpersonal consequences (e.g. Will I be liked?), instrumental consequences (e.g. Will I get what I want?), and the moral value (e.g. "Do I approve of this behavior?") of their behavior and how it relates to their goals in the situation.

Step five of Crick and Dodge's (1994) model proposed that a response is chosen based on an evaluation of their goals. And then finally, at step six, the theory posits that the chosen response is behaviorally enacted**.** It is at this stage that emotion regulation coincides with emotion processing. Crick and Dodge (1994) note that the response may include motor, verbal, or a combination of both behaviors. It is presumed that the behaviors that are enacted are 'skills' that have been acquired over time and are chosen based on the frequency they have been used and the success they have offered in past situations (Crick & Dodge, 1994; Dodge, 1991). This

being considered, according to the emotion regulation literature previously discussed here, when one has not acquired, or learned, responses that are effective, an individual's 'skills repertoire' will be lacking, and therefore their interpersonal interactions may suffer (Eisenberg et al., 1994, 1996).

According to both Lemerise and Arsenio (2000), and Halberstadt et al. (2001), the Crick and Dodge theory (1994), while thorough, failed to take into account the full capacity that emotion is involved in processing social information. Therefore, both Lemerise and Arsenio (2000), and Halberstadt and colleagues (2001) attempt to correct this in their own model, the Integrated Model, and the Affective Social Competence model, respectively.

Integrated model of emotion and social information processing. Lemerise and Arsenio (2000) acknowledged that the difference between emotion and cognitive processes may be difficult to delineate. Nonetheless, they have stressed the importance of incorporating emotion into processing models because, as they concur, the two processes undoubtedly influence each other in any given situation (Lemerise & Aresenio, 2000). The authors propose that individual differences in both emotionality and regulatory ability affect both processing of social and emotional information, and decision-making in social situations. Furthermore, Lemerise and Arsenio (2000) believe that maladjusted children, who have shown to be poor regulators of their emotions (e.g. Eisenberg et al., 1996), most likely also have social information processing deficits.

Lemerise and Arsenio (2000) enhanced the steps of encoding and interpreting (1&2) of the Crick and Dodge (1994) model so that in their model, emotion influences the process. They proposed that self and others' emotional signals provide ongoing information about how the situation is progressing, and that these signals allow for adjustments to behavior. The authors

suggested that the level of emotional investment in a situation may influence encoding and interpretation. For instance, they explained that being teased by a friend would be quite different than being teased by the class bully. In this case, while the situational cues are the same (teasing) the encoding and interpretation will most likely be different, because the pre-existing feelings towards the friend or the bully are different (Lemerise & Arsenio, 2000). Additionally, Lemerise and Arsenio (2000) suggested that encoding and interpretation can be influenced by mood and level of arousal during the situation. They hypothesized that mood, emotions, and /or arousal can affect what is noticed about a social encounter by influencing what memories are drawn upon during the interpretation phase. In other words, if a child is in a negative mood state, their interpretation of a situation will probably be negatively skewed, or, children who are experiencing strong emotions may be too overwhelmed to generate a variety of responses from which to choose the best solution. In these cases, Lemerise and Arsenio (2000) postulated that children may engage in "preemptive processing" as coined by Crick and Dodge (1994) which can result in an impulsive behavioral response that is unlikely to positively influence the situation (e.g., running away or aggressively retaliating).

Affective social competence. Halberstadt and colleagues (2001) developed their model of affective social competence (AFC) based on the notion that emotional content, communicated verbally, facially, or through body language, plays a role in nearly every interaction, and often determines the meaning of the interaction. The authors conceptualized a model of affective social competence that includes three basic components: sending affective messages, receiving affective messages, and experiencing affect (Halberstadt et al., 2001). Within each component, the authors further suggested that four abilities are essential for positive social interactions

including awareness, identification, working within a social context, and management and regulation.

While other models identify the receiving of a message as the trigger for the processing cycle (e.g. encoding), Halberstadt and colleagues (2001) identified sending a message as the first step, and receiving as the second. According to Halberstadt and colleagues (2001), several conditions play a role during the sending process, including an awareness that an affective message needs to be sent, an identification of what that message will be, sending the message, and finally managing the sending of the affective messages. The authors suggested that what happens in 'sending' can "make or break the social encounter" (p.90), as these decisions need to be made quickly and will have a synergistic effect on what is then received from others engaged in the interaction.

According to the ASC theory, the second step of receiving others' affective signals is crucial. During this step, immediate feedback is provided about the effects of behavior and others' intentions in the situation. Halberstadt and colleagues hypothesized that the use of display rules occurs during the receiving of affective messages (Saarni, 1979), whereby receivers interpret whether the sender is enacting display rules and in turn whether they are sending an accurate or masked emotional signal. In addition, the receiver is hypothesized to note the intensity used by the sender, and how this level relates to their emotional state. Furthermore, Halberstadt and colleagues (2001) recognized that receivers need to differentiate between messages that have already been sent (and thus would be repetitive in processing), and those that provide new information to the situation. Lastly, during the receiving process, informative signals need to be differentiated from those that are useless to the situation. Halberstadt and colleagues (2001) offered an example: a receiver notices and inquires about one's frowning

while the sender is simply concentrating on the interaction. In this situation, for a less-skilled

receiver, they would be perceiving affect from an expression where none was intended.   While

these processes are happening, the authors theorized that all information is being considered

within the environment it is occurring. According to Halberstadt and colleagues (2001), in this

model, a peer to peer engagement process will be different than a parent to child process because

of the influence of emotional investment.

Halberstadt and colleagues (2001) defined the third component of their AFC model as

emotional experiencing. The authors intended this component to refer not only to awareness and

recognition of one's own emotions, but also to effective regulation of one's emotional

expression. The authors noted "emotion regulation is a large, complex part of ASC which is still

not defined to all developmentalists' satisfaction" (p.102). They further stated that "all elements

of emotional experience—arousal, cognitive construal, and behavioral action—involve

regulation" (p.102).   Halberstadt and colleagues (2001) defined the goal of the arousal

dimension of emotion regulation to either be self-soothing and arousal reducing, or to increase

physiological arousal. The cognitive dimension of emotion regulation is believed to include a

refocusing of attention and reasoning for problem solving. Halberstadt and colleagues (2001)

postulated that behaviorally, emotion regulation includes expressing appropriate and/or

inhibiting inappropriate expressions, thoughts, or behaviors related to the emotional experience.

All of the theories mentioned here offer sound ideas as to how one processes emotional

stimuli during social interactions. While Crick and Dodge (1994) did not fully embrace the role

of emotion into their theory, it is the most comprehensive theory of social information processing

offered. Lemerise and Aresenio (2000) did an adequate job of considering how Crick and

Dodge's theory could be improved upon with the inclusion of emotional influences. Halberstadt

and colleagues (2001) offered a very thorough explanation of what social competence entails, but their theory lacks empirical support of the actual process described. All of the theorists would agree that processes are most likely occurring simultaneously and therefore, it may be impossible to delineate a step by step organization. Thus instead, it may be preferable to focus on the influences on accurate processing.

A thorough review of the theoretical understanding of information and emotion processing has been offered. Now, the developmental research related to these theories will be presented.

Development of normal vs. psychopathological emotion processing. There is a large body of research examining how emotion processing in children is related to behavior (e.g. Crick & Ladd, 1993; Dodge & Somberg, 1987; Nelson & Crick, 1999). In general, studies have shown that those children who are identified as having behavior problems differ from normal controls in emotion processing (Stegge & Terwogt, 2007). It has been suggested that while encoding, they pay more attention to threatening information, they more readily interpret cues as hostile, they consider instrumental goals over interpersonal ones, they offer more aggressive options than healthy controls and finally, at the enactment step, they choose to become aggressive more often (Crick & Ladd, 1993; Dodge & Somberg, 1987). The bulk of the research in this area has focused on cue interpretation and making intent attributions during the interpretive process (Nelson & Crick, 1999). This research is premised on the notion that children's and adolescent's behavior is related to differences in their intent attributions, or in their ability to interpret social cues and motives from others (Dodge, 1991; Nelson & Crick, 1999).

For a study of children's perceptions of their peer experiences, Crick and Ladd (1993) had three goals. They wanted to compare the social feelings of neglected, controversial, and

rejected children to children who were considered to be popular and of average status. Secondly, they wanted to assess the amount and forms of distress experienced in each group. Lastly, they wanted to determine if children's feelings were related to their attributions about social outcomes (Crick & Ladd, 1993).

The subject pool consisted of 175 third graders and 164 fifth graders from five different schools. Based on nominations, researchers divided the pool into five status groups including: popular, average, neglected, rejected, and controversial (Crick & Ladd, 1993). The researchers also identified a group of high distress children based on scores that were more than half a standard deviation above the mean on at least two of the three perception measures. These measures included ratings of loneliness, social anxiety, and social avoidance.

First, the authors found that rejected children reported significantly higher levels of loneliness than their popular, average, neglected, and controversial peers, and they were more likely to attribute negative, relational outcomes to peers (i.e. blamed peers for rejection). Controversial students were less likely than average status peers to attribute positive, relational outcomes to themselves (others like you) or to mutual cause (you like doing the same activities). Crick and Ladd (1993) found that children's feelings were directly related to their attributions. For popular children, feelings of loneliness were negatively related to taking credit for relationship successes. For rejected children, avoidance of peers was positively related to blaming others when relationships fail. For average children however, feeling lonely was found to be positively related to blaming the self for relationship failures. And for neglected children, feelings of loneliness were negatively related to taking credit for both relational and instrumental successes (Crick & Ladd, 1993).

The hypothesis that rejected children were more likely than other children to view peers as the cause of their social difficulties (e.g., because other kids are mean) was supported (Crick & Ladd, 1993). The authors postulate that rejected children may become keenly aware of their peers' negative sentiments toward them and feel distressed about their relative lack of positive relationships and/or their abundance of negative relationships. In addition, the results demonstrated that children's feelings of distress in social situations may depend on the causal attributions they make in those situations.

Likewise, children who score higher on ratings of aggression and depressive symptoms have been shown to process social situations in a more negative way (Quiggle, Garber, Panak, & Dodge, 1992). When they assess situations that involve rejection, children with higher levels of depression interpret these situations to be more emotionally distressing than how their healthy peers view the same situation. The behavioral response that is readily chosen is avoidance of social situations, instead of a more effective problem solving, or cognitive reappraisal technique (Quiggle et al., 1992).

A similar study was conducted by Dodge and Somberg in 1987, yet it only included observing attribution biases among aggressive boys. For this study, social cognitive processes were assessed under relaxed (watching videos) and threatening (overhearing an indirect verbal threat of physical violence) conditions. The study included 32 boys who had been identified from a larger sample as rejected and aggressive, and 33 boys who were identified as adjusted-nonaggressive.

There were several interesting results of Dodge and Somberg's (1987) study. Overall, aggressive boys gave more hostile attributions to the peer provocateur in the vignettes than nonaggressive boys. Under the manipulation of threat, the aggressive boys became even more

likely to attribute hostility to the peer provocateur, whereas the nonaggressive boys did not change their attributional tendencies (Dodge & Somberg, 1987). Nonaggressive boys were more likely to interpret accidental intentions than their aggressive counterparts. Both groups however, were very adept at interpreting hostile cues made by the peer provocateur. In the accidental situations, aggressive boys responded with more retaliatory aggression, in both the relaxed and threat trials. In the ambiguous vignettes, aggressive boys were more likely to attribute hostile intent than nonaggressive boys. In general, the behavioral responses indicated by nonaggressive boys closely matched their interpretation of the situation, whereas for aggressive boys the situation seemed somewhat arbitrary, unless it was clearly prosocial (Dodge & Somberg, 1987).

On a different note, Nelson and Crick (1999) researched social information processing in prosocial adolescents. They hypothesized that highly prosocial children would have a benign attributional bias that serves as a buffer against negative peer interactions. Further, they hypothesized that prosocial adolescents would favor relational goals over instrumental, and more favorable evaluations of response options. Lastly, Nelson and Crick (1999) wanted to observe the influence of emotion on social cognitive performance in this population. They predicted that prosocial youth would be significantly less likely to report feeling angry or upset by altercations with peers, and therefore less likely to be aggressive.

Research subjects included 887 fourth- through sixth- grade adolescents from 12 elementary schools. Similar measures were employed in this study as those described above. Children nominated classmates according to their relational and overt aggressiveness and prosocial tendencies. In addition, ten vignettes with unambiguous situations including two peers were shown. Questions following the vignettes assessed goal preference and response evaluations (Nelson & Crick, 1999).

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Findings revealed that prosocial adolescents could be differentiated by social cognitive patterns that are most likely support their prosocial nature. For example, the hypothesis was supported that prosocial adolescents would exhibit a benign attributional bias. They were significantly more likely than even their average peers to perceive benign intent behind a provocation (Nelson & Crick, 1999). Further, prosocial status corresponded with lower levels of anticipated distress to a hypothetical provocation. Therefore, according to Nelson and Crick (1999), prosocial adolescents are less likely to experience negative emotions that are connected with an aggressive or otherwise maladaptive reaction.

To summarize, while the exact process of social information processing at this point is still theoretical, there appears to be clear processing differences between children who have developed healthy emotion regulation skills and those who have not. The research presented here suggests that dysregulation and aggressive behavioral reaction in part results from misinterpretation of cues in processing.

The research regarding emotion processing and perception in both children with anger / aggression (Crick & Ladd, 1993; Dodge & Somberg, 1987) and in children with depression (Quiggle et al., 1992) indicates that unless targeted, these processing difficulties, and ineffective behavioral responses will continue into adulthood. As mentioned several times here within, borderline personality is a disorder diagnosed in adulthood and includes difficulties with emotion regulation, mood fluctuations including aggressive behavior, and interpersonal difficulties such as vacillations in close relationships (APA, 2000). It is quite possible that attributional biases developed in childhood carry into adulthood, and these difficulties make processing of social and emotional cues more haphazard. Indeed, research has been conducted in populations with

emotion regulation difficulties. The next section will review this literature, with a specific focus on emotion processing in borderline personality disorder.

Emotion Regulation and Processing in BPD

Emotion regulation in BPD. It has been mentioned previously that children who are raised in environments where there is inconsistent, unsupportive, over-involved, or critical parental reactions to emotional expression, may struggle with the ability to control their emotions (Denham et al., 2000; Eisenberg et al., 1996; Gable & Isabella, 1992). If ignored, the inability to control emotions in childhood may lead to emotion dysregulation and impulsivity in adulthood (Lieb, Zanarini, Schmahl, Linehan & Bohus, 2004).   Emotion dysregulation is defined as "the inability, despite effort, to change or regulate emotional cues, experiences, actions, verbal responses, and/or non-verbal expressions under normative conditions" (Linehan, Bohus, & Lynch, 2007, p.583). While emotion dysregulation can exist in someone without a clinically diagnosable disorder, as well as be an aspect of any number of psychiatric disorders, it has been noted as a fundamental aspect of BPD (Linehan, 1993; Linehan et al., 2007).   This disorder, which is characterized by persistent and pervasive cognitive, emotional, and behavioral dysregulation, is among the most severe and perplexing behavioral disorders (Crowell et al., 2009).

Characteristics of emotion dysregulation are consistent with most of the criteria for BPD and inhibit the entire emotional network including the behavioral, physiological, and cognitive subsystems (Linehan et al., 2007). Emotion dysregulation includes an overload of aversive emotional experiences, an inability to regulate extreme physiological arousal, problems turning attention away from emotional stimuli, cognitive distortions regarding emotional situations, impulsive behaviors related to overwhelming affect, a lack of non-mood dependent goal

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direction, and a tendency to dissociate under very high stress. Pervasive dysregulation occurs across the entire emotional system, including the behavioral, physiological, cognitive, and experiential subsystems of emotional responding (Linehan et al., 2007).

The developmental research presented here clearly describes how emotion regulation can be underdeveloped based on internal (neurobiological; cognitive) and environmental (parental; peer) influences. The neurobiological, cognitive, and environmental literature on the development of emotion regulation capacities is very consistent with Linehan's (1993) conceptualization that those with BPD are often raised in invalidating environments, and the effects of this environment continue through adulthood. Described earlier, an invalidating environment is one where there is an intolerance of the expression of emotions, or an intermittent reinforcement of extreme expressions of emotion (Crowell et al., 2009). Linehan (1993) hypothesized that when a child is raised in this type of environment, it is communicated to the child that such emotional displays are unwarranted and that emotions should be coped with internally and without parental support. Consequently, the child does not learn how to understand, label, regulate, or tolerate emotional responses and instead learns to oscillate between emotional inhibition and extreme emotional lability (Crowell et al., 2009; Linehan, 1993). In adulthood, this inability to control emotional reactions manifests as BPD.

Linehan's (1993) theory suggests that emotional responses and behaviors are learned through repeated behavioral interactions whereby emotional responses are often punished and dysfunctional or ineffective responses are reinforced. Thus, Crowell and colleagues (2009) have asserted that in childhood, vulnerability interacts with learning to shape and maintain dysregulated emotions, maladaptive behaviors, faulty interpersonal relationships, and cognitive distortions that are later categorized as borderline personality disorder. The characteristics of

borderline individuals can be directly connected to their emotional responses. Impulsive

behaviors, interpersonal problems, dissociative behaviors, and self-injurious behaviors often

function to modulate intense emotional experience, or to increase the experience of emotion or

sensation in the absence of emotion (Wagner & Linehan, 1998; Westen, 1991).

Longitudinal research on development of the disorder is lacking, and direct links between

childhood emotional development and adult emotion regulation have not been made (Crowell et

al., 2009), it is simply observed that emotion dysregulation is pervasive throughout BPD.

Recently however, one group of researchers (Crowell et al., 2009) extended Linehan's biosocial

theory for the purpose of conceptualizing BPD from a life span developmental perspective.

They developed five testable hypotheses regarding the development of the disorder. The first

hypothesis is that poor impulse control and emotional sensitivity are early biological

vulnerabilities for BPD (e.g. temperament, see Eisenberg et al., 1996).

