The Development of Face Morphing Task to Assess Self Other Differentiation

Esen Karan

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THE DEVELOPMENT OF FACE MORPHING TASK TO ASSESS SELF OTHER DIFFERENTIATION

by

Esen Karan, M.Sc., M.Phil.

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy.
The City University of New York

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This manuscript has been read and accepted by the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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THE CITY UNIVERSITY OF NEW YORK
ABSTRACT

The Development of a Face Morphing Task to Assess Self Other Differentiation

by

Esen Karan, M.Sc., M.Phil.

Advisor: Eric Fertuck, Ph.D

Self-Other Differentiation (SOD) refers to a developmental process of acquiring a consolidated, integrated, and individuated sense of self. SOD develops at a) perceptual (e.g., facial perception) and b) representational (e.g., traits, mental states, and beliefs) levels. Impairments in representational SOD (R-SOD) are associated with many forms of psychopathology, particularly borderline personality disorder (BPD) and narcissistic personality disorder (NPD). Few studies to date have examined the perceptual aspects of SOD (P-SOD), which are hypothesized to develop from infancy onwards in tandem and in interaction with R-SOD. Given that the human face is one of the key characteristics that humans use to identify themselves and others, we developed a novel method using facial stimuli of self and other to assess SOD by way of a facial-morphing task (FM-SOD). Our study aim was to validate the FM-SOD task by assessing criterion, convergent and divergent validity, and to examine whether subjects with SOD impairments (e.g., participants with pathological narcissism and BPD features) differ in terms of their SOD on their perceptual and cognitive responses (i.e., sensitivity, discriminability, and response range). Undergraduates (N=87, 38% female) appraised a series of facial images, which comprised features of the self and other in varying degrees (from 0% to 100%, with 0% being “no morphing of self”) on the FM-SOD task. They made self/other

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1 This study was supported by grants from the American Psychological Foundation, Division 39 and Graduate Center to the author.
appraisals on randomly ordered presentations of these morphs on a Likert scale ranging from 1 (100% other) to 5 (100% self). The task measures sensitivity (i.e. a propensity to see the self in the other), discriminability (i.e. the ability to make finer distinctions between self relative to other), and response range. Our results did not provide support for criterion validity of FM-SOD by utilizing the Differentiation and Relatedness Scale (DR-S). However, we showed that individuals with lower developmental quality with respect to self-other differentiation—based on their descriptions of their mothers on the Object Relations Inventory (ORI)—provided a constricted response range in the FM-SOD task. This suggests impairments in R-SOD manifest as a lack of cognitive flexibility and black and white response patterns in perceptual tasks. In terms of construct validity, we found that participants characterized by lower levels of personality organization and higher levels of identity diffusion and who employ lower level defenses (all three as assessed by the IPO) showed poorer sensitivity (i.e. a greater propensity to “see” themselves on facial morphs. These participants’ response range while rating facial morphs was also constricted. Similarly, there was a higher likelihood that participants whose self-esteem was inordinately affected by others’ opinion and who reported poorly differentiated sense of self [assessed by Self Other Differentiation scale (SOD)] see their features more than others in the facial morphs.

Our participants did not show any perceptual deficits in discriminating between morphs of self and other. However, our findings lend some support to convergent validity of FM-SOD particularly in terms of sensitivity, suggesting a link between R-SOD and P-SOD on self and other facial recognition. Our results demonstrated divergent validity of the FM-SOD task showing that discriminability, sensitivity and response range on the FM-SOD task measure constructs other than self-esteem or mood states. However, sensitivity on the FM-SOD task was
found to be correlated with depression scores on the Center for Epidemiologic Studies Depression Scale (CESD). This might be due to the fact that in a nonclinical population, it is hard to differentiate between depression and specific pathology that would impact sensitivity parameters of the FM-SOD task. Lastly, in terms of psychopathology, BPD features were found to be significantly correlated with constricted response range and impaired sensitivity. Specifically, we found that participants with higher BPD features on the Zanarini – BPD scale (ZAN-BPD) showed a more constricted response range in differentiating themselves from others and further showed a higher likelihood of seeing themselves compared to others in facial morphs. Our results showed that perceptual sensitivity, but not perceptual discriminability or constricted response range, was associated with greater pathological narcissistic features. Lastly, individuals with high scores on narcissism, particularly vulnerable narcissism, assessed by the PNI-52 were more likely to rate the facial morphs similar to themselves. This study allowed us to validate a measure which assesses perceptual (as compared to representational) aspects of SOD in an adult population. With this study, we developed a methodology to investigate R-SOD and P-SOD impairments in a nonclinical population, as well as their relationship.
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and maintain my curiosity. Most of all, thank you both for your unfailing faith in me. Finally, to my husband, Manuel, I thank you for taking my burdens as your own and for keeping me smiling throughout many arduous days and nights. Most importantly, I thank you for your kindness, patience and love.

I dedicate this dissertation to my grandparents,

thank you for being my safe ‘objects’ in mind, soul, and spirit.
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CHAPTER I

Introduction

Self-other differentiation (SOD) has been conceptualized as the ability to identify and distinguish one’s self from others in the environment (Piaget, 1955; Neisser, 1991). Theorists and researchers investigate SOD at two levels: a) Representational SOD (R-SOD) reflects the differentiation between mental representations of self and other, which can be defined as cognitive and affective templates comprised of the individual’s experience of the self and others and their interaction. b) Perceptual SOD (P-SOD) refers to the differentiation between self and other at the corporeal or physical level: it relies on an individual’s sensory experiences that lead to bodily awareness, including a clear sense of one’s own unique facial and physical features, and boundaries between self and other.

The unique experience of one’s awareness of their body occurs when concurrently seeing and feeling, as it is based on interactions between multiple sensory modalities (e.g., touch, vision and proprioception) (Tsakiris, Hesse, Boy, Haggard, & Fink, 2007). For instance, children first see themselves in the mirror. As they move in front of the mirror, they compare their reflection with their sense of self. In order to do this, they use their vision and tactile kinesthetic feedback to differentiate self and other. Tactile-kinesthetic feedback is utilized to compare what is seen with the original stimuli and to differentiate self and non-self (Tsakiris et al., 2007; Mitchell, 1997). Another example of P-SOD is when infants encounter a perfect contingency between seen and felt movements, thereby experiencing touch for the first time. The touch from one’s hand to his or her face involves a concurrent touch and feel (“double touch”); it is a unique tactile experience of the hand touching the face and simultaneously the face touching the hand (Rochat,
Thus, P-SOD encapsulates pre-symbolic nonverbal information gleaned through sensory experiences.

Gergerly and Unoka (2008) describe R-SOD as introspectively and consciously identifiable subjective self-states which result from accumulation of the infants’ first year experiences. These experiences include receiving marked contingent affective mirroring: these first year experiences of infants are moderated by new skills including language acquisition and verbal knowledge of the child as the infants get older. With the acquisition of these new skills, the representational self includes memories, qualitative self-description and self-concept knowledge (e.g., who we are).

A broad array of psychopathology is associated with P-SOD and R-SOD impairments. Personality disorders in particular have been formulated with respect to their SOD impairments (Doidge, Simon, Gillies, & Ruskin, 1994; Friedman, Bucci, Christian, Drucker, & Garrison, 1998; Gabbard, 2000; Leichsenring, 2003). Psychoanalytic theories conceptualize personality psychopathology as stemming from a distorted differentiation between self and other particularly borderline personality disorder (BPD) (Luyten & Blatt, 2013; Diamond et al., 1995) (Diamond, Kaslow, Coonerty, Blatt, 1990; De Bonis, Boeck, Lida-Pulik, Hourtane, & Feline, 1998) and narcissistic personality disorder (NPD) (Kernberg, 1975; 1985; American Psychiatric Association (APA), 2013). Major theorists relate impairments in R-SOD with BPD (Kernberg, 1984; 2004; Bender, 2007). A pervasive pattern of instability in self-image, which is an aspect of R-SOD, is one of the nine major defining criteria of BPD in the Diagnostic Statistical Manual (DSM-5; APA, 2013). Kernberg (1984, 2004) proposes that disturbances in identity, a key feature of BPD, reflects a lack of integration of positive and negative representations of the self and other. The unintegrated self-representations result in sudden shifts in the experience of self,
preventing the person from experiencing their sense of self in a coherent and consistent way. Difficulties with self and interpersonal functioning, the core of NPD, stem from distortions in the mental representation of self and others including impairments in SOD (Blatt, 1991; 1995; 2008; Diamond, Yeomans, Stern & Kernberg, submitted; Kernberg, 1975; 2007). The confusion between self and other is evident in the major defining criteria of NPD in both Sections II and III of the DSM-5 (APA, 2013).