The second hypothesis presented by Crowell and colleagues (2009) is that broad emotion

dysregulation is promoted and maintained within an invalidating environment (e.g. parental

responses to emotional expressions, see Eisenberg et al, 1999). The third hypothesis of this

developmental theory is that reciprocal transactions between biological vulnerability and

environmental risk potentiate emotion dysregulation and lead to more extreme behavioral

dyscontrol (e.g. cortisol levels, see Gunnar & Quevedo, 2007). The last two hypotheses are

grounded in the first three and fit together. They posit that there are early behavioral indications

of risk for BPD, and that traits and behaviors indicative of BPD emerge much earlier than the full

diagnosis (Crowell et al., 2009).

The theory that Crowell and colleagues (2009) presented is consistent other

developmental literature, and explains a possible longitudinal relationship between inefficient

emotion regulation development and BPD. In fact, their hypotheses regarding precursors to BPD are nearly identical to precursors of emotion regulation difficulties in children that have been identified in the emotion regulation literature.

While Crowell and colleagues (2009) were thorough in explaining a theoretical role of emotion regulation as it relates to the development of BPD, they did not include the influence of emotion processing. As described earlier, it is theorized that one precursor to emotional responding is the interpretation of emotional cues given by others (Dodge, 1991). As has been noted, inaccuracies in emotion processing in children are related to emotion regulation difficulties. Therefore, since emotion regulation difficulties in childhood are hypothesized to continue into adulthood when left unaddressed, it would make sense that emotion processing difficulties would also continue.

Emotion regulation development and its role in BPD have been discussed. In addition, emotion processing development, especially its role in emotion regulation, has been presented. What is missing from this review is the role of emotion processing in BPD. Therefore, in the next section, emotion processing in BPD will be reviewed.

Emotion processing in BPD. Ever since several researchers have observed that borderline individuals have difficulty regulating their emotions and most likely process emotional cues differently than others (Kernberg, 1985; Linehan, 1993), they have worked to verify this observation. The research has mainly focused on emotion facial expression recognition, and stems from Ekman's (1994) research of this topic.

Ekman and his colleagues were the first to research and develop measures of the six basic emotions expressed through the human face (1969). They noted that human faces are a rich source of information regarding subjective emotional states and social communication. The six

basic emotions he identified have been observed to be universal across cultures: happiness, surprise, sadness, fear, disgust, and anger (Ekman, 1992). Ekman and Friesen (1969) suggest that while there are cultural differences in what elicits certain emotions, and which emotions are considered appropriate responses, there is universality in the recognition of emotions when they are expressed through the face.   In cross-cultural studies of 31 groups, Ekman (1994) found consistent evidence of agreement in judgment of facial expression of these basic emotions. These emotions appear to have unique features, which include signal, physiology, and antecedent events. In general, people are able to identify these features to determine the emotion (Ekman, 1992).

Termed FER, Facial Emotion Recognition measures are the most common assessments of one's ability to perceive emotion. The measures use the faces of the six basic emotions that Ekman developed and tested (e.g. Ekman & Friesen, 1979; Ekman & Matsumoto, 1992; Schaffer et al., 2006). Many researchers have investigated ideas surrounding FER and its influence on social interactions. Hassin and Trope (2000) demonstrated that we make inferences about conversations with someone based on what we are reading in their facial expression, and these inferences can dramatically alter ongoing interactions (Keltner & Kring, 1998). In addition, we tend to build on our interactions (Hamilton, Katz, and Leirer, 1980); in other words, over time, as we are developing relationships, we use facial expressions and communication (i.e. language) to build on existing information. As we build on existing information, our interpretations of others' behavior and emotions improves. For instance, if our partner suddenly looks sad, this can shift the direction of a hostile interaction, as we may pause to express concern or offer support (Gross & Thompson, 2007). In contrast, if a hostile interaction is occurring with someone we don't know well, the shift in emotion may not be as easily identifiable. It is possible to comprehend

that either consistently inaccurate emotional perception, or inconsistent emotional responses given by others, could lead to faulty interpersonal interactions and one becoming emotionally dysregulated (Wagner & Linehan, 1999*).*

In this way, emotion perception and conceptual knowledge about emotions are closely interrelated, with conceptual knowledge of emotions influencing the way emotions are perceived and vice versa. Both emotion perception ability and conceptual knowledge of emotions are mostly developed during childhood. The research involving the relationship between perception and conceptual knowledge also involves measures of FER. For example, researchers have found that supplying individuals with verbal information about still faces improves discrimination of different facial expressions (Gauthier, James, Curby, & Tarr, 2003; Russell et al., 2003). It has been speculated that individuals with more complex emotion knowledge will perceive and adapt to a variety of emotional signals or feelings and will probably generate more suitable plans for regulation, whereas those with less complex knowledge may be comparatively limited (Wranik et al., 2007).

Studies comparing FER in those with BPD versus healthy controls (HCs) have produced mixed results, without an overwhelming amount of evidence to suggest whether there is enhanced, impaired or equivalent perception ability compared to healthy groups. The findings of FER studies will be presented in terms of whether their overall results found the BPD Group to be less accurate (Bland et al., 2004; Dyck et al., 2009; Levine, Marziali & Hood, 1997; Merkl et al., 2010; Unoka, Fogd, Fuzy, & Csukly, 2011), of similar accuracy (Domes et al., 2008; Dyck et al., 2009; Minzenberg, Poole, & Vinogradov, 2006; Schilling et al., 2012; Wagner & Linehan, 1999), or more accurate (Fertuck et al. 2009; Lynch et al., 2006) in identifying emotion compared to non-clinical groups. Within each study there are discrete differences in ability, such

as bias toward fear response, or a difficulty in distinguishing neutral from emotion states, which will be reported along with the general perception results.

      BPD less accurate. Bland and colleagues (2004) conducted a study to examine emotion processing in BPD utilizing an in-patient sample of 35 women with BPD and 35 HCs. To test their hypotheses, the authors administered an abbreviated form of the Pictures of Facial Affect (PFA; Ekman & Friesen, 1979, 1984) and the Affect Intensity Measure (AIM; Larsen and Diener, 1987). The PFA (Ekman & Friesen, 1979, 1984) measures the ability to identify facial expressions of emotions. The PFA includes photographs of either a male or female face depicting one of six basic emotions-anger, disgust, fear, happiness, sadness, and surprise, or a neutral expression. The pictures are presented randomly to subjects who are asked to select the emotion that best describes the expression in the photograph. Responses are scored for overall accuracy and for accuracy within each specific emotion category. The authors also administered the AIM as a measure of affect intensity, to determine whether it related to perception abilities. On the AIM, subjects use a six-point scale to rate the strength of their emotional reactions to 40 ordinary life events. Of the 40 items, 28 (70%) reflect positive emotions, and 12 (30%) tap negative emotions.

      First, Bland and colleagues (2004) found that those with BPD were overall less accurate in identifying the facial expression of emotion. More specifically, the BPD group was significantly less accurate in identifying anger, sadness, and disgust. Secondly, they found that the BPD group reported significantly higher levels of emotional intensity, accounted for by their levels of reported negative emotional intensity. Lastly, the researchers found that the more negative affect intensity reported, the less accurate one was in differentiating between negative facial affect. They did not find any differences between groups in FER of positive emotions.

The findings reported by Bland and colleagues (2004) should be interpreted with caution. The researchers used a convenience sample of all inpatient BPD participants. Without diversity in the clinical sample, the results are less generalizable than had the BPD sample included both in- and out-patient participants. Further, considering that everyone in the healthy control sample was void of any current or past psychopathology, the extreme differences in participant groups may have contributed to the results. Therefore, future research should include a clinical participant sample with varying degrees of psychopathology. Another limitation is that the researchers utilized only two measures to test their hypothesis. Had the researchers incorporated additional measures to corroborate their findings they would have been able to corroborate their findings and offer more insight about their results.

As part of a larger study, Dyck and colleagues (2009) specifically tested ability to discriminate between fearful, angry, and neutral facial expressions. Their sample included 19 BPD outpatient participants and 19 HCs. Fourteen of the subjects in the BPD group had a comorbid diagnosis of PTSD, substance dependence, an eating disorder, or panic disorder. The Fear Anger Neutral Test (FAN) was used and comprises 16 angry, 16 fearful, and 32 neutral facial expressions depicted by men and women from Caucasian, African, and Asian ethnicities. Stimuli are presented for two seconds each and subjects are asked to respond within that time frame. They are given their choice of two of the three emotions for each stimulus.

The results indicated that the BPD group was significantly less accurate in choosing the correct emotion. More specifically, those with BPD chose either fear or anger more frequently than the HC group when the stimulus was neutral, and therefore, the significant difference was accounted for by the number of inaccurate responses to neutral stimuli. However, when the authors divided the BPD group into those with and without comorbid PTSD, they found that the

non-PTSD group did only marginally worse in identifying neutral, and performed the same in identifying negative emotions, as the HC group (Dyck et al., 2009). It is difficult to conclude that the PTSD diagnosis accounts for the difference in accuracy when several other co-morbid disorders were identified in the sample and not analyzed further.

The authors implicated a negativity bias (Dyck et al., 2009). However, the only choices available were neutral or negative so it is unknown whether the subjects would have been less biased had they been given a more choices. It is interesting that the measure used incorporates three ethnicities and the images are in color. This is divergent from most of the FER studies that utilize gray scale images from the Ekman and Friesen (1979) catalog. However, the authors failed to expand upon the implications of this and do not report the ethnic representation of their sample or if there was any bias toward any one ethnic stimulus or another.

Levine et al. (1997) conducted a FER study that also determined the BPD group to be significantly less accurate in emotion perception than a HC group. They studied 30 outpatient subjects (10 male) meeting DSM-III-R criteria for BPD and compared them to 40 age and education matched HCs. The measures of emotion perception included the abbreviated PFA (Ekman & Friesen, 1984), the AIM (Larsen & Diener, 1987), The Ambivalence Questionnaire (AMBQ; Westen & Gaborit, 1989), and the Levels of Emotion Awareness Scale (LEAS; Quinlan, Lane, & Schwartz, 1988).

The abbreviated PFA and AIM have been described previously. The AMBQ was originally designed to measure children's ambivalence or their capacity to coordinate mixed emotions, but for this study was adapted for use with adults. The subject is given a situation and asked to predict what the character's emotional response would be, and describe the

characteristics of the person in the given situation (e.g., good friend, irresponsible, dishonest). The responses are coded as negative, positive, or mixed.

The LEAS measures the respondents' ability to differentiate emotions in self and others. The measure includes 20 vignettes (the authors do not make it clear whether they are presented in written or auditory form) of two-person situations eliciting four emotions: anger, fear, happiness, and sadness. Subject's responses are tape-recorded and coded on ability to identify emotion in self and others, and to express empathy. A five point scale ranging from 'no awareness of emotion' to 'awareness of discrete, multiple emotions,' is used.

Levine and colleagues (1997) found that the two groups differed significantly on all four measures of emotion processing. On the AMBQ, the BPD group showed significantly less ability to identify what emotions were being expressed in the vignettes compared to the control group. On the LEAS, the BPD group showed significantly lower levels of emotional awareness than did the control group. Similar to Bland and colleagues (2004), Levine et al. found that the BPD group showed significantly greater intensity of negative emotions than did controls on the AIM, but did not differ from controls for intensity of positive emotions. And again as similar to Bland and colleagues (2004), on the PFA, the BPD group was significantly less accurate than the control group at identifying facial expressions of emotions. More specifically, the BPD participants were less accurate in identifying anger, fear, and disgust on the PFA.

This study was interesting because it included several varied measures of emotion perception. This allowed the researchers to determine various abilities or deficiencies, and in this case, found consistent deficiencies within the BPD group. However, there are some limitations. The researchers were liberal with inclusion criteria, allowing any Axis I disorder besides schizophrenia. For that reason, it is difficult to know whether the results are attributable to

characteristics of BPD or whether symptoms of another psychological disorder may have influenced the results. Unlike other studies presented here however, the sample in this study includes BPD participants from various resources, creating a more diverse clinical sample. In addition, the researchers made a concerted effort to have a demographically matched control group.

As part of a larger magnetoencephalographic study, Merkl and colleagues (2010) administered a set of 112 male and female faces from the Ekman and Friesen (1979) catalog, including both neutral and emotional expressions. Their sample included 13 BPD inpatient, and 11 HC community participants. The authors excluded those with current major depression, schizophrenia, substance abuse, or a neurological disorder. The measure was timed and included stimuli from Ekman and Friesen's standardized catalog (1979) with all six of the basic emotions included. During administration however, the subjects were given a choice between only two of the emotions. The authors reported that the BPD group was less accurate for all emotional and neutral faces. There was a slight tendency for the BPD group to choose fearful faces more incorrectly than the HC group. This is one of four studies reported here that found a bias toward the emotion of fear. Limitations of this study include a homogenous inpatient BPD sample and overall small sample size, making the results less generalizable than some of the other research findings presented.

Last within the 'less accurate' category is study conducted by Unoka and colleagues (2011). They aimed to investigate specific impairments and error patterns in perception of negative emotions. Their sample included 33 BPD inpatient and 32 matched HC participants. The subjects were administered the Ekman 60 Faces test, which includes male and female picture depicting the basic six emotions, each presented ten times for five seconds each. For each

stimulus, the participant was able to choose from all six emotions. Neutral facial expressions were not included in this study.

Unoka et al. (2011) reported that the BPD patients were significantly less accurate than the HC group. Further, the BPD group was less accurate in differentiating between fear, sadness, disgust, and anger. The BPD group almost never confused positive and negative emotions, a finding consistent with other studies reported here (Levine et al., 1997; Bland et al., 2004; Domes et al., 2008), suggesting that ability to differentiate between positive and negative valence is intact in BPD.

Similar accuracy between groups. Other studies have indicated that FER in BPD is *not* impaired, as their results have found no significant difference between BPD and HC groups. A study by Domes and colleagues (2008) tested 25 women with BPD and 25 HCs on two measures of emotion perception. Eleven of the BPD group had co-morbid PTSD.

For the first part of their study the researchers morphed facial expressions from the PFA (Ekman & Friesen, 1993) from a neutral to an emotional facial expression. For this task, the authors wanted to determine how long it took participants to correctly identify the emotion of the facial expression (Domes et al., 2008).

The facial expressions were electronically morphed in 5% increments of intensity from 0-100%. As the subjects were watching the face morph in intensity they were instructed to press a 'stop' button as soon as they became aware of the emotion being displayed. Overall, the researchers did not find any significant differences between groups in ability to accurately identify the emotion being displayed. The researchers found one significant difference; they determined that the BPD subjects made significantly more errors on the trials showing surprised faces.

The second portion of the study tested whether participants had difficulty identifying ambiguity in facial expressions. Domes et al. (2008) used the same set of slides and morphed two emotions together in 10% increments to produce a set of new slides, each of which represented a blend of two basic emotions (e.g. 90% anger/10% fear; 70% anger/30% fear). The blends included anger to disgust, anger to sadness, anger to fear, anger to happiness, fear to disgust, fear to sadness, and fear to happiness. The subjects were asked to report the emotion on the face displayed as quickly as possible. Again, no significant group differences were found. However, there were discrete differences in the types of emotions chosen by each group. The BPD group responded 'anger' more readily than the HCs to both the anger/disgust blend and the anger/happiness blend. This finding led the authors to suggest that those with BPD have a more difficult time identifying ambiguous faces, and that they have a negativity bias when the expression is ambiguous (Domes et al., 2008).

There were some methodological limitations to this study. First, while the study did match for age and education, only women were included. Additionally, 11 out of 25 women in the BPD group met criteria for PTSD. The emotional intensity found in PTSD might be different than that of individuals diagnosed with BPD without PTSD, and the authors did not account for this possible confound. Furthermore, while altering a FER measure to morph the faces from neutral to emotionally laden is interesting, the altered measures used in this study do not have any reliability or validity indices, and therefore, the results should be interpreted with scrutiny.

Results of a study conducted by Dyck and colleagues (2009) supported the notion that, in general, perception is not a deficiency found in those with BPD. As part of a larger study, the Emotion Recognition Test (ERT) was administered to 19 BPD outpatient participants and 19

HCs. The ERT includes 40 colored pictures of faces and requires subjects to choose one of four

emotions (happy, sad, afraid, or angry) or neutral. No significant between group differences

were found ($p = 0.58$). Though not significant, they found that happiness was most readily

accurately identified, followed by neutral, and fear. Subjects had the most difficulty identifying

sadness and anger.

The authors noted this was the first study to include in-color facial expressions, though

neither the racial representation of the stimuli or of the participants was described, making it

difficult to decipher whether this had an effect on the results. Another limitation, as cited in

other studies presented here, is the fact that only one measure was used for analysis and

therefore, nothing is available by which to compare or synthesize the findings.

Only one study has been identified to date that has tested emotion perception in more

than one modality. Minzenberg and colleagues (2006) sought to determine the ability of BPD

individuals to recognize both facial and prosodic emotions. Prosody is defined as "the study of

versification" or "the rhythmic and intonational aspect of language" (Merriam-Webster

Dictionary, 2009). The changes in one's tone when angry, excited or happy are all examples of

prosody. The researchers hypothesized that subjects with BPD would have several social-

emotional processing deficits, and that these deficits would be related to interpersonal conflicts.

Five measures were administered in total. Two measures of FER were administered; a

version of the PFA (Ekman & Friesen, 1979), and the Benton Facial Recognition Test—Long

Form (BFRT; Benton & Van Allen, 1968). The former has been discussed previously, and for

the purposes of their study, the researchers included photos representing the six basic emotions.

The latter is a test of facial feature matching. Subjects are asked to match each target face with 1

of 6 and then 3 of 6 faces shown on the same page. There are 22 trials, and each gets progressively more difficult.