Research on R-SOD impairments in BPD has employed a variety of self-report methods, including narratives (Diamond et al., 1990) and repertory grid techniques (De Bonis et al., 1998). Studies on R-SOD found that subjective experience of incoherence in the self is a common experience for patients with BPD. However, representational studies lack the understanding of perceptual mechanisms, which develops simultaneously, in interaction, or synchronously with the representational self (Stern, 1985; Beebe & Lachmann, 2002; 2014; Fonagy, Gergely, Jurist & Target, 2002).

Recent research on P-SOD and psychopathology has utilized perceptual laboratory tasks to measure psychophysical aspects of perception of body ownership. One study (Bekrater-Bodmann et al., 2016) conducted with BPD patients used an experimental illusion task which induced the feeling of ownership of an artificial limb. In this study, patients with BPD diagnoses reported ownership of the artificial limb as their own compared to healthy controls; remission was associated with a stabilization of these perceptions. This study suggests an association between BPD and altered body ownership.

Susceptibility to body representation distortion might be aroused by deficiencies in multimodal sensory integration which occur when two or more sensory information (visual and tactile) are presented and processed in temporal synchrony. These deficiencies in multimodal...
sensory integration have been found to be related or have contributed to the development of different psychopathologies including psychosis (Germine, Benson, Cohen, Hooker, 2013; Thakkar, Nichols, McIntosh, & Park, 2011; Peled, Ritsner, Hirschmann, Geva, & Modai, 2000). Research on autism spectrum disorders (ASD), where self-awareness and social cognition are impaired, has found that participants with ASD show reduced susceptibility to body ownership illusion compared to healthy controls. These studies indicate that altered susceptibility to body ownership, an aspect of P-SOD, is associated with various kinds of psychopathology.

Studies on P-SOD either have investigated infants and their developing perceptual sense of selves or investigated P-SOD after utilizing experimental illusion, thereby evoking changes in self-other representations. These studies lack an understanding of an individual’s baseline SOD within an adult population, as well as the potential correlates of SOD in terms of psychosocial functioning and psychopathology.

Furthermore, the few existing studies on P-SOD among adults focus mostly on body ownership. The face is the most distinctive feature of our physical appearance, as well as one of the key features that we use to identify ourselves and others (Haxby, Hoffman, & Gobbini, 2002; Mitchell, 1997). Facial recognition is an early precursor of self-knowledge and visual self-recognition. Thus, in our study, we utilized standardized facial stimuli in laboratory-based conditions to assess P-SOD with subjective ratings and response times.

This study aimed to validate a facial morphing task (FM-SOD) that we previously developed (Karan, Bravo, Grinband, Diamond & Fertuck, 2016) to assess individuals’ perceptual impairments in SOD. We collected psychophysical data to investigate facial identity recognition in a non-clinical college population by presenting morphed facial stimuli, which consist of varying degrees of self and other facial features (0%, 20%, 40%, 60%, 80%, 100%, with 0%
being “no morphing of self”). We used signal detection theory (Green & Swets, 1966), which is a framework that helps to explore the nature of psychophysical differences between groups. This study assessed three aspects of perceptual processing: a) perceptual sensitivity: the likelihood of rating oneself versus the other, b) discriminability: the ability to make finer distinctions in rating faces of the self and the other, and c) response range: the range of responses that participants use while rating faces of self and other.

We first investigated the criterion related validity and construct validity of the FM-SOD task. Criterion validity is the degree to which a new measure has the ability to assess a construct compared to the best measure of that construct. We used the Differentiation Relatedness Scale (DR-S; Diamond et al., 1995) of the Object Relations Inventory (ORI; Blatt, Bers & Schaffer, 1993) as a gold standard measure for SOD to evidence the criterion related validity of our newly developed FM-SOD task. Construct validity is established in two steps: a) when the constructs that are not theoretically related to each other are in fact observed not to be related to each other b) the constructs that are theoretically related to each other are in fact observed to be related to each other (Devellis, 2003; Campbell & Fiske, 1959). Given that P-SOD studies on body ownership have suggested a relationship with psychopathology and P-SOD, we investigated the relationship between individuals’ performance on the FM-SOD task and their scores on SOD-related factors such as BPD and pathological narcissism. Our study offered us an opportunity to understand the relationship between facial aspects of the P-SOD and psychopathology.

Validation of our measure on the social cognitive mechanisms of facial perceptual distortions as an index of P-SOD can potentially advance our understanding of SOD and related psychopathologies. Learning about perceptual variability and psychophysical biases in P-SOD can lead to the development of effective preventions to enhance individuals’ differentiated sense
of self. More specifically, we aimed to identify presymbolic contributing factors to personality pathology and to integrate perceptual aspects into conceptualization of personality pathology. Beyond simply addressing an absence of research examining bodily perception, the FM-SOD task can potentially assess treatment outcomes that transcend addressing symptomatic relief by tapping into structural changes in personality pathology.
CHAPTER II

Literature Review

2.1. Self-Other Differentiation

Self-other differentiation (SOD) has been conceptualized as the ability to identify one’s self as one object among other objects in the environment, as well as the ability to distinguish oneself from all others (Piaget, 1955). It is considered to be a developmental milestone wherein a child starts to acquire a differentiated sense of self and relationships with others based on mutuality, reciprocity, and reflectiveness (Diamond et al., 1995; Decety & Sommerville, 2003; Neisser, 1991).

This separated sense of self is the result of an ability to recognize others and distinguish between self and others in terms of body, thoughts, feelings and behaviors. Theorists and researchers investigate self and other awareness and differentiation on different facets such as the perceptual level (bodily awareness including physical boundaries and appearance) and on the representational level (sense of who one is) (Tsakiris et al., 2007; Decety & Sommerville, 2003; Gallagher, 2000).

Body ownership, a component of P-SOD, is perceiving one’s body as one’s own and recognizing what makes one’s body unique. It refers to a subjective and unique experience of self and contributes to the developmental basis of psychological identity formation (Gallagher, 2000; Tsakiris et al., 2007). Body ownership occurs through concurrently seeing and feeling one’s body via multiple sensory modalities (e.g., touch, vision, and proprioception) (Tsakiris et al., 2007). On the other hand, the representational sense of self is the extent to which one has a sense of who one is; it comprises cognitive and affective schemas of self and significant others and their interaction. These cognitive and affective schemas (or mental representations of self...
and other) pertain to “conscious and unconscious cognitive, affective, and experiential” components (Blatt, Auerbach, & Levy; 1997 p. 351).

2.2. Perceptual SOD and Normal Development

2.2.1 Perceptual SOD within Children

Piaget (1955) investigated the sensorimotor stage in order to understand self-recognition and SOD. During this period, children explore the relationships between their bodies and the environment. The child learns to separate the world from his or her actions and sees the world as a separate construct, not as an extension of themselves. The child uses their sensations such as seeing, touching, sucking, and feeling, to acquire this knowledge about themselves and the environment.

According to Piaget (1955), SOD occurs when two schemes, patterns of thoughts or behaviors that organizes units of information and their relationship among them, are activated simultaneously. As an example, at three months of age, an infant can see and grasp an object. The simultaneous activation of these two schemes (touch and sight) result in SOD via multisensory integration. Correspondingly then, SOD does not stem from an undifferentiated aspect of vision or of touch schemes but rather from the integration of them both (cited in Fast, Erard, Fitzpatrick, Thompson, & Young, 1985).

Theorists (Meltzoff & Brooks, 2001; Rochat, 2003) further Piaget’s (1955) sensori-motor ideas in SOD and state that vision, movement and tactile kinesthetic feedback underline the development of SOD. According to this model, the infant perceives the stimuli visually. Then, the infant produces movement. The movement provides tactile-kinesthetic feedback, which is then compared against the original stimuli to differentiate between self and other via cross-modal sensory (vision and movement) comparisons. The infant is able to understand the perfect
contingency between the seen and felt movements. Thus, they do not feel any confusion and they recognize that what they see is unique to themselves.

Furthermore, Rochat (2003) states that when infants experience their own touch, they encounter a perfect contingency between seen and felt movements. The touch from one’s hand to one’s face involves a concurrent touch and feel (“double touch”); it is a tactile experience in which one experiences the concurrent touch experienced at both hand and face by the touch contact with the other body part (i.e. hand or face). This is similar to other multisensory experiences, for example the experience of hearing and feeling oneself cry or visual-propiroceptive integration that are specific and distinct to the self. Research (Rochat & Hespos, 1997) investigated a rooting response of five newborns and 11-month-old infants. Either a tactile stimulation initiated by the experimenter’s index finger or from self-stimulation were given to the infants. Results showed that neonates root significantly more to the experimenter’s index finger compared to the instances in which they spontaneously brought their own hands in contact with their face (self-stimulation). The study suggests that from birth, infants differentiate between self- vs. non-self touch, or between stimulation initiated from their own body or an external source.

Neisser (1991) underlines the importance of the perceptual self and reports that even though concepts and representations have significant importance in our minds, perception precedes these constructs and thus representation as well. He argues that vision is the most important sensation in SOD. Even though we can feel our movements kinesthetically, kinesthesia is navigated by vision. He provides an example of when a child wears optically displacing prisms while looking at their hands, they feel that their hands are in the newly visually specified location (Neisser, 1991). Lastly, kinesthetic information can be variable in terms of the pace of the
growing child (the self navigates and differentiates itself in relation to inanimate objects) (Piaget, 1955; Neisser, 1991). Thus, vision is a key sensation in the development of perceptual SOD: it provides more reliable or consistent information on self-perception compared to the other sense modalities, such as kinesthesis.

Research has stated that P-SOD, having a sense of one’s own body as a differentiated concept, develops early on in the lifespan (Rochat, 2003), as highlighted in the aforementioned study (Rochat & Hespos, 1997) examining rooting in infants. Furthermore, 6-week-olds systematically imitate the direction of tongue protrusion of an adult model, suggesting that they differentiate their own actions from others (Meltzoff & Moore, 1994). Other studies indicate that infants show familiarity with their facial features when they are 3 months old compared to their peers’ facial features showing that as early as 3 months infants start to differentiate their faces compared to their peers (Bahrick, Moss, & Fadil, 1996).

2.2.2 Perceptual SOD within Adults

P-SOD within an adult population has been studied based on multisensory integration, where information is presented in two or more sensory modalities (visual and tactile) and is processed in temporal synchrony. Botvinick and Cohen (1998) demonstrated that by manipulating vision and touch, they could create an illusion of body ownership within adults. This is called the ‘rubber hand illusion’ (RHI). In this illusion, the experimenter synchronously strokes a visible rubber hand in front of the participant while the participant’s own hand is hidden from view. Subsequently, the participant reacts to tactile actions made to rubber hand as if it were her own. This manipulation produces the illusion of ownership of the fake hand.

Several studies have shown that a laboratory-based facial illusion task similar to the RHI can manipulate self-other boundaries among healthy controls (Tajadura-Jimenez, Grehl, &
Tsakiris, 2012; Paladino, Mazzurega, Pavani, & Schubert 2010; Sforza, Bufalarari, Haggard, & Aglioti, 2010). During one illusion task, the participants watched a video of a person receiving a touch with a cotton bud and they simultaneously received the same touch either synchronously with the video or asynchronously. After being touched synchronously and asynchronously, participants were asked to view a morphing video of an other to self (and self to other) and stop the video when the image looked more like themselves (or the other). Alternatively, participants were asked to view faces which were a composite of their own and another’s face to a varying extent (0%, to 100%, with 0% being “no morphing of self”) and rate the face on a scale of whether the faces looked more like their own face or more like the other’s. After synchronous visual-tactile stimulation, participants tended to see more of themselves in the composite face than after asynchronous stimulation, indicating that the perceptual representation of their face merged with the other’s face. This manipulation is called “enfacement illusion” (Tajadura-Jimenez, et al., 2012; Paladino et al., 2010; Sforza, et al., 2010).

Furthermore, participants reported changes in their subjective experiences. They made statements addressing the source of tactile sensation. For example, a) “I feel the touch delivered in the other’s face”, b) “the touch I felt was caused by the cotton bud touching the other’s face.” The participants also referred to the changes in resemblance between the other’s face and their own face. For example, a) “the other’s face began to resemble my own face in terms of shape”, b) “the other’s face began to resemble my own face in terms of facial features.” Participants denied the same statements following the asynchronous condition (Tajadura-Jimenez et al., 2012; Sforza, et al., 2010; Paladino et al., 2010). Researchers concluded that these results suggest a representational plasticity and might be interpreted as the “other” becoming more similar to the self due to the effect of synchronous visuo-tactile stimulation.
Relevant studies have further shown that synchronous stimulation increases confirmatory behavior of the participants (Paladino et al., 2010) and is impacted by the attributed physical attractiveness of the other’s faces (Sforza et al., 2010). In terms of racial stereotypes, there are conflicting findings. One study demonstrated that there was no effect of race, but that there was an effect of positive interpersonal interactions on self-other body illusion; individuals attributed more self features on another person’s facial features in the context of multisensory illusions when they had positive face-to-face interactions with others independent of their race (Bufalari, Lenggenhager, Porciello, Holmes, Aglioti, 2014). However, another study found that people showed less empathic responses to members of a different cultural group who were experiencing pain in their hands, suggesting a reduced empathic sensorimotor response to pain of members of another race (Avenanti, Sirigu, Aglioti, 2010). These results suggest a plasticity of self-representations. People viewed more of themselves in the other when they feel more positively about the other and perceived the other to be more attractive. After a synchronous stimulation, they also conformed to their behaviors more than compared to asynchronous stimulation.

These studies suggest a multisensory account of the self, where we do not have stable stored representations of our bodies, but instead they are dynamically maintained and integrated multisensory experiences (Tsakiris, 2008). However, these studies investigated SOD after manipulation of perceptual self-other (e.g., RHI), thereby evoking changes in self-other representations. These studies lack an understanding of baseline SOD within adult populations and the potential correlates of SOD in terms of psychosocial functioning and psychopathology. These studies collected response time and self-other resemblance ratings from participants, but not other psychophysical information including response variabilities, which can inform us about sensitivity, discriminability and response range. Thus, in our study, we utilized standardized
facial stimuli (morphed pictures) in laboratory-based conditions to assess perceptual SOD with subjective ratings, response times, and response range.

2.3. Representational SOD and Normal Development

2.3.1. Representational SOD Within Children

R-SOD comprises infants’ cognitive affective schemas, agency about their behaviors, and understanding theirs and others’ desires and beliefs. The development of these aspects of R-SOD are moderated by skills that infants acquire later in their development such as language acquisition and lexical knowledge.

Some researchers propose that a representational sense of self develops after the development of P-SOD (Rochat, 2003). Others, however, argue that the development of perceptual and representational SOD overlaps and the difference between perceptual and conceptual knowledge of self may be one of degree, not kind (Bahrick, 1995; Grene, 1993 cited in Bahrick et al., 1996). Furthermore, other theorists (Stern, 1985, Fotopoulou & Tsakiris, 2017; Beebe & Lachmann, 2002; 2014) posit that P-SOD and R-SOD occur together through the dyadic contingent co-constructed interaction. Mitchell (1997) agrees and proposes that there is no clear distinction between the two, and infants may possess perceptual knowledge of the self in one domain and conceptual knowledge in another, which are developmentally overlapping.

While the representational sense of self emerges, just like the perceptual sense of self, the self is in constant interaction with other individuals. Gergerly and Unoka (2008) assert that children in interaction with their primary caregivers construct cognitive and affective schemas of self and other. These affective schemas of self and other are infants’ interpersonal and situation-specific emotional representations (Piaget, 1955; Stern 1985, Fonagy 1991; 1995; cited in Blatt, Auerbach, & Levy, 1997). Researchers following Stern (1985) state that SOD develops through a
spiral of dyadic, contingent co-constructed interactions, which further engender more complex mental representations (Beebe & Lachman, 2002; 2014). Recent research supports the idea that SOD is driven by perceptual, cognitive and affective networks that develop in an interpersonal matrix (Steele, Steele & Beebe, 2017; Beebe & Lachman, 2002; 2014).

The development of these schemas can start as early as joint attention wherein the infants’ and primary caregivers’ gazes meet and they collaboratively make meaning of external events. As the infants encounter events, they receive systematic contingent affective feedback from their caregiver. They start to build those representations while they register, maintain and analyze causal dependencies between the self’s emotional response and reactions that are invoked in others. These representations are used to understand emotional consequences of events and influence the infants’ subsequent behaviors as adults (Stern 1985; Fonagy 1991; 1995; cited in Blatt, et al., 1997).

R-SOD includes feelings of agency. Brownell & Carriger (1990) give a timeline in terms of psychological aspects of the representational sense of self in relation to agency in later development. They assert that during the first 12 to 15 months, the child perceives themself as an omnipotent agent. The child is not aware of the other's causal agency. After 15 months, the child differentiates between self and other, yet they perceive the other as a passive receiver of their own omnipotent agency. Only during the second year of life does the child conceive of others as active, autonomous agents who behave independently of the child's wishes.