Two measures were given to determine prosodic emotion recognition. The Bell-Lysaker Emotion Recognition Test (BLERT; Bell, Bryson, & Lysaker, 1997) was designed to determine a person's ability to differentiate between the six basic emotions and neutral, given facial, voice-tonal, and upper body movements. The subject views the same actor portraying one of the seven choices while speaking one of three monologues involving work-related topics (21 vignettes total). The only instructions given are to select which emotion (or neutral) is being represented in each vignette. In addition, the Prosodic Emotion Recognition Test (PERT; Bowers, Blonder & Heilman, 1991) was given. On this test, neutral sentences (e.g. The chairs are made of wood) are read in five prosodic tones (happy, sad, surprised, angry, or neutral) four times in random order (20 trials total; Minzenberg et al., 2006). Finally, the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957) was administered as a measure of interpersonal hostility. This measure includes 75 self-report items measuring several emotions that can lead to interpersonal conflict (e.g. hostility, irritability).

On the PFA measure of FER, Minzenberg and colleagues (2006) did not find any significant differences in accuracy between the BPD and the HC groups. However, they did find that the BPD group was significantly *less* accurate than the HC group on the BFRT. On measures of prosody, Minzenberg and colleagues (2006) found that the BPD group was less accurate than HC group on the BLERT *and* that their scores on the BLERT were inversely correlated with their total hostility scores on the BDHI. In other words, the less accurate in emotion perception, the more hostility one was reporting. However, on the PERT, no significant differences in accuracy were found between groups (Minzenberg et al., 2009).

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The authors' findings are consistent with several studies reported here (Domes et al., 2008; Dyck et al., 2009; Minzenberg et al., 2006; Schilling et al., 2012; Wagner & Linehan, 1999) indicating that individuals with BPD do not have more difficulty interpreting facial expressions of emotion.   However, the authors concluded that in general, as integrations of social appraisals become more complex, individuals with BPD may begin to evidence impairments.

This study was the first of its kind to report on multiple measures of social-emotion perception in BPD, including comparison of the ability to recognize emotions in isolated sensory modes versus integrated perception.   However, there were limitations of the study. The researchers (Minzenberg et al., 2006) excluded patients with BPD who had comorbid major depression, PTSD, bipolar, or substance dependence. Comorbidity is extremely common in BPD, and thus, their study may represent an unusual subgroup of the BPD population. Similarly, this study did not include a clinical comparison group; therefore, it is unclear whether these findings are specific to patients with BPD or may reflect symptoms that are also found in other disorders. Furthermore, psychometric properties of the prosody recognition task had not been established at the time of the study.

Schilling and colleagues (2012) conducted a FER study utilizing the Reading the Minds in the Eyes (RMET) task. They administered the task to 31 BPD and 27 HC participants. The majority of the participants had a co-morbid depressive or anxiety disorder. The RMET consists of 36 black-and-white photographs of the eyes region of various human faces. Participants are asked to identify the mental state of the stimuli by choosing one of four possible adjectives (three distracter words and one correct word). Participants are provided with a glossary, which contains the meaning of words describing mental states.

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On the RMET, the authors failed to find any differences between groups in accuracy. Due to the measure used in this study, the results are not directly relatable to other FER findings, but interesting nonetheless as it suggests that on tasks with less emotional information, the BPD group maintains accuracy. However, it could also be considered that both the BPD and HC groups found the task difficult, and any differences were counteracted.

The purpose of a study conducted by Wagner and Linehan (1999) was to compare the facial expression abilities of three groups of Caucasian women, ranging in age from 18 to 45. The groups included: BPD with a history of childhood sexual abuse (BPD group; N= 21); a history of childhood sexual abuse without BPD (CSA; N=20); no history of CSA or BPD diagnosis (HC; N=20).

Two measures of FER were used, the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) and Japanese and Caucasian Neutral Faces (JACNeuF), both developed by Ekman and Matsumoto (1992). The slides represented anger, contempt, disgust, fear, happiness, sadness, surprise, and neutral, but according to the researchers, they wanted to observe the most accurate ability by the groups and thus, did not give the participants choices of emotions (Wagner & Linehan, 1999).

Wagner and Linehan (1999) did not find significant differences between the groups on any of the emotion slides except for fear. The authors determined that the BPD group was the most accurate group on recognition of fear slides, and in addition, falsely attributed fear more frequently than the other two groups. In other words, when the BPD group misidentified an emotion, they were more likely to choose a fear emotion. In regards to the non-emotional, or neutral slides, both the BPD and CSA group scored significantly *lower,* or were less accurate*,* than the control group (Wagner & Linehan, 1999).

Several limitations of this study are apparent. First, the measures included both Asian and Caucasian facial expressions, but there were not any Asian participants. Further, the subjects were not given choices of emotions and were not informed that an expression could be neutral. The authors noted that many participants had to be instructed to shorten their responses because they were giving more description than a basic emotion. Considering this, it is unclear whether the answers given were prompted or were spontaneous responses. Lastly, the researchers did not include any measures of proposed influence on FER ability. For instance, they did not measure anger, hostility, or depression; traits that are thought to be related to emotional competence. Additional measures would have offered more insight regarding discrete group differences.

BPD more accurate. Two studies of FER found that those with BPD are more accurate in their ability to identify expressions of emotion (Fertuck et al., 2009; Lynch et al., 2006). Fertuck and colleagues (2009) conducted a study similar to Schilling et al. (2012) in that they utilized the RMET as a measure of FER. For their study, a group of 30 individuals with BPD were compared to 25 HCs on RMET performance. Participants were also assessed for depression using the Beck Depression Inventory (BDI; Beck & Steer, 1993), and emotional state using the Profile of Mood States (POMS; Lorr & McNair, 1982) which is a 65-item questionnaire measuring general negative affect.

The results indicated that the BPD group was significantly more accurate than the HC group in perception, as indicated by higher overall scores on the RMET. The BPD group was more accurate in identifying neutral, positive, and negative mental states. They did not find that the POMS correlated significantly to the RMET, but the authors did find a significant positive correlation between the BDI and RMET, suggesting that greater depression is related to enhanced perception abilities (Fertuck et al., 2009).

This study offers an alternative finding to the majority of the FER literature. Unfortunately, because the RMET cannot be directly compared to FER measures that use a full face, it is difficult to determine how generalizable these findings are. As mentioned above when reviewing the Schilling et al. (2012) study, differences may simply be due to both groups finding the task challenging. More RMET specific research is needed.

A study utilizing morphed facial expressions was described above, but Lynch and colleagues (2006) were the first to assess emotion perception in BPD using a morphing measure. The authors used the Multimorph Facial Affect Recognition Task (Blair, Colledge, Murray, & Mitchell, 2001), which utilizes slides from the PFA (Ekman & Friesen, 1979), morphing them from a neutral facial expression to one of the six basic emotions. For each of the 36 trials presented (6 for each of six emotions), the subject saw a neutral face morphing into an emotional expression over 39 stages, for 450ms each stage. Participants were asked to click their choice of emotion as soon as they were able to recognize it.

The study compared 20 participants with BPD (17 women) to 20 matched HCs. Overall, participants with BPD were able to correctly identify emotional faces more quickly and more accurately than the HC group. Contrary to several other studies reported here, there was not a significant difference between groups in their ability to identify anger or happiness relative to the other emotions. This finding suggests that those with BPD have heightened sensitivity to facial expression of emotion (Lynch et al., 2006). Further, the authors postulate that the BPD group's ability to more accurately recognize emotional expressions may be related to increased emotional experience, and may exacerbate any emotional arousal they are already experiencing, contributing to emotion dysregulation.

There are limitations to be noted. First, the sample included all Caucasian's with a fairly high level education, making generalizability of results questionable. In addition, there was not a neutral stimuli included. Research that has included a neutral choice option has typically found that those with BPD have the most difficulty identifying emotion when it is ambiguous. Therefore, without ambiguity, the results may be skewed. If the study had included a neutral option the results may have different.

Summary of FER studies. In sum, the results of FER and multimodal perception are inconsistent at best. While there are studies that report the notion that those with BPD are more accurate, one tested morphed FER (Lynch et al., 2006), and the other used RMET, a variation of FER and not directly comparable to the majority of FER research findings (Fertuck et al, 2009).

Moreover, of the studies that reported no overall differences between BPD and HC groups (Domes et al., 2008; Dyck et al., 2009; Minzenberg et al., 2006; Schilling et al., 2012; Wagner & Linehan, 1999), several found significant differences on discrete emotion subtests. For instance, one study (Domes et al., 2008) found that the BPD group more readily identified angry over both happy and disgust, while another study (Wagner & Linehan, 1999) found more accuracy in identification of fear. A third study in this category (Minzenberg et al., 2006) found no overall differences, but found that those with BPD were less accurate on matching faces with the same emotion.

Of the five studies that found BPD groups to be less accurate than healthy control groups on FER measures (Bland et al., 2004; Dyck et al., 2009; Levine et al., 1997; Merkl et al., 2010; Unoka et al., 2011), four used variants of the PFA (Ekman & Friesen, 1979), making these results more easily comparable and reliable.

In sum, there are significant limitations to this body of research. Sample sizes are universally questionable, and as previously noted, differences in samples and operationalization of key variables, make interpretation of results difficult. None of the research findings have been adequately replicated.

New Direction in BPD FER Research

A single study was reported here that included multimodal measures of emotion processing (Minzenberg et al., 2006). This is the only study of its kind to date, as the majority of research completed in the area of emotional processing in BPD has involved FER. Research on multimodal integrations of emotion perception in BPD is sufficiently lacking. The lone study that integrated varying measures of facial and auditory perception reported mixed results. Results from both FER and multimodal research studies have not determined whether facial expression interpretation is deficient, or possibly hyper-sensitive, in the BPD population. Not only is further FER research needed in order to clarify discrepancies, the next avenue that may provide fuel to this debate is to observe auditory emotion perception in borderline individuals. In addition, it has been noted several times that the static observation of emotion is probably not as useful as the observation of dynamic emotional expression.

In an attempt to address the discrepancies in the existing research and to expand upon the understanding of emotion recognition in BPD, the present research study was conducted utilizing measures of auditory as well as facial emotion recognition, and also a dynamic measure of social interpretation. Recently, a tool was developed from Ekman and Friesen's (1979) 'face catalog' to measure emotional perception and processing on three levels: facial expression, prosody, and lexical function. This measure, called The Comprehensive Affect Testing System - Abbreviated (CATS; Schaffer et al., 2006) allows researchers to accurately determine one's ability to perceive

emotion, and can determine if there are specific areas of perception that are less accurate than others. For instance, it can be determined if one was able to understand semantic content but unable to detect tonal fluctuations in a spoken language, whereby for instance, anger is missed because someone is unable to detect a change in tone. The measure can answer whether an individual is able to recognize subtle changes in prosody without being able to recognize a change in facial expression. If this were the case, the pout that often accompanies the classic "I'm fine" response would not be detected and the individual would go about business as usual, unaware of the emotional upheaval that awaits them in their relationship. While this measure still does not replicate a 'real world' setting, it is a much better depiction of actual communication and emotional perception than looking at still photographs. Originally developed as a neuropsychological measure, it has yet to be used in a study assessing emotion recognition in BPD. The next chapter will provide an explanation of the study design that incorporated this measure.

Chapter 3: Project Design

Introduction and Purpose

The primary aim of the study was to expand upon research in the area of emotion recognition processing in individuals diagnosed with BPD. This was be the first study of its kind to utilize a single measure of varying types of emotion perception to determine whether there are differences between those diagnosed with BPD and healthy controls.

Previous research in this area has focused primarily on facial emotion recognition, with only one study identified that incorporated measures of prosody perception (Minzenberg et al., 2006). The study conducted by Minzenberg and colleagues however, did not use a unitary construct of varying degrees of emotion perception, and therefore, analysis of differences between visual and auditory perception were not completely reliable. For that reason, a second goal of this study was to provide a more accurate representation of any differences that exist between abilities to perceive facial versus auditory emotion information. A third goal was to explore group differences between performance on a dynamic social interpretation task, in order to evaluate emotion processing in a more complex context requiring processing of multiple social cues. Measures of both visual and auditory affect perception were administered, in addition to several written self-assessments of anger, impulsivity, and emotion intensity.

Hypotheses. Specific hypotheses are as follows:

1. To date, research on emotion processing in BPD has not yielded clear results. Utilizing the CATS, a newly developed instrument that incorporates multimodal assessment of multiple domains of emotion processing, helped clarify the question of whether individuals with BPD are more or less accurate at identifying emotional expression compared to others. The measure includes 13 subtests and an Emotion Recognition

Quotient (ERQ), which includes the 11 subtests of emotion recognition (the other 2 are baseline non-emotion recognition scales). It was hypothesized that, in general, individuals diagnosed with BPD would be significantly worse at accurate identification of emotion expression compared to healthy controls. Therefore, the first hypothesis predicted that the BPD group would have significantly lower CATS-ERQ scores than the healthy comparison group.

2. More specifically, the following findings were hypothesized to be evident on CATS-A subtests:

   a. Because auditory perception and conflicting prosody have not yet been measured in BPD, this hypothesis was largely exploratory. However, based on the single previous result in auditory recognition in BPD (Minzenberg et al., 2006), it was predicted that those with BPD would be less accurate in several areas of recognition. Scores for BPD participants were predicted to be significantly lower on the subtests Emotional Prosody Discrimination (discrimination of nonaffective sentences read in varying emotional tones), Conflicting Prosody—Attend to Meaning (ignore the expressed emotion), and Match Emotional Face to Emotional Prosody subtest (choose face that matches the emotional tone of the sentence) compared to healthy controls.

   b. Several previous studies have reported discrepancies in ability for those with BPD to accurately identify neutral stimuli (Dyck et al., 2009; Fertuck et al., 2009; Wagner and Linehan, 1999). Therefore, it was predicted that those with BPD would be less accurate than the HC Group in differentiating between neutral and emotional expressions. This was measured by the number of accurate responses on items including both an emotional and neutral stimuli, found in the Affect Discrimination,

Conflicting Prosody/Meaning—Attend Meaning, and Match Emotional Face to

Emotional Prosody CATS subtests.

c. The CATS facilitates direct comparison of facial and prosody perception. Previous

research supported the notion that individuals with BPD are hyper-sensitive to

emotional cues. Therefore, it was predicted that the BPD Group would have

significantly higher scores on two subtests of the CATS: Conflicting Prosody—

Attending to Prosody (ignore meaning and attend to emotion), and the Match

Emotional Prosody to Emotional Face. Both of these subtests require heightened

attention to directed stimuli and therefore, higher scores on these subtests would

suggest a greater ability to differentiate more complex emotional cues.

3. Based on the findings in FER research suggesting that those with BPD are inconsistent

perceivers of emotion (e.g. Minzenberg et al., 2006; Wagner & Linehan, 1999), it was

predicted that this trend would translate into lower scores on a social perception task in

the BPD group compared to the Healthy Control Group. It was predicted that healthy

controls would score significantly higher than BPD subjects on the Interpersonal

Perception Task-15 (IPT-15) indicating better appreciation of expressive and

interpersonal relationship cues.

4. Several studies have identified a relationship between emotion recognition accuracy and

levels of negative emotion (Bland et al., 2004; Levine et al., 1997; Minzenberg et al.,

2006). Based on these previous findings, it was predicted that those with higher levels

of trait anger and impulsivity would be less accurate in emotion recognition. It was also

predicted that higher levels of affect intensity result in less accurate emotion perception

ability. Therefore, the fourth hypothesis predicted negative correlations between trait anger and impulsivity, and affect intensity, across the whole sample.

   a. Trait scores on the State-Trait Anger Expression Inventory (STAXI) were predicted to be negatively correlated with CATS-ERQ scores.

   b. Scores on the Barett Impulsivity Scale (BIS) were predicted to be negatively correlated with CATS-ERQ scores.

   c. Scores on the Affect Intensity Measure (AIM) short form were predicted to be negatively correlated with CATS-ERQ scores.

5. It was anticipated that those who have stronger abilities in perception on the CATS would also have stronger abilities to interpret social situations on the IPT, in comparison to other group members. Therefore, the fifth hypothesis predicted a positive correlation between scores on measures of emotion recognition and perception of social cues; thus total scores on the CATS measure were expected to increase with total scores on the IPT measure.

Method

All subjects were administered diagnostic and clinical measures. Diagnostic measures were administered first as they determined inclusion/exclusion criteria. The appropriate version of the Structured Clinical Interview for DSM Disorders (SCID; Axis I and Axis II disorders; patient and non-patient versions) was utilized for diagnostic purposes. The clinical measures included the CATS for assessing both facial and auditory emotion perception and the IPT-15 to assess for identification of emotion social cues. Additionally, surveys of anger, impulsivity, and affect intensity were administered and used in correlational analysis of emotion perception results.

Recruitment. All participants were recruited from the community. Separate advertisements were used for the clinical and healthy control groups. Ads were posted on craigslist.org (a free community website to post various types of classified ads). Advertisements and any other materials were approved by the IRB before being distributed (see Appendix A).

Subjects. According to G*Power (Erdfelder, Faul, & Buchner, 1996) in order to detect a moderate effect size of .20, using an alpha level of .05, a sample size of 70 was required. The BPD Group included 36 participants, and the HC Group included 35 participants. All participants were between the ages of 18 and 55, signed an informed consent, and were fluent in English.

Inclusion/Exclusion Criteria. For inclusion in the BPD clinical sample, participants needed to meet five of the nine DSM-IV BPD criteria (diagnosis requires at least five of the nine criteria). Subjects with co-morbid disorders were included, except for those with a psychotic disorder (e.g. Schizophrenia) or with active drug or alcohol dependence. Anyone exhibiting psychotic symptomatology or evidence of cognitive impairment was excluded. Sixty-five individuals responded to the clinical group advertisements. Of these inquiries, 51 were screened and 36 qualified and were tested. Nine were disqualified for various reasons including: diagnosis of Asperger's, active substance dependence, or not meeting enough criteria for BPD diagnosis. Fourteen individuals who called about the study did not follow through with further contact.

The healthy control (HC) sample included individuals who did not meet criteria for any psychological disorder, including an alcohol or drug abuse disorder. Those reporting any history of any psychological disorder were excluded. Anyone who evidenced cognitive impairment or reported taking psychotropic medication was also excluded from the healthy control sample. Forty-six individuals were screened for the HC sample. Eleven were excluded from participation due to endorsing more than three but less than five BPD criteria, active alcohol or substance abuse, or a history of being prescribed psychotropic medication. Inclusion and exclusion criterion for both groups are listed in Table 1 below.