Gergely (2002) proposes that a child in the second year of life demonstrates an understanding of the subjective desires of others (e.g., Repacholi & Gopnik, 1997). In the Repacholi and Gopnik (1997) study, children were asked to offer an experimenter food after observing the experimenter show both disgust after tasting one type of food, and then also
happiness after tasting another type of food. The 14-month-old infants offered the experimenter the food that they themselves would prefer, regardless of the initial reaction of the experimenter. However, 20-month-old infants were able to predict which food the experimenter would like and operated on this information. These results suggest that there is an understanding of the differentiation between desires of the self and desires of the other around the second year of life, indicating a development of R-SOD.

After the middle of the second year, Rochat (2003) underlines the fact that explicit self-awareness emerges when linguistic and symbolic competencies start to play a major role in the psychic life of children. He argues that the successful recognition of self in the mirror is linked to symbolic (referential) development of the child, particularly with regard to language development. Infants who are 18 months old start to mark contrasts between themselves and other people in their mirror reflections and also start to differentiate between themselves and others in their verbal production (Rochat, 2003). Bates (1990) indicates the relationship between verbal and representational self and argues that language acquisition requires a preexisting representational sense of self as “Me” (representational), as opposed to a solely perceptual sense of self as “I” (Bates, 1990, p. 165). Thus, the self is not only distinct from other people, but there is a recognition of the point of view of the other and how the self is perceived by the other.

In an experimental study (Oppenheimer, Warnars-Kleverlaan, & Molenaar, 1990), children ranging from 6 to 13 years old were asked to give a description of themselves and of others. The study found that as age increases, understanding of oneself and other shifts from the physical and material (such as “I am tall”) to a psychological (e.g., “I am a kind person”) and to a social (e.g., “I have many friends”) understanding of the self. This direction in development of understanding was evident both in self and other descriptions, which supports the notion that
SOD evolves from the bodily and perceptual to verbal and representational. Understanding the self in terms of material bodily experience and psychological and social understanding is also in line with assessment of SOD, including the ORI (Blatt et al., 1979), Conceptual Level Scale (CL; Blatt, 1974, Blatt et al., 1979; 1988) and the DR-S (Diamond et al., 1995).

Overall, as shown in Table 1, current literature suggests that the representational sense of self is the result of infants’ experiences during their first year of life. These include the marked context-dependent affective mirroring, a sense of agency of their behavior, and understanding other’s desires. The development of R-SOD is varied and multidimensional, as some aspects of R-SOD (such as feelings of agency) develop earlier than language. Thus, it is difficult to track the exact timeline of the development of representational sense of self during infancy.

Table 1

The Development of P-SOD and R-SOD in Children

<table>
<thead>
<tr>
<th>P-SOD*</th>
<th>P-SOD is to experience what makes one’s body unique to itself. This unique experience occurs when concurrently seeing and feeling, as it is based on interactions between multiple sensory modalities (e.g., touch, vision and proprioception)</th>
<th>(Piaget, 1955; Tsakiris et al., 2007; Mitchell, 1997)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Double touch occurs when infants experience their own touch, and they encounter a perfect contingency between seen and felt movements. The touch from hand to the face involves a concurrent touch and feel (“double touch”)</td>
<td>(Rochat, 2003)</td>
</tr>
<tr>
<td>R-SOD**</td>
<td>Cognitive affective mirroring, affective schemas</td>
<td>(Gergerly &amp; Unoka, 2008)</td>
</tr>
<tr>
<td></td>
<td>Agency of the behaviors</td>
<td>(Tsakiris et al., 2007).</td>
</tr>
</tbody>
</table>
2.3.2. Representational SOD within Adults

Representational SOD (R-SOD) is a commonly researched area in SOD among healthy adult samples. Different scales have been developed to assess R-SOD among adults. These self-report scales assess different dimensions in R-SOD such as intimacy, dependency, logical reasoning and emotional reactivity. Given that the awareness of a separate sense of self requires awareness of others, these studies focused mainly on interpersonal relationships. As our study aimed to develop a measure to assess SOD, it is important to review prior R-SOD assessment methods.

Bowen (1978) differentiates self-concept as the degree to which one is able to balance a) emotional and intellectual functioning and b) intimacy and autonomy in interpersonal relationships (Bowen, 1978 cited in Skowron & Friedlander, 1998). Differentiated individuals have intact logical reasoning reflected in their functioning. In contrast, poorly differentiated people have impaired logical reasoning and make decisions irrationally. On an interpersonal level, differentiated individuals experience intimacy maintaining a sense of autonomy. They maintain a clear self-identity in their relationships and have flexible boundaries that permit emotional intimacy and physical union with another without a fear of merging. However, individuals with impaired SOD differentiation tend to a) remain in enmeshed relationships with
their parents and find separation overwhelming b) remain emotionally cut off from these relationships and find intimacy threatening (Johnson & Waldo, 1998). For instance, an enmeshed person might be financially as well as emotionally dependent on their family, while an emotionally cut-off person might isolate themselves and avoid family gatherings.

Bowen (1978) constructed a scale to measure SOD as a personality variable on a scale (0-100), which represents varying levels of certain intrapsychic (i.e., a balance between thoughts and feelings) and interpersonal characteristics (i.e., a balance between intimacy and independence) which motivate different types of relationships (e.g., disengaged) (Bowen, 1978 cited in Skowdron & Freidlander, 1998; Kerr & Bowen, 1988 cited in Johnson & Waldo, 1998).

Unlike Bowen, who aims to understand the motivations underlying different types of relationships, Minuchin (1974 cited in Johnson & Waldo, 1998) proposes that the degree of individuals’ emotional and physical proximity are regulated by boundaries. He proposes a continuum where one extreme of the continuum represents disengaged boundaries, and the other represents enmeshed boundaries. The middle point of the continuum represents the healthy balance between intimacy and independence (Minuchin, 1974 cited in Johnson & Waldo, 1998).

According to Minuchin (1974), individuals can be in disengaged or enmeshed relationships depending on the pressures driven by the environment citing the suicide attempt of a spouse as an example. This emotionally provoking event may activate the enmeshed system of the disengaged partner. Even though the disengaged partner’s behavior following the attempt may deviate from their baseline in reaction to this suicide attempt, he would soon go back to his disengaged position to preserve his recurrent regular behavioral pattern. Minuchin's continuum provides a framework for understanding an individual’s behavior that occurs when systems impose extremely rigid or diffuse boundaries (cited in Johnson & Waldo, 1998). The continuum
accurately portrays the need to find balance in significant relationships. Johnson and Waldo (1998) propose an integration of Bowen’s and Minuchin’s theories in which both the current functioning of the relationships and motivating factors of partners’ behaviors to each other can help to understand varying levels of SOD.

Another group (Skowron & Friendlander, 1998) developed the Differentiation of Self Inventory (DSI), a self-report instrument that tests theoretical assumptions, assesses individual differences in adult functioning, and evaluates psychotherapeutic outcomes. The DSI is a 43-item scale containing four subscales assessing emotional reactivity, clearly defined sense of self, fear of intimacy, and over-involvement with others. They found that healthier scores on the DSI scale were associated with lower chronic anxiety, better psychological adjustment, and greater marital satisfaction. Murdock and Gore (2004) found that the effects of stress were moderated by R-SOD, which was assessed by the DSI scale in predicting psychological functioning. These results confirmed Bowen’s theory proposing that differentiated individuals experience intimacy while maintaining a sense of autonomy (Bowen, 1978 cited in Skowdron & Freidlander, 1998; Kerr & Bowen, 1988 cited in Johnson & Waldo, 1998). The results also showed that adaptive coping strategies were associated with higher levels of R-SOD, whereas maladaptive coping strategies were associated with lower levels of R-SOD. Lastly, Jenkins, Buboltz, Schwartz, and Johnson (2005) investigated the DSI (Skowdron & Friedlander, 1998) and found that differentiation level was significantly predictive of psychosocial development.

Overall, research has provided support for the theoretical notion that lower levels of R-SOD have been associated with greater amounts of chronic anxiety and physical and psychological distress (Bohlander, 1999; Elieson & Rubin, 2001; Griffin & Aposthal, 1993; Haber, 1993; Harvey & Bray, 1991; Harvey, Curry, & Bray, 1991; Skowron & Friedlander,
higher levels of emotional reactivity (Johnson & Buboltz, 2000), and lower levels of marital satisfaction (Skowron, 2000). These results are also confirmed across cultures. Tuason and Friedlander (2000) examined the relationships among R-SOD, anxiety, and psychological symptoms in a sample of Filipino individuals. They found that the R-SOD appeared applicable across cultures and it was inversely related to psychological distress, supporting Bowen’s theory (1978).

Another measure that was developed to assess SOD in close relationships is by Aaron and Aaron (1986). It is a pictorial measure in which participants choose from Venn diagrams that show different levels of overlap between self and other in close relationships. This measure allows researchers to investigate R-SOD in close relationships. Aaron and his colleagues (1991) propose that being in a close relationship is described as sharing resources, perspectives and characteristics. For most human beings, the inclusion of another person in the self is a particularly important opportunity for self expansion because of the complexity and richness of another human being. There are multiple possible outcomes of closeness. First, closeness can mean joint benefit where one benefits from another’s resources in the long run. Second, closeness can mean taking in another’s perspective of memories and events, which can result in experiencing the events as if they were first hand. Third, closeness can mean vicariously sharing another’s characteristics, such as having overlapping traits with another person. Thus, individuals take on a close other’s identity, treating their characteristics and memories as their own and treating their resources as joint resources. This can lead to a less differentiated self. This measure is developed to assess closeness in the relationship; however, it has also been used to identify the degree of care or “merging” between two strangers (Batson, Sager, Garst, Kang, Rubchinsky, & Dawson, 1997).
Bowen (1978) explored differentiation of self-concept in the family systems literature to measure differentiation as a personality variable in order to understand motivations of the specific self-other closeness of the individuals (cited in Skowron & Friendlander, 1998). Skowron and Friendlander (1998) developed the Differentiation of Self Inventory (DSI) to create a self-report instrument to assess individual differences in adult functioning. Aaron and Aaron (1986) developed a pictorial measure in which participants chose from Venn diagrams depicting different levels of self-other differentiation in close relationships. Finally, the SOD scale (Olver et al., 1990) has been developed as a true-false self-report measure. This scale is significant in that it has been the only scale that is specifically concerned with the construct of SOD to assess the vulnerability to evaluation by others, lack of independent judgment as well as lack of identifying one’s emotions without a dialogue with others (Ingoglia, Faraci, Musso, Coco & Liga, 2018).

Research within a healthy population has found that lower levels of SOD have been associated with greater amounts of chronic anxiety and physical as well as psychological distress across different cultures (Bohlander, 1999; Elieson & Rubin, 2001; Griffin & Apostal, 1993; Haber, 1993; Harvey & Bray, 1991; Harvey, Curry, & Bray, 1991; Skowron & Friedlander, 1998; Skowron et al., 2003; Tuason & Freidlander, 2000). These results suggest a link between R-SOD and psychopathology. Given that the development of P-SOD precedes, overlaps, and interact with the development of R-SOD, it also invites the discussion of both R-SOD and P-SOD in relation to psychopathology. Lastly, as shown in Table 2, all studies focused on R-SOD solely used self-report measures. This highlights the lack of multi-method use to assess R-SOD, such as including an interview or laboratory task to measure R-SOD and investigate the link between P-SOD and R-SOD. We aim to do this in our study by utilizing the Differentiation
Relatedness Scale (D-RS; Diamond et al., 1995), an interviewer rated measure based on the Object Relations Inventory (Blatt et al., 1979) and a laboratory task (FM-SOD) to assess P-SOD.

Table 2

*Assessment Tools to measure SOD within Adults*

<table>
<thead>
<tr>
<th>Name</th>
<th>Assessment Method</th>
<th>Explanation</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowen’s Differentiation Scale</td>
<td>Self-report</td>
<td>A personality variable that can be placed on a scale (0-100), to measure the balance between thoughts and feelings and between dependency and independence</td>
<td>(Bowen, 1978)</td>
</tr>
<tr>
<td>Minuchin's Boundary Continuum (Framework)</td>
<td>Self-report</td>
<td>Minuchin's continuum provides a framework for understanding the here-and-now behavioral manifestations that occur when systems have inappropriately rigid or diffuse boundaries. The continuum accurately portrays the need to find balance in significant relationships</td>
<td>(Minuchin, 1974)</td>
</tr>
<tr>
<td>Differentiation of Self Inventory (DSI)</td>
<td>Self-report</td>
<td>43-item self report scale, containing four subscales of emotional reactivity, “I” position (clearly defined sense of self), emotional cut off (being threatened by intimacy), and fusion with others (over-involvement with others)</td>
<td>(Skowron &amp; Friendlander, 1998)</td>
</tr>
<tr>
<td>Inclusion of Self in the Other</td>
<td>A pictorial multiple choice</td>
<td>A pictorial measure in which participants</td>
<td>(Aaron &amp; Aaron, 1986)</td>
</tr>
</tbody>
</table>
choose from pictures of Venn diagrams between different levels of including other in the self in close relationships to investigate SOD in close relationships

| Self Other Differentiation Scale | Self-report | Self-report scale which measures a separate sense of self with an 11-item true-false scale | (Olver et al., 1990) |

2.4. Perceptual SOD and Psychopathology

Perceptual SOD has recently been the focus of studies examining populations with psychopathology. Available research has investigated psychopathology in adulthood including borderline personality disorder (BPD), psychosis, and eating disorders (ED) as well as a childhood developmental disorder, Autism Spectrum Disorders (ASD). These research studies pointed out that deficiencies in multisensory integration are associated with debilitating psychopathologies related to SOD.

Patients with BPD often report an unstable and incoherent sense of self (Pollack, 1989; Bender, 2007). One study (Bekrater-Bodmann et al., 2016) assessed the propensity to perceive the rubber hand illusion (RHI) in female patients with current and remitted BPD diagnosis compared to healthy controls. They found that participants with a BPD diagnosis, compared to healthy controls, reported at a greater propensity to perceive the RHI. However, remission of BPD diagnoses was associated with a stabilization of these perceptions. This study also assessed dissociation symptoms, which are commonly experienced by BPD patients. Dissociation, which is considered to be a detachment from the immediate surroundings or emotional and physical experiences, can manifest as an experience in which one’s body feels as though it does not
belong to one’s self. These perceptual features suggest an association between dissociation and alterations in body ownership. This study demonstrated that the RHI was positively related to state and trait dissociation across groups, and specifically among the group with current BPD diagnosis when controlling for symptom severity. Overall, the results of this study suggest that alterations in body ownership are associated with current BPD diagnosis, and that dissociation as a symptom of BPD is an important correlate for body plasticity. The study highlights the relationship between P-SOD impairments and symptomatology associated with BPD. However, it lacks the use of facial stimuli, which is the most distinctive feature of our physical appearance, and a key feature in P-SOD.

Susceptibility to body ownership alteration was also found to be associated with patients with psychosis. Thakkar and his colleagues (2011) investigated RHI in 24 schizophrenia patients and 21 matched controls. Patients showed stronger RHI during synchronous stimulation indicated by self-report (e.g., I felt the rubber hand was my hand) and proprioceptive drift, which is quantified as the difference between mean perceived index finger location before and after tactile stimulation compared to matched controls. Furthermore, self-reported strength of RHI was found to be associated with schizotypy in controls. These findings confirm the findings of a previous study that demonstrated stronger RHI with patients with schizophrenia (Peled et al., 2000). Another study (Germine et al., 2013), which was conducted with 55 healthy adults, assessed the participants’ self-reported psychosis-like characteristics and their susceptibility to experiencing RHI. They found that positive psychotic-like characteristics were associated with higher susceptibility in experiencing RHI. These studies suggest that patients with psychosis have a more flexible body representation and weakened sense of self, and potentially indicate abnormalities in body ownership and deficits in multisensory information integration. Thakkar
and his colleagues (2011) suggested that this multisensory information deficit can be explained by patients with schizophrenia requiring a greater time interval between two distinct stimuli to discern that they are not transpiring concurrently. Patients with schizophrenia have been shown to have difficulties in integrating perceptual information simultaneously. As an example, patients with psychotic-like traits reported experiencing two distinct stimuli (visual and auditory) as co-occurring more often (or need more time to experience two stimuli one after the other) compared to healthy controls (Foucher, Lacambre, Pham, Giersch, & Elliott, 2007).

During childhood, the development of perceptual representation of self and other can be disrupted, leading to certain developmental disorders. The most commonly researched developmental psychopathology driven by difficulties in SOD is ASD (Rogers & Pennington, 1991). Palmer and his colleagues (2013) used the RHI experimental paradigm to understand SOD with participants with ASD. They showed reduced effects of the RHI in individuals with higher ASD-like traits compared to individuals with lower ASD-like traits. The participants with ASD demonstrated high sensory precision across contexts relying on lower-level sensory estimates compared to higher-level, more globally driven estimates. This finding confirms previous findings indicating sensory integration difficulties in individuals with ASD as compared to controls (Paton et al., 2012; Cascio et al., 2012).