Table 1.

Inclusion and Exclusion Criteria

Clinical Sample	
Criterion	Method of Ascertainment
A. Inclusion:	A. Inclusion:
1. Meet DSM-IV-TR criteria for BPD	1. Phone Screen (preliminary); SCID-II
2. Age 18-55 years	2. Phone Screen
3. Willing to give informed consent	3. Patient Interview
4. English speaking	4. Patient Interview
B. Exclusion:	B. Exclusion:
1. Current substance dependence disorder	1. Phone Screen; SCID-I Section E
2. Evidence of cognitive impairment	2. Phone Screen; Patient interview
3. Significant psychotic symptomatology	3. Phone Screen; SCID-I Section B

Healthy Controls	
Criterion	Method of Ascertainment
A. Inclusion:	A. Inclusion:
1. Age range 18-55 years	1. Phone Screen
2. Able and willing to give informed consent	2. Patient interview
3. English speaking	3. Patient interview
B. Exclusion:	B. Exclusion
1. Current or past Axis I or II Disorder	1. Phone Screen; SCID-NP; SCID-II (BPD Section)
2. Current alcohol/substance abuse or dependence	2. Phone Screen; SCID-NP
3. Taking psychotropic medications	3. Phone Screen
4. Evidence of cognitive impairment	4. Phone Screen; Patient interview

Study procedures. The study followed the following procedures. First, subjects called the

advertised number to express their interest in participating. At the time of phone contact, it was

determined to which ad they were responding, and the caller was given a brief overview of the

study. Once the caller gave their verbal consent, a pre-screen was conducted to determine if

preliminary inclusion and exclusion criteria were met. The phone screen included gathering

information about age, how many (if any) characteristics of BPD were being met, and whether

there was evidence of an alcohol/substance abuse, psychotic, or cognitive disorder. Those who

responded to the HC or the BPD advertisement, but met between 3 and 4 criteria for BPD (5 is

needed for diagnosis) were excluded from participation as they did not meet inclusion for either

group. Those who met preliminary criteria for either group were invited to the research lab for

participation.

Upon arrival to the research lab, all subjects were given a detailed, verbal explanation of the

project by an investigator. Before beginning the assessment, all subjects participated in the

informed consent process which included review of the document, signing the informed consent

and being given a copy for their records. Following consent, participants were administered the

diagnostic and clinical measures. Lastly, each volunteer was given a list of local clinical

resources and websites related to BPD. All participants were offered the opportunity to debrief

about their experience.

Measures. The following measures were administered:

A. Phone Screen *(10min; all participants).* All persons interested in participating in the
   study were administered a Phone Screen to determine whether they met preliminary
   inclusion/exclusion criteria. The Phone Screen included relevant demographic
   questions, as well as questions related to BPD diagnosis, substance use, psychotropic

medications, symptoms of psychosis, and traumatic brain injury. The Phone Screen is
available for review in Appendix B.

B. Demographic Questionnaire (10 min; *clinical participants only*). Subjects in the BPD
Group were administered a questionnaire that is an expansion of the phone screen. This
questionnaire was developed by the P.I. of the project and assessed any history of self-
injury or suicide attempts, as well as any history of psychiatric treatment. The
Demographic Questionnaire is available for review in Appendix C.

C. Diagnostic Measures

 1. *Structured Clinical Interview for DSM-IV Axis I – Non-Patient Edition (SCID-NP).*
   (20 min.; *healthy control group only*)**.** The SCID-NP allows the screening of specific
   psychiatric diagnoses. Any endorsed items on the NP screen can then be addressed
   using the SCID-I clinical version (listed below) if necessary (e.g. more diagnostic
   clarification is needed to determine inclusion/exclusion criteria). For the purposes of
   this study, anyone not meeting criteria for BPD but meeting criteria for any other
   diagnosis will be excluded from participation.

 2. *Structured Clinical Interview for DSM-III-R and DSM-IV Axis I Diagnosis* (SCID-I;
   First et al. 1997). (25 min; *relevant sections*) The SCID-I was designed for
   differential diagnosis and assessment of psychiatric disorders, using DSM-IV criteria.
   Field trials with this instrument have shown evidence of good inter-rater reliability.
   Inter-rater reliability for SCID diagnoses varies but typically ranges from .6 to .9,
   with most diagnosis exceeding .7.

 3. *Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID- II;*
   First et al., 2002). (30min; *BPD section to both groups*). The SCID-II is a counter-
   part measure to the SCID-I with comparable inter-rater reliability. This is a
   structured personality disorder examination for use by a trained clinical interviewer
   and developed to systematically survey the phenomenology and life experiences
   relevant to diagnoses of all Axis II personality disorders in DSM-IV.

D. Clinical Measures

 1. *The Comprehensive Affect Testing System-Abbreviated (CATS; Schaffer et al. 2006).*
   (30 min.) The CATS is the first standardized, cross-culturally valid

neuropsychological measure of emotion processing. The CATS utilizes a computerized measure of visual and auditory emotional processing of the six basic emotions. The subtests assess facial identification, emotion matching with and without verbal denotation, emotional tone or prosodic processing with and without verbal denotation, and with conflicting or congruent semantic content. Preliminary reliability on the CATS-A subtests range from .57 to .79, with several subtests reaching the .79 level. Construct validity analysis is ongoing as the measure develops. Table 2 lists the Alpha and Split Half reliability of the composite scales, and what subtests are included in each scale. Table 3 lists and describes the 13 CATS subtests.

2. *The Interpersonal Perception Task-15 (IPT-15; Archer & Constanzo, 1988).* (20 min.) The IPT-15 is a shorter version of the Interpersonal Perception Task. It was specifically designed for use in research. It is a measure of nonverbal social perception. The measure utilizes stimuli of a videotape consisting of 15 scenes depicting social interactions, ranging in 20-60 seconds in length. After each scene, participants are asked to reach a conclusion about people who appeared in the scene by answering a multiple choice question. Interrater reliability was found to be .81.

3. *State-Trait Anger Expression Inventory (STAXI; Spielberger, Jacobs, Russell, & Crane, 1983).* (10 min) The STAXI is comprised of several subscales corresponding to "state" and "trait" anger and several aspects of anger expression. The STAXI has been repeatedly demonstrated to have a high degree of internal consistency, and this reliability is comparable for both males and females (coefficient alpha < .80 for males and females for the "trait" anger scale and > .90 for both genders for the "state" anger scale). Numerous studies have found the STAXI to be highly correlated with self-report measures of aggression and hostility, behavioral indices of aggression, and physiological measurements (Speilberger, 1986).

4. *Barrett Impulsiveness Scale (BIS; Barrett, E.S., 1985).* (10 min) The BIS is a 30-item self-report measure for assessing dimensions of impulsivity, including three factors: Attentional, Motor, and Nonplanning Impulsiveness. It is scaled from 1 (rarely/never) to 4 (almost always/always). It is designed to measure a trait related or enduring dimension of impulsivity. Internal consistency coefficients for the BIS-11

total score that range from 0.79 to 0.83 for separate populations of under-graduates, substance-abuse patients, general psychiatric patients, and prison inmates.

5. *Affective Intensity Measure-Simplified (AIM; Larsen & Diener, 1987).* (10 min.) The AIM-Simplified contains 20 items assessing neutral (e.g., feeling calm and context), positive (e.g., feeling exuberant and euphoric), and negative (e.g. feelings of shame, guilt, and anxiety) emotional intensity. The AIM has been used in multiple studies and has good reliability and good internal consistency (rs¼.44–.82, all ps<.005). The measure obtained a coefficient in the range of 90 to .94 across four separate samples.

Table 2. Cronbach's Alphas and Spearman-Brown split-half reliabilities for CATS-A component scales and quotients

Composite Scale	Subtests Included	Alpha	Split-Half
Simple Facial Scale	2, 5	.6589	.5927
Facial Matching Scale	7, 8, 13	.7747	.7337
Prosody Discrimination Scale	4, 9	.7045	.6971
Prosody Identification Scale	6	.8558	.7917
Lexical Scale	10	.7993	.8490
Affect Recognition Quotient (ARQ)	2, 5, 7, 8, 13	.8101	.6462
Prosody Recognition Quotient (PRQ)	4, 6, 9	.8404	.8349
Emotion Recognition Quotient (ERQ)	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	.9061	.8505

Table 3. List of CATS-A Subtests and Descriptions

Subtest	Description	Items
1: Discriminate Facial Identity	Two same sex faces are shown; decide if the faces are the same or different actors.	12
2: Discriminate Facial Affect	Same actor; decide if the emotional expression is the same or different.	12
3: Discriminate Non-emotional Prosody	No faces are shown. A pair of non-affective messages (e.g., *The boy opened the window. The boy opened the window?*) are either both said as simple declarative sentences, as questions, or one of each; decide if they are the same or different.	6
4: Discriminate Emotional Prosody	No faces are shown. A pair of non-affective sentences is read in either an emotion or neutral tone; decide whether the tone is the same or different.	6
5: Name Affect	The examinee is asked to choose the emotion (or neutral) expressed within the single face presented.	6
6: Name Emotional Prosody	No faces are shown. One sentence at a time is read; select which emotion, or neutral, the voice is expressing.	12
7: Match Affect	One face is shown above five others, each of which expresses a different emotion; select which of the five faces expresses the same emotion as the top face.	12
8: Select Affect	Five portraits of the same individual are shown, each expressing a different emotion. A target emotion is displayed and announced orally (e.g., *Which face is angry?*); select the expression that matches the target emotion.	6
9: Conflicting Prosody/Meaning-Attend Prosody	No faces are shown. A sentence is read and the examinee is instructed to ignore the affective meaning and to focus on the emotion expressed by the voice; select the emotion.	12
10: Conflicting Prosody/Meaning-Attend Meaning	No faces are shown. The same sentences are presented as in Subtest 10, but the examinee is instructed to focus on the affective meaning of the sentence and to ignore the emotion expressed by the voice.	12
11: Match Prosody To Face	A single sentence is read by the actor on each trial; select the face that exhibits the corresponding emotion.	12
12: Match Face to Prosody	Three sentences are read by the actor on each trial; select which sentence expresses the same emotion as shown by the face.	12
13: 3 Faces Test	A trio of portraits of the same gender is displayed. Two portraits show the same individual expressing different emotions. The examinee must select the two portraits that express the *same emotion*.	24

Note: Choices on emotion tasks include: Happy, Sad, Angry, Frightened, Surprised, Disgusted, or Neutral

Chapter 4: Results

Descriptive Statistics

The community sample obtained for this study included a racially diverse group of 71 individuals ranging in age from 20 to 55 years old (*M*=33.39; *SD*=10.41). Fifty five (76.4%) were female, and 16 (22.2%) were male. All individuals reported having at least a high school diploma (*n*=22; 30.6%), and the majority reported earning a college degree (*n*=40; 55.6%).

The sample consisted of two groups: A Borderline Personality Disorder group (BPD; *n*=36) and a Healthy Control Group (HC; *n*=35). Individuals in the BPD group each met DSM-5 criteria for Borderline Personality Disorder. The HC Group was screened for Mood, Anxiety, Psychotic, Substance, and Personality Disorders, and were only included if they did not meet criteria for any of the disorders in these categories. Although the two groups were not matched, most of the comparable characteristics were fairly evenly represented across groups. Table 4 provides entire sample and sub-group demographics.

Descriptive Statistical Analysis: BPD Group. The BPD Group included 27 (75%) females and 9 (25%) males ranging in age from 20 to 52 (*M*=34.06; *SD*=10.48). These percentages reflect those of BPD gender differences in the general population. Well over half (66.3%) had obtained a college or graduate degree (*N*=12; 33.3% with high school diploma only). During the interview process, specific BPD symptom information was gathered from this group, as well as any history of self-injury, suicide attempt(s), psychotherapy, and being prescribed psychotropic medication.   There are nine symptom criteria of BPD, with at least five criteria needed for diagnosis. The Mean number of BPD criteria met was 7.06 (*SD*=1.17). Specific statistics on all nine of the BPD criteria can be found in Table 5.

Table 4

Group Demographics

Characteristic	BPD Group		HC Group		Total Sample	
	n	*%*	*n*	*%*	*n*	*%*
Female	27	75.0	28	80.0	55	77.4
Age						
20-25	11	30.6	14	40.0	25	35.2
26-35	10	27.8	8	22.9	18	25.3
36-45	8	22.2	8	22.9	16	22.5
46-55	7	19.4	5	14.3	12	16.9
Race						
White, non-Hispanic	13	36.1	22	62.9	35	49.3
Hispanic	4	11.1	2	5.7	6	8.5
Black, non-Hispanic	15	41.7	10	28.6	25	35.2
Asian	1	2.8	1	2.9	2	2.8
Other	3	8.3	0	0	3	4.2
Level of Education						
High School	12	33.3	10	28.6	22	30.9
College	21	58.3	19	54.3	40	56.3
Graduate School	3	8.3	6	17.1	9	12.7

Table 5

BPD Group Symptom Characteristics

	Item Endorsed by BPD Group Participant	
BPD Criteria	*n*	*%*
1. Fear of, or avoid abandonment	36	100
2. Pattern of unstable and intense relationships	34	94.4
3. Identity disturbance	26	72.2
4. Impulsivity	26	72.2
5. Suicidal behavior, gestures, threats, or self-mutilating behavior	15	41.7
6. Affective instability	32	88.9
7. Chronic feelings of emptiness	27	75.0
8. Inappropriate, intense anger or difficulty controlling anger	27	75.0
9. Transient, stress-related paranoid ideation or severe dissociative symptoms	31	86.1

Of the 36 BPD participants, 15 (41.7%) reported a history of self-injury, including incidents of cutting, burning, hitting or pinching themselves, banging their head, or punching objects. Thirteen (36.1%) reported at least one suicide attempt. Reported incidents included attempting over-dose, cutting wrists, and by hanging. Within the group, 13 (36.1%) reported being in psychotherapy at the time of participation, 12 (33.3%) reported a history of psychotherapy, and 11 (30.6%) reported never going to psychotherapy. Five (13.9%) were taking psychotropic medication to address symptoms related to BPD at the time of participation, 11 (30.6%) had been prescribed psychotropic medication in the past, and 20 (55.6%) reported never taking prescribed psychotropic medication. Participants had the opportunity to report any previous diagnosis they had been given by health care professionals. Fifteen participants in the BPD Group (41.7%) reported having a past or current diagnosis, not included in the exclusion criteria, and other than BPD. Examples include a history of major depressive episodes, anxiety disorders, and eating disorders. Table 6 represents descriptive statistics for the BPD Group.

Table 6

BPD Group Clinical History Data

Characteristic	Characteristic Endorsed by BPD Participant	
	n	*%*
History of non-suicidal self-injury (NSSI)	15	41.7
History of suicide attempt	13	36.1
Psychotherapy		
Current	13	36.1
In the past	12	33.3
Never	11	30.6
Psychotropic Medication		
Currently prescribed	5	13.9
History of taking prescription	11	30.6
Never prescribed	20	55.6
Psychiatric Disorder, current or history of	15	41.7

Inferential Statistics

   Tests of hypotheses. The first hypothesis proposed that the BPD Group would be significantly less accurate in their ability to perceive emotional expression compared to the HC Group. This hypothesis was assessed by comparing scores between groups on the CATS Emotion Recognition Quotient (ERQ). The ERQ is an overarching scale that includes all 11 emotional subtests of the CATS. The CATS includes facial and auditory cues and is the best indicator of overall emotion perception ability. This hypothesis was supported. The results of a t-test between groups indicated that scores on the CATS-ERQ for the HC Group ($M = 96.17$, $SD = 12.87$) were significantly higher than the BPD Group ($M = 89.50$, $SD = 12.87$), $t(69) = -2.27$, $p = .026$

   The second hypothesis included several predictions about specific emotion perception abilities, as measured by CATS subtests. Hypothesis 2a predicted that the BPD Group would be significantly *less* accurate in three areas of emotion perception. First, Hypothesis 2a predicted that the BPD Group would be less accurate in their ability to discriminate between emotional tones expressed in auditory sentences (as measured by the Emotional Prosody Discrimination subtest). Secondly, Hypothesis 2a included the prediction that the BPD Group would be less accurate in identifying the affective meaning of a sentence when it is read with a conflicting emotional tone (as measured on the Conflicting Prosody – Attend to Meaning subtest). Finally, Hypothesis 2a predicted that the BPD Group would be less accurate in identifying a match between a facial expression of emotion and emotional tone, as expressed in a sentence (measured on the Match Emotional Face to Emotional Prosody subtest). T-tests failed to reveal statistically significant differences in scores between the BPD and HC Groups on all three of these CATS subtests. Table 7 provides the specific statistical findings.

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Hypothesis 2b predicted that the BPD Group would be less accurate in differentiating between neutral and emotional expressions. This was measured by the number of accurate responses on the nine items of the CATS that include neutral or non-emotional facial or auditory expressions, compared to emotional expressions. A t-test was conducted and results did not indicate a significant difference between groups in the number of correct responses on these nine items ($M = 5.89$, $SD = 1.55$) and the HC Group ($M = 6.46$, $SD = 1.20$), $t(69) = -1.73$, $p = .09$.

Table 7

Hypothesis 2a Results

CATS Subtest	Group	Mean	S.D.	t	p
Emotional Prosody	BPD	5.75	.73	.587	.559
Discrimination	HC	5.65	.59		
Conflicting Prosody –	BPD	6.44	2.84	-.360	.720
Attend to Meaning	HC	6.69	2.83		
Match Emotional Face to	BPD	9.42	1.93	-1.29	.190
Emotional Prosody	HC	9.97	1.65		

Hypothesis 2c predicted that the BPD Group would be significantly *more* accurate in two specific areas. First, it was predicted that the BPD Group would be more accurate in their ability to attend to the emotional auditory tone of a sentence while ignoring the conflicting semantic meaning (as measured by scores on the Conflicting Prosody – Attend to Prosody subtest; $M_{BPD} = 9.53$, $SD = 1.76$; $M_{HC} = 9.71$, $SD = 2.02$). Second, it was predicted that the BPD Group would be more accurate in their ability to match an emotionally intoned sentence to a facial expression of the same emotion (as measured by the Match Emotional Prosody to Emotional Face subtest; $M_{BPD} = 9.42$, $SD = 1.93$; $M_{HC} = 9.97$, $SD = 1.65$). Results of a t-test indicated no statistically significant differences in scores between groups on either of these subtests [$t(69) = -4.1$, $p = .68$ and $t(69) = -1.29$, $p = .19$ respectively].

Hypothesis 3 predicted that the HC Group would be more accurate in identifying social and relationship statuses between individuals, as measured by the number of accurate responses on the Interpersonal Perception Task-15. This hypothesis was supported. The scores for the HC Group ($M = 10.14$, $SD = 1.72$) on the ITP-15 were significantly higher than the BPD Group ($M = 8.64$, $SD = 1.93$), $t(69) = -3.47$, $p = .001$.

The fourth hypothesis predicted that in general, the *more* accurate one was in emotion perception abilities, the *less* anger, impulsivity, and affect intensity that individuals would endorse. Specifically, negative correlations were predicted between the CATS-ERQ and each of the self-report measures of anger (STAXI), impulsivity (BIS), and affect intensity (AIM). Pearson product-moment correlation coefficients were used to identify whether there were any significant differences. The results indicated significant differences in the predicted direction between each the STAXI and the BIS total scores when compared to the CATS-ERQ scores. Across the entire sample, levels of trait anger were negatively correlated with accuracy of emotion perception. The more trait anger ($r = -.256$, p = .016) or impulsivity ($r = -.227$, p = .028) one reported the less accurate they were in emotion perception. On the contrary, there was not a significant correlation found between reported levels of affect intensity and emotion perception ability ($r = -.79$, $p = .26$). These results are highlighted in Table 8 below.

Finally, the fifth hypothesis predicted a positive correlation between accuracy of perceived facial/auditory expressions and accuracy of verbal/non-verbal social cues. Correlation analysis between total scores on the CATS and the IPT-15 indicated a significant positive relationship between total CATS score, the CATS-ERQ, and IPT-15 scores. As CATS/CATS-ERQ scores increased, so did IPT-15 scores ($r = .42$, $p<.001$). This hypothesis was supported in the predicted direction.

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Table 8

Hypothesis 4 and 5 Results

	STAXI	BIS	AIM	IPT-15
CATS-ERQ	$r = -.256$	$r = -.227$	$r = -.79$	$r = .42$
	$p = .016*$	$p = .028*$	$p = .26$	$p < .001*$

*denotes significant

Post Hoc Emotion Perception Analysis.   As previously noted in the first and third

hypothesis, the HC Group was determined to have significantly better emotion and social

perception ability than the BPD Group. Additional analyses were conducted to determine

whether more discrete significant differences in emotion and social perception existed between

the two groups. Further, post hoc analysis was conducted to determine within BPD Group

differences. The appropriate Bonferroni alpha corrections were used for all post-hoc tests, with

the individual values noted when applicable.

Emotion perception discrete differences as measured by the CATS. On the CATS, there

are quotient and composite scales, as well as emotion subscales, which allowed for analysis of

differences on a more specific level. *Post hoc t* tests, using a Bonferroni alpha correction of .005

[.05/10 (number of subtests not tested previously)] was used to analyze subtest differences

between the BPD and HC Groups.

First, the most general, the Quotient Scales, were analyzed. They include the Affect

Recognition [ARQ; subtests that include facial affect identification (2, 5, 7, 8 and 13)], Prosody

Recognition [PRQ; subtests that include prosody affect identification (4, 6 and 9)], and Emotion

Recognition (ERQ; all subtests of emotional perception) Quotient Scales. It was determined in

the first hypothesis that there was a significant difference between groups on the CATS-ERQ.

There were not significant differences found between groups on either the ARQ ($M_{BPD} = 46.28$,

SD = 12.20; M_{HC} = 48.86, *SD* = 5.15), *t*(69) = -1.15, *p* =.25 or PRQ (M_{BPD} = 23.17, *SD* = 3.43;

M_{HC} = 22.23, *SD* = 3.94) *t*(69) = -.07, *p* =.94.

Next, while the Quotient Scales differentiate between facial (ARQ) and auditory (PRQ)

emotion perception abilities, the five Composite Scales are more discrete in that they divide the

ARQ into Simple Facial (subtests 2 and 5) and Complex Facial (subtests 7, 8 and 13), and in

addition to a Prosody scale (subtest 4), also include a Lexical (subtest 10) and a Cross Modal

Scale (subtests 11 and 12). As noted above, there were not significant differences between

groups on the ARQ, but when the ARQ is divided into two composite scales, a significant

difference was found between groups on the Complex Facial Composite Scale (M_{BPD} = 29.31, *SD*

= 4.46; M_{HC} = 32.23, *SD* = 3.89). A t-test determined that the HC Group did significantly better

on this composite scale, *t*(69) = -2.94, *p* =.004 indicating that the HC Group is more apt to

correctly match facial expressions of emotion as presented in a variety of formats on three

different subtests. Further, a t-test determined that the HC Group approached significantly

better ability in integrating facial and auditory emotion perception as evidenced through their

ability to match emotional facial expressions to emotional tone on the Cross Modal Composite

Scale (M_{BPD} =16.72, *SD* =3.39; M_{HC} =18.06, *SD* =3.34) *t*(69) = -1.67, *p* =.099   It should be noted

that the Quotient and Composite Scales include only the subtests that measure emotion

perception. The two subtests (1 and 3) that are non-emotional measures of facial and prosody

discrimination were also analyzed for between group differences. There were no significant

differences between the BPD (M_{facial} = 11.5, *SD* =.85; M_{prosody} =5.61, *SD*=.90) and HC (M_{facial}

=11.26, *SD* =1.22; M_{prosody} =5.80, *SD* =.58) Groups on either of these subtests, an indication of

fairly equal ability to discriminate between two faces or sentences presented in two tones. Table

9 displays the between group differences on the Composite Scales, as broken down by subtest, as

well as the between group differences on the scales measuring non-emotional facial and prosody

identification.

Table 9

Group Differences on CATS Subtests Grouped by Quotient and Composite Scale

Subtest	Group	Mean	S.D.	t	p
2. Affect Discrimination ER, AR, SF	BPD	11.56	1.42	.64	.52
	HC	11.34	1.37		
5. Name Affect ER, AR, SF	BPD	3.86	1.22	-1.75	.09
	HC	4.37	1.24		
7. Match Affect ER, AR, CF	BPD	9.50	1.80	-2.99	.004*
	HC	10.74	1.70		
8. Select Affect ER, AR, CF	BPD	2.56	.65	-3.31	.001*
	HC	2.94	.24		
13. Three Faces ER, AR, CF	BPD	17.25	2.96	-1.90	.062
	HC	18.54	2.77		
4. Emotional Prosody Discrimination ER, PR, P	BPD	5.75	.73	.59	.56
	HC	5.66	.59		
6. Identify Emotional Prosody ER, PR, P	BPD	7.89	1.97	-.21	.83
	HC	8.00	2.46		
9. Conflicting Prosody/Meaning-Attend Prosody ER, PR, P	BPD	9.53	1.76	-.41	.68
	HC	9.71	2.02		
10. Conflicting Prosody/Meaning-Attend Meaning ER, L	BPD	6.44	2.84	-.36	.72
	HC	6.69	2.84		
11.Match Emotional Prosody to Face ER, CM	BPD	7.31	2.01	-1.64	.11
	HC	8.09	1.99		
12. Match Emotional Face to Prosody ER, CM	BPD	9.42	1.93	-1.30	.20
	HC	9.97	1.65		
1. Identity Discrimination NE	BPD	11.50	.85	.98	.33
	HC	11.26	1.22		
3. Non-emotional Prosody Discrimination NE	BPD	5.61	.90	-1.04	.30
	HC	5.80	.58		

Note: Quotients: ER=Emotion Recognition, AR=Affect Recognition, PR=Prosody Recognition. Composite Scales: SF=Simple Facial, CF=Complex Facial, P=Prosody, L=Lexical, CM=Cross Modal. Non-emotional subtests=NE. * denotes significant at Bonferroni adjusted *p*< .005

CATS Discrete Emotion Scales were also analyzed to determine between group

differences. The Emotion Scales are only comprised of facial affect identification (i.e. prosody

is not included) and include Happy, Surprised, Fearful, Sad, Angry, and Disgusted. As the scale

names imply, each scale score is representative of one's ability to correctly identify each discrete emotion. *Post hoc t* tests, using a Bonferroni alpha correction of .008 (.05/6) found that the HC Group did significantly better on the Angry (M_{BPD} = 3.06, SD = 1.26; M_{HC} = 4.2, SD = 1.39) t(69) = -3.63, p = .001, and Disgusted (M_{BPD} = 4.89, SD = 1.46; M_{HC} = 6.27, SD = 1.68) t(69) = -3.70, p = .00 scales, and approached significance on the Sad subscale (M_{BPD} = 6.03, SD = 1.65; M_{HC} = 6.94, SD = 1.3) t(69) = -2.59, p = .01, These results indicate that the BPD Group had a more difficult time correctly identifying these emotions in facial expressions.

   Social perception discrete differences as measured by the IPT-15. As noted previously, the IPT-15 is a measure of social perception ability. Each scene/item on the test is representative of relationships involving kinship, intimacy, competition, status, or deception. The third hypothesis found that the HC Group scored significantly higher overall than the BPD Group on the IPT-15. Further analysis was conducted to determine whether there were significant differences between groups in their scores on the five categories of social interaction listed above. *Post hoc t* tests, using a Bonferroni alpha correction of .01 was used to determine differences.   The HC Group was found to have significantly higher scores on scenes measuring perception of competition (M_{BPD} = 2.00, SD = .72; M_{HC} = 2.49, SD = .70) t(69) = -2.88, p = .01, and approached significance on scenes measuring rception of intimacy (M_{BPD} = 1.53, SD = .77; M_{HC} = 1.89, SD = .68) t(69) = -2.07, p = .04, and deception (M_{BPD} = 1.31, SD = .92; M_{HC} = 1.80, SD = .87) t(69) = -2.33, p = .02.

   Additional BPD Group analyses. Within the BPD Group, it was of interest to determine whether specific symptoms of BPD were associated with performance on the measures of emotion and social perception. Scores of those with a history of non-suicidal self-injury (NSSI) or a suicide attempt (SA) were compared to those who had neither of these characteristics. On

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the measure of emotion perception (CATS-ERQ), no significant differences were found between either the NSSI ($n = 15$, M = 88.73, $SD = 15.63$) or SA ($n = 13$, M = 88.62, $SD = 14.65$) BPD sub-groups compared to the remaining BPD subjects (no history of NSSI or SA); $M_{NoNSSI} = 90.05$, $SD = 10.88$, $t_{NSSI}(36) = -.29$, $p = .77$ and $M_{NoSA} = 90.0$, $SD = 12.08$, $t_{sa}(36) = -.31$, $p = .76$.

When analyzing IPT-15 scores, both the NSSI and SA BPD sub-group were found to have scored significantly higher than the remaining BPD subjects, indicating that these sub-groups had an easier time interpreting social cues than the sub-group of BPD participants without NSSI or SA. A one-way between subjects ANOVA was conducted controlling for race and gender to determine whether either factor accounted for this difference. Further, the ANOVA controlled for any current or history of psychotherapy, and any current or history of psychotropic medication. None of these factors were found to be a significant factor in the difference between the BPD sub-groups scores on the IPT-15. There were no differences found between the two BPD subgroups on the self-report measures of anger, impulsivity, or affect intensity.

Supplemental Statistics

In addition to testing the a priori hypotheses, several supplemental analyses were conducted. Supplemental analyses included comparisons between various demographic groups and the measures of emotion perception (i.e. CATS and IPT-15), as well as comparisons between the BPD and HC Groups on specific emotion perception variables that were not included in the hypotheses.

Demographic findings. A t-test was used to determine whether there were relationships between either age or gender and emotion perception ability. A significant negative correlation was found between age ($M = 34.06$; $SD = 10.48$) and the CATS-ERQ score ($M = 92.79$, $SD = 12.75$), t(69) = -.21 $p = .039$. In general, younger participants scored higher on the CATS-ERQ,

indicating better emotion perception abilities than older participants. This finding is consistent with the CATS normative data results, which also found that as age increased, CATS-ERQ scores decreased. There was not a significant correlation found between age and IPT-15 scores. There is no normative age data for the IPT-15 available to which this finding can be compared.

With regard to gender, the trend was the same. There was not a significant difference found between gender groups on total correct items on the IPT-15 (M_{male} = 9.06, SD = 1.81; M_{female} = 9.47, SD = 2.02), $t(69)$ = -.73, p = .47 but there were significant gender differences on the CATS-ERQ. On the CATS-ERQ, the female group (M = 112.36, SD = 12.42) scored significantly higher than the male group (M = 104.56, SD = 12.30), $t(69)$ = -2.22, p = .03 suggesting that females have more accurate emotion perception abilities. These findings are consistent normative data for both the CATS and the IPT-15.

Interestingly, there was no significant relationship between level of education and emotion perception abilities (using either CATS-ERQ or IPT-15 scores). However, this finding is also consistent with the CATS normative data, which found that neither education level nor estimated IQ significantly correlated with CATS scores. The IPT-15 does not have published normative data regarding educational differences.

Analyses were conducted to determine whether significant perception differences existed between the races of those who identified as White (n = 35) and Black (n = 25). These two races were the two most heavily represented racial groups, and the others did not include enough data points for accurate analysis. On the CATS-ERQ (M = 92.79, SD = 12.75), White participants (M = 98.40; SD = 8.98) scored significantly higher than Black participants (M = 87.68; SD = 13.57) $t(60)$ = 3.68, p = .001. However, there were no significant differences between these races on the IPT-15 measure of social perception. The race differences on the CATS-ERQ cannot be

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compared to the normative data as the authors only included Caucasian participants in their

sample. Further, the authors of the IPT-15 did not include any race characteristics of their

normative sample so it is unknown if the current finding is unique.

Chapter 5: Discussion

The literature pertaining to the development of emotional experiencing and regulation, including theories of emotion processing and perception was reviewed. Based upon limitations in that body of literature, the current study was proposed in order to comprehensively investigate emotion processing and perception in individuals diagnosed with BPD. The results of the study were presented in the previous chapter. Below, the findings of the current study will be discussed and interpreted in terms of prevailing emotion processing theories, and previous perception research. Implications of the current findings will be highlighted, along with limitations and suggestions for future research in this area.

Summary of Results

Emotion perception findings. It should first be noted that there were no significant differences between groups in identifying *non*-emotional facial expressions or prosody. This suggests that both groups had relatively the same baseline perception abilities, including the ability to discern between two neutral facial expressions, and the ability to discern between tones used in non-affectively laden sentences. However, on measures of affective, or emotion, perception, there were several significant differences found between the individuals diagnosed with BPD and the Healthy comparison participants.

Identifying facial expression of emotion. In general, the BPD Group was found to be significantly *less* accurate at identifying emotional expression compared to the HC Group. While there were no significant differences found in abilities to identify whether affect between two faces was the same or different, or to identify which emotion was expressed in a single facial portrait (e.g. What emotion is this face expressing?), there were significant differences on more complex facial perception tasks (i.e. two of the three subtests comprising the Complex Facial

Scale). For instance, the BPD Group found it significantly more difficult than the HC Group to determine which two faces were expressing the same emotion when given a single facial expression to match to one of five different faces expressing various emotions. The BPD Group also found it significantly more difficult to identify which of five facial expressions was expressing a target emotion (e.g. Which face is angry?). These findings suggest that as facial perception tasks become more complicated, deficiencies in the BPD Group became more apparent.

On facial perception items that included a neutral (no affect) target or choice selection, the BPD Group was able to differentiate between which expressions were neutral and which were exhibiting emotion as well as the HC group. However, the BPD Group was significantly less accurate differentiating between the facial expressions of anger and disgust.   In other words, there was no difference in abilities between groups to discern between neutral and emotion facial expressions, but when the task involved choosing between several negative emotions, the BPD Group found it more difficult to discern which negative emotion was being portrayed. Previous research has found similar results, suggesting a trend. Implications of this finding will be elaborated upon in the Implications section below.

Identifying prosodic expression of emotion. Despite significant differences in overall emotion perception ability and in several specific areas of facial emotion perception, there were *not* significant differences between groups in accurately identifying emotion in prosody. Whether the prosody task was basic (e.g. identify whether tone is the same or different) or more complex (e.g. ignore the semantic meaning of a sentence and identify emotional tone, or match tone with facial expression), the groups performed relatively the same. The significant group differences in ability to perceive facial expressions of emotion, and the lack of significant

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differences in identifying emotional prosody, suggests that the significant overall differences in perception are mainly due to the deficiencies identified in facial emotion recognition. This was only the second study to test prosody perception in BPD, and possible explanations for this unexpected finding will be offered below.

Perception differences within the BPD Group. After determining that there were several significant perception differences between the BPD and HC Groups, it was of interest to determine whether more discrete differences existed *within* the BPD Group. While it is outside the scope of this research to reason why some with BPD purposely harm themselves and some do not, the behavior of self-injury or making a suicide attempt offers an unambiguous measurable characteristic that can differentiate two sub-groups. For analysis, the group was divided into sub-groups of those who had a reported history of non-suicidal self-injury (NSSI) or had made a suicide attempt (SA), compared to those meeting BPD criteria who denied any history of NSSI or SA.

There were no differences between the sub-groups in accuracy of identifying emotion in either facial expressions or prosody. While this sub-grouping was chosen for analysis, there are a number of ways the BPD group could have been more discretely analyzed. Considering that BPD criteria can manifest in a large number of different combinations, it is impossible to determine a specific combination of characteristics that would influence differences between subgroups in perception ability. However, the lack of differences between the sub-groups created here suggests that the characteristic of engaging in suicidal behavior is not by itself indicative of emotion perception ability.