One study that focused on self-other representation in ASD used a similar paradigm to ours by utilizing facial stimuli to assess SOD (Uddin et al., 2008). In this study, the researchers used event related fMRI to investigate brain responses in reaction to images of self and others. Children with ASD and typically developed (TD) children were asked to make self other judgments when they viewed a stimuli of facial morphs between their and another’s face (a gender- and race-matched face chosen from a stimulus data set) to a varying extent (0%, 20%,
40%, 60%, 80%, 100%, with 0% being “no morphing of self”). The study showed that the number of self-responses diminished as the presented images contained less of the self-face, indicating that TD and ASD children were able to successfully perform the task. There were no significant group differences in behavioral performance (neither in percentage of self responses nor in reaction time). The study found differences in the brain activation and concluded that while self- and other-face processing involved virtually overlapping right frontal activity in TD children, children with ASD only exhibited such activation when viewing their own faces. This study suggests SOD differentiation difficulty in children with ASD, and it is the first study in the literature utilizing facial stimuli without inducing manipulation (e.g., enfacement and RHI) to measure the baseline difficulties in SOD. However, this study only measured reaction times and did not consider the response variability of the participants using psychophysical functions.

A study (Eshkevari, Longo, Rieger, & Treasure, 2011) on eating disorders (ED) found that individuals with ED experienced RHI more strongly than healthy controls on both perceptual (i.e., proprioceptive drift) and subjective reports (self report questionnaire). Furthermore, both subjective reports of experience of RHI and associated proprioceptive biases were correlated with ED psychopathology. Another study (Mussap & Salton, 2006) on eating psychopathology demonstrated that variance in unhealthy body development in males (22%) and in bulimic symptomatology in both females and males (10%) was explained by susceptibility to the illusion. Overall, these studies on psychopathology found that deficiencies in multisensory integration, which is involved in the development of P-SOD, are associated with childhood as well as adulthood psychopathologies related to SOD. However, as shown in Table 3, all studies except one focused on the body ownership illusion, despite the fact that face is the most distinctive feature of self-recognition. The face is the most significant feature of our physical
appearance, and facial recognition is an early precursor of self-knowledge and visual self-recognition (Haxby et al., 2002; Mitchell, 1997). Thus, in our study, we utilized standardized facial stimuli (morphed pictures) in laboratory-based conditions to assess perceptual SOD. We measured response times as well as analyzed the participants’ response variability utilizing psychophysical functions, which gives us more information as to the nature of the difficulties in SOD.

Table 3

Assessment Techniques of P-SOD in Population with Psychopathology

<table>
<thead>
<tr>
<th>Assessment Technique</th>
<th>Citation</th>
<th>Results</th>
<th>Psychopathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber Hand Illusion (RHI)</td>
<td>Bekrater-Bodmann et al., 2016</td>
<td>Participants with a BPD diagnosis, compared to healthy controls, reported higher proneness to perceive RHI. However, remission of BPD diagnoses was associated with a stabilization of perceptions</td>
<td>Borderline Personality Disorder</td>
</tr>
<tr>
<td>RHI</td>
<td>Thakkar et al., 2011; Peled et al., 2000</td>
<td>Patients with psychosis showed stronger RHI</td>
<td>Psychosis</td>
</tr>
<tr>
<td>RHI</td>
<td>Germine et al., 2013</td>
<td>Positive psychotic-like characteristics were associated with higher susceptibility in experiencing RHI</td>
<td>Psychotic traits</td>
</tr>
<tr>
<td>RHI</td>
<td>Palmer, Paton, Hohwy, &amp; Enticott, 2013; Cascio, Foss-Feig, Burnette, Heacock, &amp; Cosby, 2012</td>
<td>Reduced effects of RHI in individuals with higher ASD-like traits</td>
<td>Autism Spectrum Disorders Traits</td>
</tr>
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</tr>
<tr>
<td>Face morphing task and fMRI</td>
<td>Uddin et al., 2008</td>
<td>Differences in brain activation between TD children and children with ASD while they viewed self- and other-faces</td>
<td>Autism Spectrum Disorders</td>
</tr>
<tr>
<td>RHI</td>
<td>Eshkevari et al., 2011</td>
<td>Participants with eating disorders showed increased susceptibility to RHI compared to healthy controls</td>
<td>Eating Disorders</td>
</tr>
</tbody>
</table>

### 2.5. *Representational SOD and Psychopathology*

Healthy development of R-SOD is a foundation for having a coherent and stable identity. Identity comprises a stable sense of self including many aspects of the representational self such as beliefs, attitudes, memories, goals and desires. Major theoretical models highlight impaired R-SOD, as well as identity disturbance in personality disorders such as BPD (Bender, 2007; Pollock, 1989; Kernberg 1984).

A pervasive pattern of instability in self-image (disturbance in identity), which is associated with impairments in SOD, is one of the criteria to diagnose BPD in the DSM-5 (APA, 2013). Kernberg (1984, 2004) proposes that instability in self image, a key feature of identity disturbance, is an aspect of R-SOD. Identity disturbance in patients with BPD reflects a lack of integration of positive and negative representations of the self. Unintegrated self-representations result in sudden shifts in the experience of self while preventing the person from experiencing
their sense of self in a coherent and consistent way. Clinicians highlight the centrality of identity disturbance in BPD symptomatology, yet little empirical attention is given to address identity disturbance among these patients.

The subjective experience of incoherence in the self is a common experience for patients with BPD. This literature review provides information on how this impaired aspect of R-SOD, identity disturbance, is assessed within patients with BPD. This review identified the existing assessment methods and the gaps in the literature in order to develop an empirical measure of P-SOD, which will assess the perceptual aspects of the self utilizing psychophysiological data.

Jorgensen (2009) assessed the Identity Style Inventory (ISI-3; Berzonsky, 1992), which contains four subscales including three assessing different identity styles (i.e., normative, information-oriented and diffuse) and one assessing commitment to roles and values. He conducted the ISI-3 with 66 females with BPD and 65 female psychology students. The results showed that females with BPD scored higher on diffuse-avoidant identity style. The diffuse-identity style is characterized by avoidance and procrastination until affective and contextual stimuli drive certain behaviors. Furthermore, the results demonstrated that more than half of the individuals with BPD were classified as having primarily diffuse-avoidant identity style compared to only 12% of the participants in the healthy control group. Another study (Walter et al., 2009), which used the Inventory of Personality Organization (IPO, Kernberg & Clarkin, 1995), a self-report measure, found that individuals with BPD showed less integrated self concept compared to individuals with depression. They also showed that people with identity disturbance showed higher levels of negative affect on the self-questionnaires, while no such effect was found on the interviews. This might suggest that people with BPD are not able to articulate their negative affects during an interview process, but that they can self-reflect about
their affect when reminded by self-report questions. Furthermore, individuals with BPD reported a greater subjective sense of self-fragmentation on the Personality Structure Questionnaire (PSQ), an eight item questionnaire investigating identity disturbance, as well as higher scores on dissociation, which is found to be related to the fragmentation of self compared to individuals with other personality disorders (Wildgoose et al. 2000).

Jorgensen and his colleagues (2012) focused on the life narrative of individuals to examine the sense of identity by looking at the coherence and continuity of narratives among individuals with BPD. The authors asked 17 individuals with BPD, 14 individuals with OCD and 23 college students to write down three autobiographical memories, memories of personal events that they experience as central to their lives. The results showed that individuals with BPD showed most frequently the diffuse identity style, as assessed by the ISI (Berzonsky, 1992), confirming the results of a previous study from the same group (Jorgensen, 2009). Furthermore, the memory narratives of the participants with BPD were found to be less coherent and more disoriented. This suggests that the reader found the events hard to understand. They were either switching from one event to another without any integration, or missing the most relevant details of the memories. This supports the notion that they lack a sense of history necessary to create an inner coherent sense of self. In a similar line of investigation, Adler and his colleagues (2012) conducted life story interviews to understand narrative coherence of 40 mid-life individuals. They asked participants to divide their lives into a series of chapters, provide a title and description of each chapter, and then asked them to write a series of key episodes in their life course. They found that narrative coherence significantly distinguished the stories of those people with features of BPD from those without the disorder. Narrative coherence was found to be significantly and negatively correlated with multiple measures of BPD as well as predicting
the BPD features. However, this study lacked a third group of people with non-BPD psychopathological presentation. The absence of this control group may have prevented the study from concluding that the incoherence of narratives are due to BPD pathology rather than general psychopathology.

Horsz and his colleagues (2009) used a semi-structured interview measurement, the Structured Interview of Personality Organization (STIPO) (Stern et al., 2010), which assesses central domains such as reality testing, identity, and primitive defenses specified by Kernberg (1984) to differentiate psychotic, borderline and neurotic personality organization. They assessed 60 patients (41 women) who were diagnosed with different psychopathologies, mostly around neurotic and borderline ranges of personality organization. They concluded that prototypical profile of BPD includes unintegration in perception of self and others. The same group of researchers showed in another study that in a large sample of people with BPD, an incoherent, inconsistent and unstructured sense of self was related to Cluster B personality traits (Hörz et al., 2010).