Social perception findings. On the measure of social perception, which required participants to use both verbal and non-verbal cues to draw conclusions about relationship

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statuses in a variety of scenes, the BPD Group was found to be significantly less accurate than the HC Group. Further, a positive association was found between emotion perception and social perception, whereby the less accurate individuals were in facial and prosodic emotion perception, the less accurate they were in perceiving social cues between others. More specific findings indicated that the BPD Group found it more difficult to interpret cues given in scenes portraying themes of intimacy, competition, and deception. There was no difference in accuracy between groups in their ability to interpret cues in scenes depicting kinship or status. Possible explanations for this finding will be discussed in more detail below.

Social perception differences within the BPD Group. As mentioned above, it was of interest to determine whether more discrete differences existed *within* the BPD Group on the measures of perception. On the measure of social perception, it was determined that those in the BPD Group who had a history of either non-suicidal self-injury (NSSI) or a suicide attempt, were significantly more accurate compared to those who denied either of these characteristics. This finding is interesting considering the NSSI/SA group did not perform differently than the other BPD group members on the emotion perception task. It suggests that, for reasons to be extrapolated below, those with NSSI behaviors and/or a history of SA, there is a heightened attunement to social cues.

Findings related to emotional experiencing. Participants were asked to report on their own experience of anger and impulsivity, including how intensely they experience emotions. Considering the characteristics of BPD, it was not surprising to find that; overall, the BPD Group reported significantly more anger and impulsivity than the HC Group. They also reported having significantly more intense emotional experiencing than the HC Group. When comparing self-report measures to the measures of emotion and social perception, it was found that the more

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anger and impulsivity one reported, the worse their perception ability. This finding suggests that while the BPD group experiences significantly more anger, they are not as able to accurately identify anger in others. This finding is supported by the BPD finding reported earlier, which indicated that for the BPD Group, anger was difficult to differentiate from both sadness and disgust. Considering that intense anger is a characteristic of BPD, this finding could suggest that anger is one characteristic that is specifically related to perception ability. Further, this finding suggests that the BPD criteria of impulsivity may also be related to perception ability, as the more impulsivity one reported, the less accurate their perception ability became.

However, when looking at the self-reported levels of affect intensity, which included both positive and negative affect, there was a significant correlation found only with social perception, not with emotion perception. In other words, the intensity of one's emotional experiences did not significantly relate to their accuracy in emotion perception of facial expressions and prosody, but it did factor into their accuracy of social perception, whereby the more intensely one reported experiencing emotions the *less* accurate their social perception ability. This would suggest that emotional intensity does not hinder perception in face-to-face interactions as much as it does when trying to decipher the emotional stance of those with whom they are not directly interacting. In other words, when observing interactions, those with BPD may have a more difficult time relating to how others conduct themselves, and thus a more difficult time interpreting what is happening between others in an exchange.

Findings related to demographic variables. It was also of interest to determine whether any of the demographic information collected from subjects related to their perception abilities. There were a few significant differences found between the demographic groups that were represented in the general sample. It was found that as age increased, accurate emotion

perception decreased. On the contrary, age was not found to significantly relate to social

perception ability. Females were significantly more accurate in emotion perception, but there

were no gender differences found in social perception ability. Level of education was not found

to relate to emotion or social perception ability. There were no differences in accuracy between

groups with a high school education compared to those with a college or graduate degree.

Lastly, those who identified their race as White did significantly better than Blacks in

facial and prosodic emotion perception, but there were no significant differences between races

in social perception ability. Interestingly, all of the facial expressions on the CATS are gray

scale Caucasians, and on the IPT-15 there are several races represented. Therefore, while there

is no data with which to compare this finding; it could suggest that the significant race

differences on the CATS is a product of 'other' race unfamiliarity, rather than perceptual

differences. However, Ekman and Friesen (1979), the creators of the facial expression catalog

used in most FER measures, suggest that while there are cultural differences in what elicits

certain emotions, there is universality in the recognition of emotions when they are expressed

through the face (Ekman & Friesen, 1979). This particular finding may have identified a

potential weakness of the CATS, and serve as an indication that a validated emotion perception

measure representative of multiple race groups is needed for more thorough results.

Integration of findings with theories of emotion processing

Five theories of emotion and social information processing were presented in the

literature review. Below, these theories will be interpreted in terms of the current research

findings.

To review, each includes a step of emotional processing and emotional response. It was

suggested that if there were glitches within the steps of any given theory, this could lead to faulty

processing, and in turn, faulty emotional response. As mentioned, BPD is a disorder characterized by pervasive emotion regulation difficulties, and therefore, deficiencies in emotion processing could be related to faulty regulation of emotion. The five theories will briefly be reviewed and compared to the findings of the current study.

The first of the five theories presented was Saarni's (1999) theory of emotional competence. This theory includes eight skills and states that those who are emotionally competent rely heavily on awareness, acceptance, empathy, and using skills to cope adequately with emotional experiences. The theory does not offer explanation as to how these skills are developed or implemented; only positing that one applies knowledge about emotions to ultimately achieve emotional competence (Saarni, 1999). Some might say this theory is the antithesis of emotional experiencing in those with BPD, as BPD is often characterized by emotion dysregulation and non-acceptance.   In the present study, the BPD Group was found to be significantly less accurate in emotion perception. According to the theory of Emotional Competence therefore, the BPD Group might be considered as emotionally *in*competent.

The second theory, offered by Mayer and Salovey (1997), addressed the idea of emotional intelligence (EI) and includes four abilities that lead to positive emotional growth and adaptation. Their model is focused on self-awareness and analyzing emotional states. They propose that those who are more self-aware are more apt to regulate their own emotions and accurately perceive emotions in others. Further, the theory suggests that general intelligence is related to increased emotional awareness and perception. The current study inquired about feelings of anger, but did not inquire about participants' self-awareness of their emotions in general. While the BPD Group did report significantly more anger, impulsive behavior, and emotional intensity than the HC Group, this does not imply that either group is any more or less

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aware of their emotional states in the moment. From this aspect, it is difficult to interpret the current findings from the perspective of the EI theory. However, education level of participants was accounted for in the current study, and there were not any differences found between level of education and emotion perception accuracy. Therefore, the theory of EI, as it relates to education and emotion perception, is not a good fit for explaining the current findings.

The third theory presented was a reformulated model of information processing offered by Crick and Dodge (1994). This theory suggests that processing is continuous and cyclical through six steps. The theorists suggest that one enters any situation with genetically predisposed traits as well as stored information from past experiences, which both influence the cycle of processing. Further, they suggest that while some cues are easily and accurately encoded because of a history with the stimuli (e.g. a very familiar person), new interactions require more attention, such as a heightened focus on facial expression, for an interpretation. When the interaction requires a quick response, it is theorized that the interpreter will default to similar information that is stored in memory, despite its accuracy. This encoding, along with all of the previous, is then stored in memory and effects future interpretations.

Several aspects of the Crick and Dodge (1999) theory are relevant to the present study, including the pre-determinates of genetic traits, stored memory, and the steps of encoding and interpretation. In the current study, the BPD group was asked to complete measures of emotion and social perception that included observations of faces and brief social interactions. According to Crick and Dodge (1999), since the scenarios were unfamiliar, the subjects' attention would likely be heightened. While it cannot be determined whether any subject's attention was more or less heightened, the results do conclude that the BPD group did significantly worse in emotion and social perception, and specifically in identification of the facial expressions of sad, angry,

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and disgusted. These findings could be supported by this theory in one of two ways. First, it is

possible that factors other than attention were interfering with accurate perception. Thus, those

with BPD may have been less accurate in perception due to their genetically predisposed traits

and/or stored information from past experiences. For instance, those in the BPD Group may

have been exposed to more negative experiences and environments (sometimes referred to as an

invalidating environment in developmental theories of BPD) where they did not learn how to

accurately express or perceive emotion. Alternatively, at higher levels of intensity, individuals

with BPD may have difficulty disengaging their attention, which can interfere with their ability

to accurately identify an emotion. Either way, a history of miscues or misinterpretations would

theoretically continue to influence encoding and perception. In other words, the BPD Group

may have a processing 'cycle' that includes faulty information but nonetheless continues to alter

their encoding and interpretation of emotion. Further to this point, for the current study, the

participants were in a situation that expected them to rather quickly encode and make

interpretations without any prior knowledge of the faces or situations they viewed. Given this,

Crick and Dodge (1999) would probably predict that participants would default to stored

memory for perception decisions, which for the BPD Group, may include selecting answers

responses from a bank of faulty responses.

The fourth theory, offered by Lemerise and Arsenio (2000), is an integrated model of

emotion processes in social information processing, and expands upon the Crick and Dodge

(1994) model. It is theorized in this model that there is a level of emotional investment, such as

feelings and state of mood, which influence the steps of encoding and interpretation, as discussed

above. Further, they hypothesized that individual differences in emotionality and regulatory

abilities affect processing of social and emotional information. Considering this theory in terms

of the current study, it provides a rationale for why the BPD Group performed less accurately in both emotion and social perception. The BPD Group reported more state anger, and significantly more trait anger, impulsivity, and affect intensity (combined negative and positive affect). In fact, of the BPD criteria, 75% reported chronic feelings of emptiness and/or periods of intense anger, and 72% reported impulsive behavior. According to the Lemerise and Arsenio (2000) theory, these characteristics would have an underlying effect in all encoding and interpretations, and therefore would have influenced the perception scores of those with these characteristics. If this were the case, it would explain the significant differences between the BPD and HC Groups on the emotion perception measure, where the BPD Group found it significantly more difficult to discern negative emotions, and on the social perception measure, where the BPD Group found it more difficult to accurately identify relationships of intimacy, deception, and competition. Further, as was discussed in the previous theory, one's stored memory and genetic traits are theorized to influence perception, and this information, combined with the current theory, offers a strong rationale for why those with BPD were found to have significantly less accurate emotion perception.

Last to be discussed in terms of the current research is the theory of affective social competence (Halberstadt et al., 2001). To review, this theory is organized around three components: sending, receiving, and experiencing affect. The theory suggests that those with affective competence are aware what emotion they are portraying, they accurately monitor emotional responses from the environment, and they respond to these receptions with a socially acceptable response. One who is affectively competent uses the entire context of the situation, including verbal, facial, and body language cues, to make an interpretation. Further, display rules are used in any social context to aid in effective communication. Display rules are

explained in the theory to be when someone sends more, less, or a different affective message than what they are feeling, as might be appropriate due to environmental expectations. This theory, unlike the ones presented before it, includes the use of body language and decoding the social cues, as essential components of accurate emotion and social perception. Further, the authors suggest that one needs to know when to invoke the use of display rules for ongoing effective communication (Halberstadt et al, 2001).

The theory offered by Halberstadt and colleagues (2001) could aid in explanation of the results of the current study. First, the finding that the BPD group was less accurate on the social perception measure relates to the proposition that body language is an integral part of accurate perception when used in conjunction with verbal and facial cues. On the measure of social perception, the viewer needed to utilize and decode the non-verbal cues to aid in an accurate interpretation (e.g. physical closeness, touching, gestures etc…), and the BPD Group was significantly less accurate in perception on this measure. One explanation for this finding is that the BPD Group did not effectively use the non-verbal cues, or body language, when making their interpretations on this measure, perhaps due to faulty preconceived notions of emotional valence. Further, the theory proposes that the appropriate use of display rules is necessary for affective competence. From this standpoint, it could be postulated that the BPD Group has not learned the most effective use of display rules for various social contexts, and therefore they were not able to identify the display rules being used in the scenes of the social perception task, which led to more inaccurate responses. Specifically, on the social perception task, the BPD Group did significantly worse than the HC Group in correctly identifying relationships of intimacy, competition, and deception. There was not a significant difference on scenes that involved kinship and status. Arguably, situations involving intimacy, competition, and deception are more

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emotionally loaded than the latter. As suggested previously, emotional investment plays a role in perception. When thinking in terms of the characteristics of BPD and the emotional upheaval that is often associated with the diagnosis, it would make sense to consider that intense emotional responses in certain situations (i.e. intimate relationships, deception) could lead to increased misperceptions across modes of perception. While this theory helps to explain the social perception differences, it does not offer suggestion as to why there were deficiencies in facial perception, but not prosody specifically.

Integration of perception findings with previous research

Eleven studies of emotion perception in BPD were discussed previously in the literature review. The findings have been inconsistent, and one aim of this study was to move toward greater clarity of whether perception deficiencies exist in this population.

Due to methodological differences (e.g. type of perception measurement used), as well as differences in sample characteristics (e.g. inpatient versus community), findings cannot be directly compared. However, all but two of the studies are similar in that they included an emotion recognition test that drew facial expressions from Ekman and Friesen's (1979) catalog, and all required subjects to ascribe a qualitative label to pictures of facial expression. It should be noted that some of the studies had the goal of rating speed and accuracy, and others used morphing or blending techniques to gauge at what level of intensity accurate perception occurred. For the morphing studies, the comparisons made here are to the findings of accuracy at 100% intensity (i.e. the equivalent to what is presented as stimuli in the CATS). Only one of the studies included a measure of emotional prosody perception. Obviously, only results offered in the previous research studies can be compared to the current findings, and therefore, unfortunately, there are not comparisons to each dimension analyzed here. Comparisons that can

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be made include general differences in emotion perception abilities between BPD and HC groups (facial and prosody), findings related to neutral and discrete emotion expressions, and emotional experiencing related to perception.

Overall, current findings are in agreement with several of the previous studies that reported emotion perception deficiencies in BPD, compared to a HC group (Bland et al., 2004; Dyck et al., 2009; Levine et al., 1997; Merkl et al., 2010; Unoka et al., 2011). Consequently, the present results do not support previous studies demonstrating more accurate perception ability in BPD (Fertuck et al., 2009; Lynch et al., 2006), nor do the results support the research that failed to find any significant differences between groups in perception ability (Domes et al., 2008; Dyck et al., 2009; Minzenberg et al., 2006; Schilling et al., 2012; Wagner & Linehan, 1999). Explanations for the discrepancies in results will be discussed below.

Six of the FER studies reported results regarding differences in accuracy of differentiating neutral from emotion stimuli (Dyck et al., 2009; Fertuck et al., 2009; Merkl et al., 2010; Minzenberg et al., 2006; Schilling et al., and Wagner & Linehan, 1999). The current study failed to identify a significant difference between groups in ability to differentiate neutral from emotion expressions. This finding is in agreement with three studies (Dyck et al., 2009; Minzenberg et al., 2006; and Schilling et al., 2012) and in disagreement with three (Dyck et al., 2009; Merkl et al., 2010; Fertuck et al., 2009; and Wagner and Linehan, 1999). This finding is in contrast to the work published by Fertuck and colleagues (2009), which found the BPD group was more accurate in identifying neutral eyes in the Reading the Mind in the Eyes task (RME), and is also in contrast with the three studies that found the BPD group to be less accurate in differentiating a neutral expression from an emotional one (Dyck et al., 2009; Merkl et al., 2010; and Wagner & Linehan, 1999).

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Regarding specific emotional stimuli, two of the studies (Lynch et al., 2006; Schilling et al., 2012) found no significant differences in discrete perception ability. The current study found that the BPD Group was significantly less accurate in identifying sad, angry, and disgusted facial expressions. This finding is consistent with Bland and colleagues (2004), and Levine and colleagues (1997) who found that those with BPD were less accurate in identification of both anger and disgust. Unoka and colleagues (2011) had similar results to the current study, finding that the BPD group had difficulty differentiating the emotions of disgust, surprise, and fear. Further to this point, five studies found significant differences in the identification of fear (Levine et al., 1997; Wagner & Linehan, 1999; Merkl et al., 2010; and Unoka et al., 2011), with only one study indicating that the BPD group was more accurate at identifying the emotion (Wagner & Linehan, 1999). The current study does not support this finding, as there was not a significant difference found between groups in accuracy of fear identification. These discrepancies will be reviewed more specifically below in the Implications section, as negative emotions, particularly fear, are discussed frequently in BPD perception literature.

Lastly, four of the studies reported results of various scales of emotional experiencing (e.g. anger, depression, affect intensity). Three of the research groups found negative correlations between emotional experiencing and emotion perception ability (Bland et al., 2004; Levine et al., 1997; Merkl et al., 2010); the current study lends support to these results. Only one of the previous research studies included a measure of prosody perception (Minzenberg et al., 2006). Minzenberg and colleagues (2006) administered two tasks to measure prosody perception. On the task that required subjects to choose the emotional tone represented in a non-affective sentence, they found no significant differences between groups. On the task that required subjects to choose the emotional tone of a 10 second work monologue that was read

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aloud, the authors found that the BPD subjects were significantly less accurate than the healthy controls. The former measure is more in line with what was offered in the CATS, and their findings are in agreement as well. From the description offered by Minzenberg and colleagues, the latter task seemed to be more similar to a social perception task in that the actor's upper body and full face is shown in the videos, allowing the viewer to use both verbal and non-verbal cues to make their decisions. This being considered, the results of the social perception task, the IPT-15, is a better comparison to their finding. In this comparison, the current finding that the BPD Group was less accurate in social perception is supported by the results of the dynamic perception task administered in the Minzenberg et al. (2006) study.

Implications of Research Findings

Most FER research utilizes images from the catalog developed by Ekman and Friesen (1979). The current study is no different. However, unlike the FER measures described in other studies, the CATS is able to assess basic and more complex facial emotion perception ability, as well as prosodic emotion perception. The inclusion of facial and prosodic perception in one measure offers a unique opportunity to integrate and directly compare perception ability in two different modes. Further, because the CATS measures basic identity discrimination and *non-emotional* facial and prosodic perception, it is possible to first determine whether baseline differences in perception exist, and to then determine whether there are more specific differences in emotion perception. Most of the perception measures used in the studies discussed previously included tasks requiring subjects to look at one stimulus at a time, and choose which one of the basic emotions the expression represented. The CATS on the other hand, has 13 different subtests, each aimed at determining a specific perception skill (the 13 subtests and group results in Table 7 of the Results section).

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Several findings of the current study extend those of previous research, and others provide more specific information about perception abilities that were not known until now. One extension of previous research is the finding that those with BPD were less accurate overall in emotion perception. This lends support to previous research (Bland et al., 2004; Dyck et al., 2009; Levine et al., 1997; Merkl et al., 2010; Unoka et al., 2011), as well as to the notion that those with BPD find it more difficult to interpret what others are feeling. This notion is supported by several of the theories described previously (Crick & Dodge, 1999; Lemerise & Arsenio, 2000; and Halberstadt et al., 2011), which imply that inaccurate emotion processing can lead to deficiencies in interpersonal communication and emotion regulation.

By using the CATS it was possible to determine that the significant difference in perception ability was due specifically to deficiencies on the subtests comprising the Complex Facial Scale. On the more complex items, subjects had to differentiate and make matches between several facial expressions and emotions. This finding supports prior research that suggested as integrations of appraisals become more complex, individuals with BPD begin to evidence impairments (Domes et al., 2008; Dyck et al., 2009; Minzenberg et al., 2006; Schilling et al., 2012; Wagner & Linehan, 1999).

Across all emotion subtests, the BPD Group was significantly worse at identifying anger and disgust. This finding is consistent with several previous studies that found BPD groups have a more difficult time differentiating between these specific negative emotions (Bland et al., 2004; Levine et al., 1997; Unoka et al., 2011). There are several explanations for these emotions being more difficult to decipher. Regarding anger, this is an emotion that is heavily emphasized in the diagnostic criteria for BPD. Those with BPD are known to be more prone to inappropriate, intense and uncontrollable outbursts of anger. Indeed, facial displays of anger may induce higher

levels of arousal in these patients compared to healthy individuals. As noted previously, individuals with these characteristics may make perception decisions based on what's stored in their memory. Further, as their own emotional intensity increases due to autonomic response to the social threat of the perception of anger, it may be difficult for them to disengage their attention, and make accurate appraisals, or identifications of another's emotion. On the contrary, it is also possible that intense internal anger results in avoidance of emotionally laden interactions with others, and in avoiding these interactions they disengage and attend less to perception.

Facial expressions of disgust were also significantly more difficult for patients with BPD to differentiate compared to healthy controls. Disgust-related perception may be highly relevant to BPD for two reasons. First, there is some evidence to suggest that BPD patients have higher disgust sensitivity than healthy controls (Rusch et al. 2011). Research has found that individuals with BPD report more experiences and situations as disgusting, and have a higher degree of distress associated with "disgusting" experiences (Rusch et al., 2011). If this is the case, than as with anger, disgust may induce higher levels of arousal in patients with BPD and cause cognitive interference, or avoidance of the stimulus, making accurate choices difficult in the moment.

This study failed to find a significant difference between groups in identification of fear, which is in contrast to several previous findings (Levine et al., 1997; Merkl et al., 2010; Unoka et al., 2011; Wagner & Linehan, 1999). With respect to this inconsistent result, an explanation can be proposed. Since fear tends to be the least accurately recognized emotion in normal populations across cultures (Elfenbein & Ambady, 2002), one could argue that the lack of differences demonstrated in fear recognition reflects the difficulty of the task for both groups, which may have eliminated significance.

Further, we did not find a significant difference between groups in their ability to decipher between neutral and emotion expressions, something that has been discussed in several studies presented here (Levine et al., 1997, Bland et al., 2004, Wagner & Linehan 1999, Dyck et al., 2009, Merkl et al., 2010, Fertuck et al., 2009, and Schilling et al., 2012), mainly regarding negativity bias toward neutral expression. The CATS results for individual items are displayed as "Correct" or "Incorrect" and therefore, it was not possible to determine whether any bias to negative items existed within the sample. However, given that the BPD and HC Groups performed similarly on the non-emotion scales of the CATS, and were just as accurate as the HC Group in detecting neutral stimuli within the emotion subtests, it can be hypothesized that neither group had difficulty differentiating neutral from emotional stimuli. However, as mentioned previously, when emotional choices involved two negative options, the BPD Group did have significant difficulty differentiating which negative emotion was being portrayed, specifically between the emotions of sad, angry, and disgusted.

Unlike previous research, the current study was able to measure prosody perception by incorporating and comparing it directly to facial perception. Even though one of the scales included by Minzenberg and colleagues (2006) measured both facial and prosodic perception, it did not combine the modalities to measure direct differences, and it excluded the emotion of disgust. The researchers found that on this particular measure (BLERT; Bell et al., 1997), the BPD group performed significantly worse, but the authors failed to report or provide a suggestion as to what contributed to this finding. On the CATS scales of prosody and combined prosody/facial perception, no significant differences were found. While it was not the predicted finding, it is interesting for two reasons. First, it lends support to the findings related to the pure prosody task (PERT; Bowers et al., 1999) administered by Minzenberg and colleagues (2006),

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who found no significant differences between their BPD sample and HC comparison group. Secondly, the absence of prosody deficiencies in participants with facial perception deficiencies is surprising. The difference in accuracy between facial and prosody perception could be for several reasons. The most straightforward explanation is that the prosody tasks were difficult for both groups and therefore no significant differences emerged. On the contrary, in today's world of technology and multi-tasking, phone communication is frequent, and listening to someone while focusing on another task (i.e. not reading their facial expression) is commonplace. When considering this, prosody perception skills in both groups could be more finely tuned than facial perception skills, leading to similar abilities in prosody perception skills for both groups. For instance, prosody is often the only option available to identify emotion during phone conversations, and for this reason prosody may be easier to interpret due to fewer cues to encode. In facial perception on the other hand, one needs to attend to several areas of the face and encode all the cues before reaching a conclusion; it is theoretically a more complex process. Further, the distance from which prosody perception typically occurs (e.g. over the phone), allows for a non-threatening environment within which to focus on perception. In other words, if emotional investment is heightened during in-person interactions and, as proposed previously, interferes with emotion perception, then it would be reasonable to suggest that prosody perception from a distance would limit the amount of emotional investment and allow for perception to occur without distraction.

Also unique to this study was the measurement of social perception in conjunction with the emotion perception task. This provided an opportunity to begin investigating whether there were differences between groups in social perception, and to compare abilities between a static and dynamic perception task.

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Consistent with emotion perception findings, the BPD Group did significantly worse in decoding verbal and non-verbal cues to determine relationship status. This finding suggests that patients with BPD may have subtle deficits in the processing of social stimuli that extend beyond the range of emotional expressions. More specifically, the significant difference was the result of BPD subject's poorer accuracy in identifying specific types of relationships; those involving intimacy, competition, and deception. This finding can best be interpreted in terms of either the integrated model of emotion and social information processing (Lemerise & Arsenio, 2000), or the theory of affective social competence (Halberstadt et al., 2001). The former theory implies that emotional investment affects processing of social situations. The common BPD characteristics of struggling with intimate relationships, having paranoia about relationships, and general distrust may be related to the deficiencies found on the scales of intimacy, competition, and distrust. This finding could lend support to the idea that when someone is not able to accurately perceive situations, can handicap individuals, interfering with their ability to maintain healthy interpersonal relationships. Given that there were differences in facial and social perception but not in prosody, it can be suggested that perception difficulties are mainly related to non-verbal cues such as facial expression and body language. For instance, even when given more information, such as the conversations between actors on the IPT-15, the BPD subjects still found it more difficult than the HC Group to interpret the perception cues accurately.

Interestingly, *within* the BPD Group, there were no differences in reported anger, impulsivity, or affect intensity, but those with a history of NSSI or suicide attempt were found to be more socially perceptive than the others in the BPD group. This difference was not found in facial or prosodic perception. It is difficult to understand this finding, and it may be that it is spurious, affected by small sample sizes and outliers in groups. However, it may be that those

who are diagnosed with BPD as a result of a suicide attempt have emotion regulation difficulties that are inherently different, and affect perception differently, than those without a history of suicide attempts.

Of note however, is that 14 of 15 in the NSSI/SA sub-group were either in therapy at the time of participation, or had been in therapy previously. Participation in treatment could have contributed to more accurate social perception. As described in the literature review, Saarni (1979) and then again in the Theoretical Implications above (Halberstadt et al., 2001), the valuable use of display rules is imperative for healthy communication. When considering that those with BPD are frequently raised in invalidating environments, it would stand to reason that they did not learn how to correctly use display rules, if at all. However, in treatment, they were probably exposed to techniques that helped to clarify interpersonal confusion, as well as how to approach various interpersonal encounters. In other words, they may have learned how to be more 'relationship appropriate' but there may not have been a focus on the specifics of facial expressions (hence the lack of NSSI/SA differences on the CATS). Therefore, this finding could be explained in terms of the NSSI/SA sub-group learning and improving upon their use of display rules and becoming more adept at correctly reading the use of display rules by others in social situations.

Clinical Implications. The findings presented here have implications for the study of emotion perception impairment and its treatment in BPD. First, patients with BPD exhibit poorer recognition of facial and social emotional cues, especially when the cues involved facial expressions of negative emotions. Misperception of emotions in others interferes with interpersonal relationships and leads to misjudgments of others, and as has been noted numerous times, relationship problems are common among people with BPD. Clinically, these findings

suggest that interventions targeting the differentiation and labeling of negative emotions may be a fruitful component of therapeutic intervention for BPD. For instance, psycho-educational sessions or groups that include learning to recognize and identify one's own emotions and those of others could be a useful addition to treatment. Further, interventions targeting the understanding and implementation of socially acceptable non-verbal body language signals could aid in improving perception ability and social interactions in general.

Though it is a lengthy therapy program with many other components, Dialectical Behavior Therapy (DBT) has been shown to be an effective treatment for individuals with BPD (e.g. Linehan et al., 2006; Neacsiu, Rizvi, & Linehan, 2010). It includes skills training components and education related to emotion regulation and effective emotional expression in relationships (Linehan, 1993). However, it may be that providing more specific information about accuracy of identification of emotion *in others* as well as in *one's self* may be a useful addition to the treatment. Similarly, adding more psychoeducational material about emotion processing into the biosocial theory as it is presented to clients (and clinical providers) may be valuable. Further, examining ways in which prosody may be highlighted in the service of accurate emotion perception in individuals with BPD (as this ability appears to be intact) may be another helpful adjunctive element of treatment.

Additionally, it would be ideal to inform those who treat BPD patients about the potential difficulty with recognition, intensity, and regulation of emotion. Though the diagnosis includes criteria relative to intensity and regulation of emotion, there is not mention of perception deficiencies. This information may enable staff to deal more objectively and therapeutically with this diagnostic group, especially considering that professionals have been known to use pejorative labels for BPD patients, which may be in part due to difficulty with BPD patients'

expressions of distress. Often, those interacting with BPD patients feel personally attacked during 'outbursts' rather than recognizing that the BPD patient's maladaptive emotional expressions are more than likely in response to a history of invalidation. From the perspective of the biosocial theory, an invalidating environment is a source of continued emotion dysregulation. It can also be considered that inaccurate perception contributes to dysregulation. If staff began to view these 'outbursts' as a response to misperceptions rather than as an attack, the staff could use the interaction as a teaching tool. For instance, staff could help to clarify what emotions are being expressed (or not expressed), and correct the faulty perception pattern.

Limitations and Future Directions

Several limitations are noted in the current study. This research was largely exploratory for two reasons. First, it was only the second study to test prosody in BPD. Second, it utilized the CATS, a measure capable of testing single and cross modal perception, which has not been used in previous BPD perception research. The CATS, in and of itself is new, being published in 2006. Therefore, one of the limitations of this study was the limited reliability and validity data available for the CATS (Schaffer et al., 2006), as well as no reported reliability or validity for use with a BPD population. However, the measure does incorporate images from Ekman and Friesen's facial catalog (1979) which is similar to most of the FER research discussed here.

Failure to include brain imaging data was another limitation in the current study. In general, long standing research has suggested that the amygdala is in large part responsible for the processing of the emotional content of facial expressions (Kling & Brothers, 1992) as well as the processing of more complex interpersonal social interactions (Kling, Steklis, & Deutsch, 1979). More specifically, it has been suggested that a hyper-reactive amygdala could predispose BPD individuals to be hyper-vigilant and especially over-reactive to others' emotional

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expressions.   Therefore, while it would not have influenced or changed the results of the study, it would have been beneficial to be able to assess differences in amagdyla reactivity and how much this correlated with perception ability. FMRI research is costly and requires expertise in neuroanatomy, making it the exception rather than the norm in emotion perception research. The information fMRI provides however, cannot be discounted and it is important to continue examining the influence of brain abnormalities in BPD.

Additionally, by design, the present study did *not* exclude BPD participants who had comorbid diagnoses such as anxiety and mood related disorders (those with reported psychotic disorders and substance dependence were excluded). While the presence of co-occurring disorders is well representative of the heterogeneity of BPD, the inclusion of co-morbidity may have consequently affected the findings. However, BPD samples without Axis I co-morbidity are highly atypical, and although the presence of other disorders may have influenced the results, it also renders findings more generalizable. In future research it would continue to be beneficial to include co-morbidity, but better control for its influence so that differences between diagnostic groups could be determined.

Similarly, the decision was made to include participants taking psychotropic medication and/or who were engaged in psychotherapy. Including these participants raises the question of whether the observed effects were influenced by therapy and/or medication effects on the brain. For instance, the observed differences may have actually been more distinct had anyone with prior or current treatment been excluded. Future BPD treatment studies may benefit from including perception measures as part of a pre- and post- test battery to determine the effect that treatment and/or psychotropic medication has on perception ability. Similarly, this study did not include a clinical comparison group.   While this group did represent a diverse group of BPD

participants, and several who had been hospitalized for problems related to the BPD diagnosis, they were all ambulatory and fairly high functioning in the community at the time of their participation. Therefore, it is unclear whether these findings are specific to this subject pool, or if the findings can be generalizable to BPD as a whole. A wider spectrum of individuals with BPD at different levels of care, severity, and with varying demographic characteristics would aid in clarifying the generalizability of these findings. An ideal study would include a newly diagnosed BPD group (i.e. little if any treatment), an outpatient BPD group, and an inpatient BPD group.

Lastly, the current study did not control for environmental and temperamental influences. As noted several times, it is theorized that BPD stems from a combination of environmental and biological influences, often including a history of an abusive environment and an emotionally sensitive disposition. The current study only gathered diagnostic information, and did not gather information regarding how the disorder may have evolved. Gathering information about childhood trauma history, parenting styles, and personality traits/temperament would have greatly contributed to the understanding of the current findings and would have offered more perspective about how the findings relate to the theories of emotion processing and BPD development. Future research would ideally gather developmental information. Further to this point, administering non-personally relevant perception materials under low stress conditions may have limited the 'real world' influence that one's emotionality has on interactions. It is important to extend this research by using dynamic and personally relevant social stimuli in multiple modalities and differing social contexts and stress levels to identify whether the effect documented here is seen under other conditions.

Conclusion

The theories of emotion processing all suggest that emotion perception is a component of emotion regulation. Therefore, when there are difficulties in emotion regulation, there are most likely difficulties in emotion perception. In people with BPD, emotion regulation is of primary concern, and when in treatment, is often targeted as such. The more that is understood about the relationship between emotion perception and components of emotion regulation, the more treatments can cater to targeting deficiencies. The emotion perception differences found between groups in the current study further solidify that such differences exist, and will add to the scant information regarding the less researched prosody perception.

This research is the first known study to directly compare facial and prosodic perception as well as emotion to social perception ability. The findings of this study are consistent with previous research indicating that facial emotion perception is less accurate in those with BPD compared to healthy controls. More specifically, this study suggests that deficiencies are not apparent in basic tasks of perception, but arise when the situation is more complex and especially, when there is ambiguity between the emotions of anger, sadness, and disgust in others. Results concerning prosody perception suggest that this is not a deficiency for those with BPD. This finding is in line with that of the one study that included a comparable prosody perception task (Minzenberg et al., 2006). Because there are only two studies of prosody perception in BPD, the current study being one of them, it is suggested that more research be conducted in this area before any generalizations regarding prosody can be made.

Social perception also appears to be deficient in those with BPD. This finding, along with the differences in emotion perception, suggest that misinterpretations may be occurring on several different levels including facial perception, body posturing, space boundaries, and use of

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display rules. Further research is needed to explore whether there are important personality trait dimensions or historical factors that may also be impeding perception ability. However, it appears that negative emotional stimuli increase the likelihood of perception difficulties.

While there is still much to be learned about the mechanisms by which emotion processing and regulation degrade in individuals with BPD, this study has added to this by offering several explanations for the differences in perception including: interference from traumatic memories, lack of perception or emotion knowledge, heightened sensitivity to emotional stimuli, and avoidance of emotional stimuli. Likely, perception difficulties stem from a combination of factors, and treatment to target multiple deficiencies (e.g. emotion dysregulation, interpersonal difficulties) would be in the best interest for an individual diagnosed with BPD. All of this information allows for conceptualization of how these deficiencies can be remedied in treatment and ultimately aid in alleviating symptoms of the disorder.

Subject line: **PAID Research Study - Borderline Personality Disorder (BPD)**

BPD VOLUNTEERS NEEDED: If you are diagnosed with Borderline Personality Disorder, you may be eligible to participate in a research study examining emotion perception abilities in those diagnosed with BPD versus those who do not meet the criteria for this disorder.

VOLUNTEER REQUIREMENTS:
1. Age 18-55
2. Meet diagnostic criteria for BPD
3. No current drug or alcohol dependence

OVERVIEW of RESEARCH STUDY:
1. Phone screen to determine eligibility (approx 15min). Those who do *not* meet eligibility will *not be invited* for the research study.
2. One time visit to research lab, located in Midtown Manhattan, to complete assessment measures (approx 2 hours)

PAYMENT: Volunteers will be reimbursed for their time upon their completion of the assessment measures.