Using STIPO (Stern et al., 2010), Dammann and his colleagues (2011) evidence another dimension of incoherence in the subjective experience of the self. They included twelve patients with BPD and 12 patients with remitted major depressive disorder (MDD) without a personality disorder. BPD patients depicted an altruistic, superficial and suffering-self image while stating exclusively negative emotions. The patients with BPD described themselves predominantly as friendly, helpful and sensitive. This is the first study that shows a positive self-image within BPD patients. However, their self-description can be interpreted as owning a “victimized” identity, as they described others being malevolent. Furthermore, these clients used more superficial and
meaningless statements to describe themselves, indicating that they may have had no coherent sense of self to report.

Wilkonson-Ryan and Westen (2000) asked clinicians to rate identity disturbance among individuals with BPD. They constructed a 35 item instrument (Identity Disturbance Questionnaire) pulled from clinical and theoretical literature. They found that there are four major categories of identity disturbance including role absorption, painful incoherence, inconsistency and lack of commitment. All of these four factors, especially painful incoherence, differentiated individuals with BPD from other personality disorders. The limitation of this study is that the clinicians did not use structured interviews to diagnose the participants. Also, the results reflect clinicians’ implicit generalizations about the nature of sense of self in BPD, rather than what BPD patients experience. Another study (Nejad, Kheradmand, & Toofani, 2010), which used the questionnaire developed by Wilkonson-Ryan and Westen (2000) in a sample of Iranian patients, found different results. They found that all factors but role absorption significantly differentiated individuals with BPD. They concluded that identity disturbance is a complex variable with multiple measurable facets. The different findings may have emerged from each of these studies because aspects of identity may differ based on the characteristics of each study’s sample, including differences in culture and gender. For example, the Nejad, Kheradmand, & Toofani study used exclusively male participants.

Additionally, several researchers used matrix techniques to assess the sense of identity among individuals with BPD. De Bonis and his colleagues (1995) used the grid technique to ask participants to describe themselves and nine family members. They were asked to provide salient features as well as the opposites of these features. Three indices were derived from the matrix to measure the extent of SOD: 1) overlap of salient attributes 2) overlap of opposite attributes and
3) degree of differentiation. The first index corresponds to the proportion of nine attributes assigned by each subject to others that were also assigned to self. When none of the attributes assigned to the self are assigned to others, there is no overlap between perception of self and other. The second index corresponds to the proportion of nine attributes, generated as opposites to salient attributes. If all opposite attributes assigned to others are assigned to self, the self would contrast with others. The third index corresponds to the proportion of which salient attributes of others were assigned to different others, thus measuring the extent to which others are perceived to be alike. The study examined overlap of salient attributes and opposite attributes and the degree of differentiation among three groups of subjects with schizophrenia (N=19), BPD (N=17) and healthy controls (N=18). Patients with schizophrenia and BPD showed higher proportions of opposites attributes assigned to themselves than normal controls; however, only patients with schizophrenia showed higher overlap of attributes among others, indicating a poor differentiation among others. The findings contradict the assertion that a BPD diagnosis is considered to be a SOD disturbance. This study showed that differentiation between significant others was severely impaired in patients with schizophrenia but preserved in patients with BPD. This might indicate that both patients can be characterized by a contrast between self and other; however, borderline patients are able to differentiate others more evenly, despite the fact that their self-identity is not fully achieved.

Another matrix technique, the psychological distance scaling task (PDST), was used by Evans and his colleagues (2015) in a study in which they asked participants recruited from the community to name their interpersonal adjectives on a grid of two dimensions, including valence (i.e., positive and negative) and self-reference (i.e., like me and not like me). They assessed the fragmentation of self by calculating the average distance between the adjectives on the grid. The
authors proposed that the distance between the adjectives on the grid represents psychological distance, and the different cluster of adjectives on the grid represents different clusters of the self. For instance, words placed distantly on the PDST grid by the participant that are not closely associated (interconnected) in their self-concept indicates that these adjectives structure differently in the self and play different roles in shaping subjective experience of the self. To evaluate the fragmentation of self-concept of the participants, they used the standard deviations of the interstimulus distances. They found that BPD severity (over and above depression symptoms) was uniquely (independent from depression severity) associated with greater ‘clustering’ for positive and negative content, thus indicating a more fragmented self-concept.

In a similar study that used a subclinical population, Parker and his colleagues (2006) asked 154 undergraduate students (71% female) to list as many self-aspects as they can to provide a full description of themselves. They investigated whether self-discrepancies between the actual self (i.e., the attributes the individual actually possesses), the ideal self (i.e., the attributes the individual would ideally like to possess including their hopes, aspirations or wishes) and the ought-self (i.e., the attributes the individual ought to possess, including duties, obligations or responsibilities) were directly related to BPD personality features. They found that participants with larger self-discrepancies of both types (between actual self and ideal self and actual self and ought self) reported more BPD features. Self-complexity, which was calculated by dividing the number of nonmatching attributes by the total possible number of attribute combinations, had no direct relationship to BPD personality features; rather, it was found to moderate the relationship between ideal self-discrepancies and BPD personality features. For individuals low in self-complexity, a stronger relationship between ideal self-discrepancies and BPD personality features existed. The authors concluded that they may have found a moderation
(but no main) effect due to the subclinical nature of the sample. Additionally, they argued that a limitation of the study was that participants who were low in self complexity and could generate fewer adjectives to define themselves may have done so because of their limited lexical knowledge, or because it was hard for them to come up with different adjectives in one state to describe themselves fully. In this study, the authors used the mean scores of the discrepancies rather than the total score because they argued that people can have different discrepancy values for each self-state. The mean value of these discrepancies suggested whether a person has a large discrepancy in one self-state and a moderate discrepancy in another, since this person may experience intense outcomes within one state but moderate outcomes in another. However, it is important to note that due to the nature of the study, they were not able to capture the discrepancies in the moment and the oscillations of these discrepancies.

To capture momentarily labilities in self-states, several researchers have used experience sampling methodology. Tolpin, Gunthert, Cohen and O’Neill (2004) examined whether undergraduate students with BPD features have more labile self-esteem and affect in response to daily interpersonal stressors by using a daily process design consisting of repeated measurements over 14 days. Although students (60% female) with BPD features reported more interpersonal stressors, they did not show labile self-esteem and affect. The failure to find the lability of self-esteem and affective lability could be due to the objective checklist measure of interpersonal stressors. Also as the authors indicated, it might be due to the restricted range of daily interpersonal stressors; on average, participants reported an interpersonal stressor only once every two days. Thus, they did not assess the behavior on a daily basis; daily stressors can evoke different self-states for individuals with BPD and lead to different levels of self-esteem and
affect. In other words, the study concluded that lability is caused by the subjective experience of events, not their objective stress value.

Another study on experience sampling took the subjective perception of these daily stressors into account. Zeigler-Hill and Abraham (2006) examined the instant changes (i.e., lability) in self-esteem and affect in reaction to interpersonal events with a sample of 156 undergraduates (50 male). The findings suggest that individuals with BPD possess unstable and low level state self-esteem, which was assessed using a modified version of the RSES (Rosenberg, 1965), developed to measure state self-esteem specifically. Participants showed self-esteem instability as well as high and unstable negative affect. The limitation of this study is that their sample consists of college students, the majority of whom fail to report significant BPD features. The self-esteem of individuals with BPD features was found to be low and affected by the interpersonal stressors of everyday life. These results reflect an incoherent sense of self driven by the environmental affective stimuli. The importance of the study is that they focus on the events in a person’s everyday life rather than laboratory settings.

Overall, as shown in Table 4, there are seven self-report studies, two narrative assessments, three semi-structured interviews, two experience sampling and one clinician ratings study. All of these studies investigate the linguistic and symbolic (i.e., representational) self and conclude that individuals with BPD traits or a BPD diagnosis experience an incoherent and inconsistent sense of self. Our study aimed to use a visual stimulus-based facial morphing task to assess individuals’ psychophysical variability in SOD given the following: a) perceptual SOD precedes, interacts with, and overlaps representational SOD, b) research on P-SOD provides greater understanding of nonverbal neurological processing utilizing psychophysiological data
(i.e., psychophysiological biases) c) the face is the most distinctive feature of our physical appearance, and a key feature that we use to identify others, and ourselves.