BENEFITS: This research study will give participants a chance to contribute to the research on how we perceive others emotions and how this affects our own emotional response. Further, this will contribute to the body of research that is aiding in the development of effective treatments for those with Borderline Personality Disorder. All participants will be given resources for therapy and/or support groups in the NYC area should they be interested.

IF YOU THINK YOU MAY QUALIFY, PLEASE CALL xxx-xxx-xxxx and leave a message.

THANK YOU
This research has been approved by: The City University of New York (CUNY), Institutional Review Board (IRB) # xxxxxx

Subject line: **PAID research study seeking those who have difficulty with their EMOTIONS**

VOLUNTEERS NEEDED: If you relate to most or all of the questions listed below, you may be eligible to participate in a research study examining emotion perception abilities in people with these characteristics versus those who do not have these characteristics:

-Do you often feel anxious about relationships, or fear that others will end relationships with you?
-Do your relationships tend to be rocky and/or intense?
-Do you find it difficult to manage your emotions throughout the day?
-Do you often find you experience emotions more intensely than others?
-Do you have a hard time finding direction in your life?
-Have you ever thought about hurting yourself because your emotions were too overwhelming?

VOLUNTEER REQUIREMENTS:
1. Age 18-55
2. Meet diagnostic criteria for Borderline Personality Disorder (BPD)
3. NO current dependence on drugs or alcohol

OVERVIEW of RESEARCH STUDY:
1. Phone screen to determine eligibility (approx 15min). Those who do *not* meet eligibility will *not be invited* for the research study.
2. One time visit to research lab, located in Midtown Manhattan, to complete assessment measures (approx 2 hours)

PAYMENT: Volunteers will be reimbursed for their time upon their completion of the assessment measures.

BENEFITS: This research study will give participants a chance to contribute to the research on how we perceive others emotions and how this affects our own emotional response. Further, this will contribute to the body of research that is aiding in the development of effective treatments for those with Borderline Personality Disorder. All participants will be given resources for therapy and/or support groups in the NYC area should they be interested.

IF YOU THINK YOU MAY QUALIFY, PLEASE CALL xxx-xxx-xxxx and leave a message.

THANK YOU
This research has been approved by: The City University of New York (CUNY), Institutional Review Board (IRB) # xxxxxx

Subject line: **PAID Research Study Seeking Healthy Volunteers – Emotion Perception**

VOLUNTEERS NEEDED: If you consider yourself to be mentally stable and generally in control of your emotions, you may be eligible to participate in a research study examining emotion perception abilities in a clinical sample versus a non-clinical sample.

VOLUNTEER REQUIREMENTS:
1. Age 18-55
2. Currently NOT meeting criteria for any diagnosable mental illness (e.g. Depression, Anxiety)
2. Not prescribed psychiatric medications for any reason
3. No dependence on drugs or alcohol

OVERVIEW of RESEARCH STUDY:
1. Phone screen to determine eligibility (approx 10min). Those who do *not* meet eligibility will *not be invited* for the research study.
2. One time visit to research lab, located in Midtown Manhattan, to complete assessment measures (approx 2 hours)

PAYMENT: Volunteers will be reimbursed for their time upon their completion of the assessment measures.

BENEFITS: This research study will give participants a chance to contribute to the research on how we perceive others emotions and how this affects our own emotional response. Further, this will contribute to the body of research that is aiding in the development of effective treatments for those with Borderline Personality Disorder. All participants will be given resources for therapy and/or support groups in the NYC area should they be interested.

IF YOU THINK YOU MAY QUALIFY, PLEASE CALL xxx-xxx-xxxx and leave a message.

THANK YOU
This research has been approved by: The City University of New York (CUNY), Institutional Review Board (IRB) # xxxxxx

Appendix B: Phone Screen

CODE:_____   Date of Screen___/___/___   Preliminary Group: HC   or   BPD

Verbal Consent Script: "This is a research study to determine whether individuals with certain personality characteristics perceive emotions the same or differently than those who do not have these characteristics. If during a phone screen it seems that you meet the criteria and are willing to participate, the study will include coming to the research office for one visit lasting approximately two hours. During that time you will be asked many questions about your mental health and your personality. You will also be asked to complete a computerized task, watch several video clips, and complete three brief written questionnaires. No portion of the study is anticipated to be distressing or have a negative impact to participants. Participation in this study is voluntary. You can discontinue participation at any point during the study. If you meet the eligibility criteria and come to the research office to participate, you will receive $40 compensation upon completion of the protocol. You will also be given a list of community mental health resources should you be interested. Does this sound like something you would be interested in?"

YES: "Okay, then at this point I would like to ask you several questions that will help to determine whether you are eligible to be a participant in this research study. This will take several minutes and includes questions about your personality, mood, thinking patterns, and habits. You are being assigned a numeric code that will be listed on this questionnaire, and it is _____. From this point forward all of the information you give will be identified by the code and neither your name or phone number will be associated with this information. This will ensure your privacy. Can I have your **consent** to conduct this interview?"
Yes   No

NO to either of above: "Thank you. If you change your mind, you may re-contact the study. We will not save your name or phone number and therefore will not contact you again."

1. What is your age? _____   2. What race do consider yourself?_____

3. BORDERLINE PERSONALITY DISORDER CRITERIA   *Number of criteria met_____*
(Minimum of 5 needed for BPD Group, and no more than 2 for HC Group; If YES to any, ask for elaboration)
__ 1.Abandonment (This question refers to all types of relationships. Do you ever experience fear or worry that people will end relationships with you?) _____
_____
__ 2.Unstable and intense relationships (Do you feel like in general your relationships have a lot of ups and downs?)_____
__ 3.Identity Disturbance (Do you have a good sense of who you are and where you're headed in life?)_____

__ 4.Impulsivity (Are there ever times you spend a lot more money than you planned, or have "road rage" or have one night stands, or find that you often drink too much or use drugs?)
_____
__ 5.Suicide attempts, threats, gestures, self-injury (Have you ever injured yourself on purpose?)
_____
__ 6.Affective instability (Do you feel like your emotions and mood change often throughout the day? For instance do you get irritated very easily or find that your anxiety levels shift quickly?)_____
__ 7.Emptiness (Do you often feel like something is missing in your life, or that you're emotionally empty inside?)_____
__ 8.Anger (Do you feel like your anger is stronger than others, or really intense? If so, what do you do when you're really angry?)_____
__ 9.Paranoid ideation/Dissociation (Do you often think people have ill will toward you? Do you tend to "space out" when you're stressed?)_____

4. SCID SCREEN ADDITIONAL DIAGNOSIS (To determine Exclusion only)
___1. Substance/Alcohol Abuse (In the last three months have you had 5 or more drinks on one occasion?____ How often do you drink alcohol?_____ and typically how much? _____
Do you use drugs?_____ How often?_____ Have you ever abused prescription medication?
_____ Have you ever experienced withdrawal from alcohol or drugs, or been to rehab? ___
___2. Psychotic Symptoms (Have you ever been bothered by thoughts that didn't make any sense or feel as though others were communicating with you in a strange way? Have you ever experienced seeing or hearing things that others couldn't see or hear?)_____
___3. Have you ever been prescribed medication to address depression, anxiety, or another mental health concern?_____
__ 4. Have you ever had a traumatic brain injury or been knocked unconscious?_____

When Inclusion or Exclusion has been determined:
INCLUSION: Thank you for answering all of the questions. It seems at this time that you meet eligibility criteria for the study. Would you like to schedule an appointment to complete your participation? (set appointment, give details of location)

EXCLUSION: Thank you for answering so many questions. We are looking for people who fit very specific criteria and unfortunately you do not qualify for the study. This information just gathered will be saved but your identifying information is not attached to it. We will not be contacting you again but will save your name and phone number in a separate, secured file for logging purposes only.

CODE:____

DEMOGRAPHIC QUESTIONNAIRE for BPD GROUP

1. HISTORY OF SELF-INJURY and/or SUICIDE ATTEMPTS (complete if subject reported YES to item 3.5 on Phone Screen) "On the phone screen you indicated that you have injured yourself on purpose. How did you do this?"_____

"Did you ever injure yourself with the intention of committing suicide? YES   NO

If YES, "How many times?" _____   "When was the first time you made an attempt?" _____"Can you please describe what you did?"_____

_____

"When was the most recent attempt?" _____ "Can you please describe what you did?"_____"When is the last time you had a thought to hurt yourself?" _____

**If current suicidal ideation is reported, call 911 from office or call campus Security to have subject escorted to St. Lukes Roosevelt ER on 59th and 10th Ave. (across the street from John Jay campus) **

2. PSYCHIATRIC TREATMENT HISTORY

"Are you currently in therapy and/or prescribed psychotropic medication?"_____

If NO: "Have you ever been in treatment?" _____When?_____

If YES: "Were you given a diagnosis? With what?"_____

All participants will receive a list of psychotherapy clinics and crisis hotlines

Appendix D: Selected images from the Comprehensive Affect Testing System (CATS)
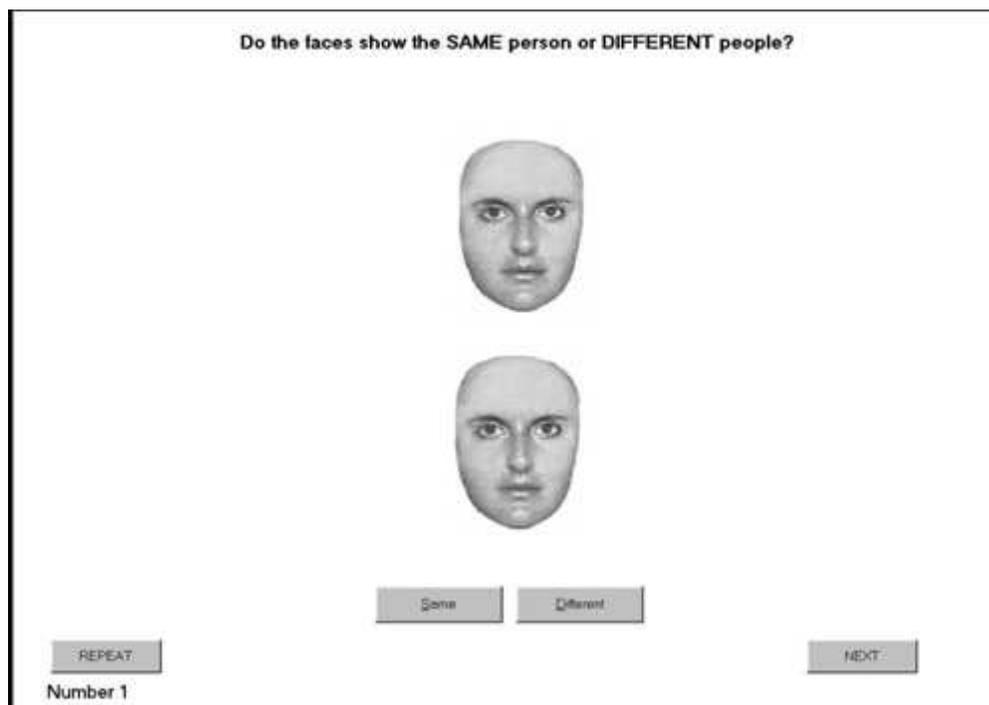
Sample from Subtest 1: Identity discrimination
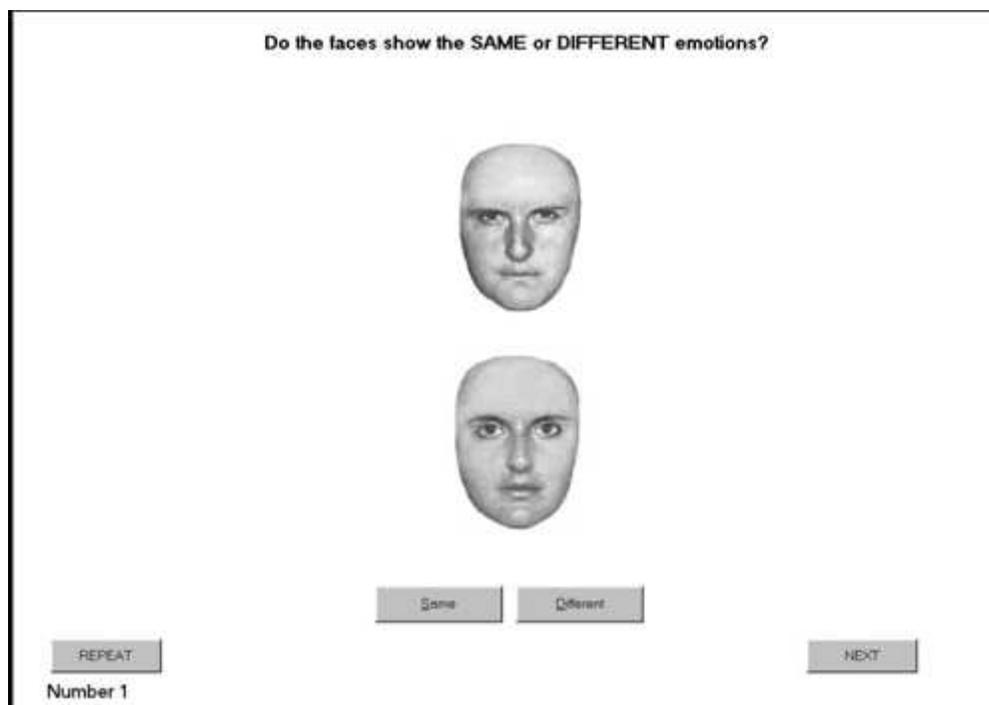
Sample from Subtest 2: Affect discrimination

Sample from Subtest 5: Name affect

Sample from Subtest 7: Match Affect

Which face is FRIGHTENED?

REPEAT   NEXT
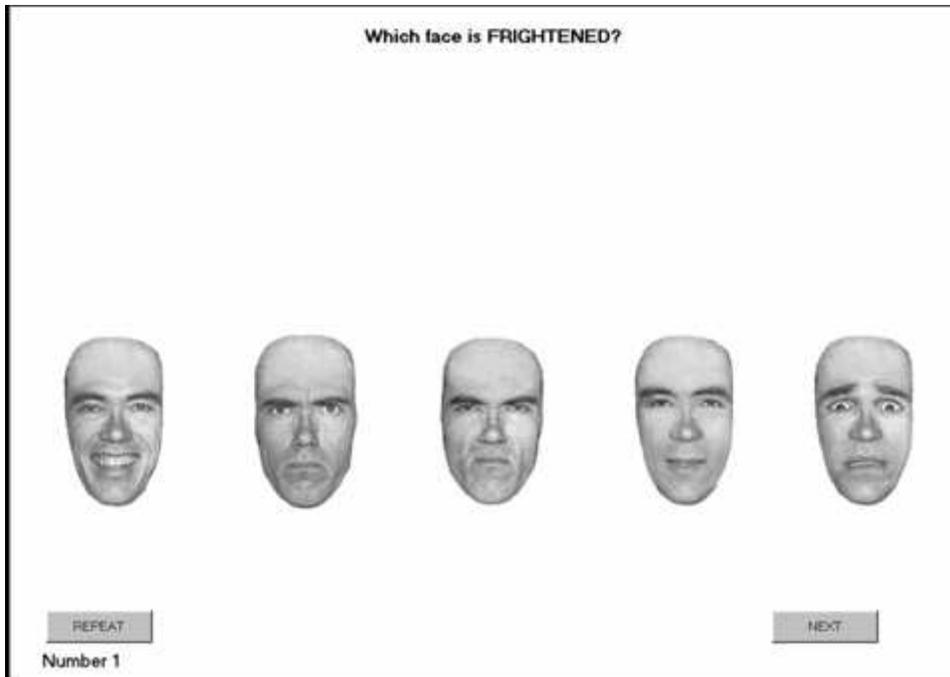
Number 1

Sample from Subtest 8: Select Affect

Which face shows the same emotion as my voice?

REPEAT   NEXT
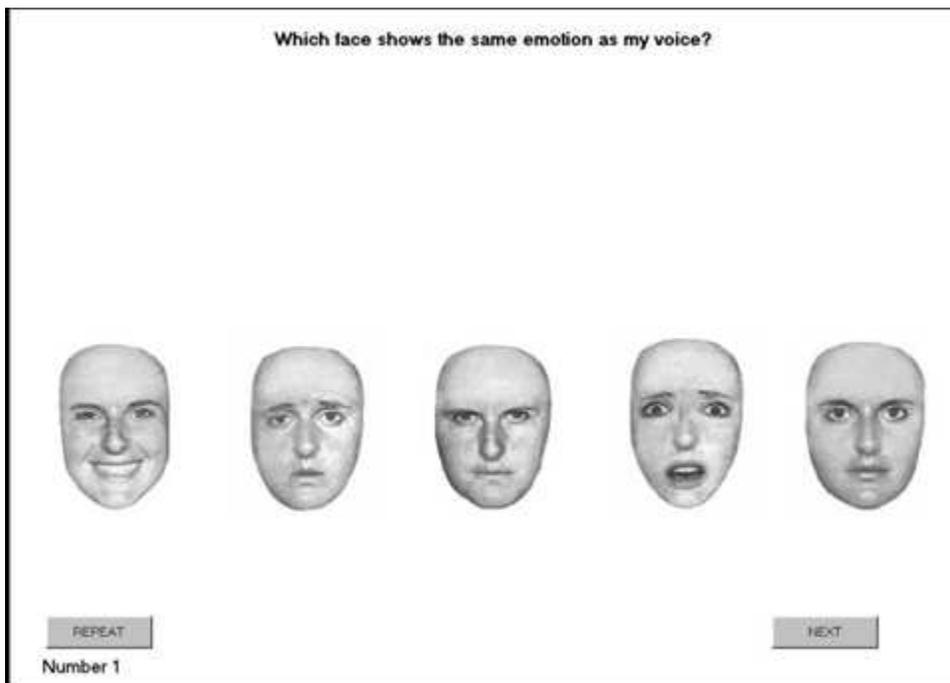
Number 1

Sample from Subtest 11: Match emotional prosody to emotional face

Sample from Subtest 12: Match emotional face to emotional prosody

Sample from Subtest 13: Three faces

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