Table 4

Assessment Techniques in Healthy Population

<table>
<thead>
<tr>
<th>Assessment Techniques</th>
<th>Names and Citations</th>
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</thead>
<tbody>
<tr>
<td><strong>Self-report</strong></td>
<td>Identity Style Inventory (Jorgensen, 2009); Inventory of Personality Organization (Walter et al., 2009); the Personality Structure Questionnaire (Wildgoose et al., 2000); the Grid Technique (De Bonis et al., 1995); Psychological Distance Scaling Task (Evans et al., 2015); Self-Complexity (Parker et al., 2006); Identity Disturbance Questionnaire (Nejad, Kheradmand, &amp; Toofani, 2010)</td>
</tr>
<tr>
<td><strong>Narrative Assessment</strong></td>
<td>Life Story Interviews (Jorgensen et al., 2012; Adler et al., 2012)</td>
</tr>
<tr>
<td><strong>Semi Structured Interview</strong></td>
<td>Structured Interview for Personality Organization (STIPO) (Horsz et al., 2009; 2010; Dammann et al., 2011)</td>
</tr>
<tr>
<td><strong>Experience Sampling</strong></td>
<td>Tolpin et al., 2004; Zeigler-Hill &amp; Abraham, 2006</td>
</tr>
<tr>
<td><strong>Clinician Rating</strong></td>
<td>Identity Disturbance Questionnaire (Wilkonson-Ryan &amp; Westen, 2000)</td>
</tr>
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</table>

Until now, studies on this topic either focused on R-SOD or P-SOD; however, to our knowledge only one study (Ainley, Maister, Brokfeld, Farmer & Tsakiris; 2013) investigated both
perceptual and narrative aspects of the self. In this study, the authors focused on both levels of SOD including body ownership and agent/narrative (i.e., perceptual and representational) and investigated whether the processing of self-related narrative information can bring participants’ internal bodily selves into their conscious awareness. The authors contrasted a condition in which participants gazed at a photograph of their own face with another in which they looked at a set of self-relevant words (e.g. their first name, hometown and school). They hypothesized that reading self-relevant words, which enhance attention to narrative aspects of the self, would enhance the individuals’ attention to the perceptual self. The study supported the hypothesis that an increase in interoceptive awareness is elicited both by a still self-face photograph, and by attention to the narrative aspects of the self. Importantly, this increase was found to be independent of individuals’ baseline levels of interoceptive awareness. This study suggests the fact that interoception, which is the perception of sensory signals arising from within the body, interacts with perception of the self as perceived exteroceptively (Ainley et al., 2012; Maister & Tsakiris, 2014; Tsakiris, Tajadura-Jimenez, & Constantini, 2011). This study suggests that enhanced attention to narrative aspects of the self have equal impact on the accuracy of interoceptive awareness as cues such as one’s own face, which appear to direct attention more specifically to the bodily self. Thus, this study underlines the interaction between the representational as well as perceptual aspects of self.

2.6. Synthesis of the Literature

From this literature review, we can conclude that a) SOD is an important foundation for maintaining a consistent and coherent sense of self b) SOD is comprised of representational and perceptual dimensions c) previous studies mainly have focused on representational SOD such as the more linguistic, symbolic and narrative aspect of SOD d) perceptual aspects of SOD
developmentally precedes, overlaps and interacts with the representational aspects of SOD e) research on P-SOD gives us more understanding of nonverbal neurological processing as well as social affective neurobiological mechanisms of SOD f) there has not yet been conclusive literature on P-SOD in an adult population, particularly without psychopathology g) perceptual aspects of self have mainly been studied by inducing illusion to the hands with RHI, though the face is the most distinctive feature of our physical appearance, and a key feature that we use to identify others, and ourselves f) when studies use facial stimuli to assess SOD, they induce illusion (i.e., enfacement) and thus these studies lack an understanding of baseline SOD within an adult population and the potential correlates of SOD in terms of psychosocial functioning and psychopathology h) studies collect response time and self-other resemblance ratings from participants but not other psychophysical data including response variables which can inform us about sensitivity, discriminability and response tendencies. Thus, this study used a visual stimulus based facial morphing task to assess individuals’ psychophysical variability in SOD. This study allowed us to validate a measure which assesses perceptual (as compared to representational) difficulties in SOD in an adult population.

To fulfill our aims, we used signal detection theory. Signal detection theory (Green & Swets, 1966) is a framework that helps to explore the nature of psychophysical differences between groups. We developed a facial morphing task to assess SOD. Thus far, we showed that it was feasible to use it to measure SOD-generating psychometric functions including sensitivity, discriminability and response range (Karan et al., 2016). This study assessed three aspects of perceptual processing: a) perceptual sensitivity, the likelihood of rating oneself versus the other, b) discriminability, the ability to make finer distinctions in rating faces of the self and the other and c) response range. By parametrically manipulating the facial feature of a self and other
stimulus, it is possible to determine whether differences between groups are due to perceptual (sensitivity or discriminability) or response range properties of the decision. We manipulated the faces by morphing the participant’s face to eight unfamiliar faces from different genders and races. Below is a depiction of the author’s face (100%), an “other’s” face (100%), and a combination where the face is 50% the author’s and 50% the other person’s.

*Figure 1. Sensitivity and Discriminability*

For the next step, we aimed to see whether our newly developed measure can exhibit criterion validity and construct validity by investigating convergent and discriminant validity.
2.7. Research Aims and Hypotheses

**Aim 1:** We will investigate the criterion related validity of the FM-SOD task.

*Criterion validity* refers to the degree to which a new tool’s ability to measure a construct compares to the best measure of that construct as defined by another instrument deemed the gold standard. We measured the criterion validity by assessing concurrent validity. Concurrent validity refers to the correlation degree that is measured between the new measure and a “gold standard” measure at the same time. We used the DR-S (Diamond et al., 1995) as a gold standard measure for SOD to evidence the criterion related validity of our newly developed FM-SOD task.

H1: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the DR-S (Diamond et al., 1995) will be associated with lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task.

H2: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the DR-S (Diamond et al., 1995) will be associated with poorer sensitivity (i.e., the likelihood of rating oneself versus the other) on the FM-SOD task.

H3: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the DR-S (Diamond et al., 1995) will be associated with narrower response range on the FM-SOD task.

**Aim 2.** We will investigate the construct validity of the FM-SOD task.

Construct validity involves convergent and discriminant validity as subtypes of this category. If our results support the presence of both convergent and divergent validity, we can assume that construct validity exists for our measure. Divergent validity refers to observing no relationship
between constructs that are not theoretically relevant to each other. It can be defined as “absence of correlation between measures of unrelated constructs” (Devellis, 2003). On the contrary, convergent validity can be established when a positive correlation is observed to exist between measures of theoretically related constructs (Campbell & Fiske, 1959).

H4: The lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task will be associated with more impaired scores on the Identity Personality Organization Questionnaire (IPO), more enmeshed scores on Inclusion of Other in the Self (IOS), and lower scores on the Self Other Differentiation Scale (SOD scale), indicating poorer SOD.

H5: Poorer sensitivity (i.e., the likelihood of rating oneself versus the other) will be associated with more impaired scores on the IPO, more enmeshed scores on the IOS, and lower scores on the SOD scale, indicating poorer SOD.

H6: Narrower response range on the FM-SOD task will be associated with more impaired scores on the IPO, more enmeshed scores on the IOS, and lower scores on the SOD scale, indicating poorer SOD.

H7: There will be no significant correlation between discriminability, sensitivity and response range scores of FM-SOD and depression scores on the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), self-esteem scores on the Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965), and mood scores on the Profile of Mood States (POMS; McNair et al., 1971).

Aim 3: We aim to examine the relationship between perceptual sensitivity and discriminability on the FM-SOD task and individuals’ scores on SOD-related psychopathology such as borderline personality and narcissism.
H8: Poorer sensitivity (i.e., the likelihood of rating oneself versus the other) will be associated with higher BPD scores on the SCID II BPD Questionnaire, higher BPD scores on the ZAN-BPD scale, and higher pathological narcissism scores on the Pathological Narcissism Inventory (PNI-52; Pincus et al., 2009).

H9: Lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) will be associated with higher scores on the SCID II BPD Questionnaire, ZAN-BPD scale, and higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).

H10: Narrower response range use on the FM-SOD task will be associated with higher scores on the SCID II BPD Questionnaire, ZAN-BPD scale (Zanarini, 2013), and with higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).

CHAPTER III

Method

3.1. Participants

A convenience sampling approach was used. A total of ninety male and female participants ages 18 or over were recruited via City College subject pool using SONA, a web-based participant pool management system. This provided us with sufficient power to detect small to medium effect sizes in behavioral and physiological parameters (Cohen, 1988). Advertisement flyers were posted throughout the CCNY campus including notice boards, department offices, and classrooms. All participants volunteered to participate in the study through City College subject pool using the SONA system and received a reimbursement of 3 SONA credits in exchange for their time. All recruitment was done through the Social and Psychopathology Laboratory at City College, which has a track record of recruiting participants for different projects (Fertuck, Grinband, & Stanley, 2013).
3.2. Procedure

Participants were invited for two sessions. The first appointment session took one hour to complete and the second session took approximately 20 minutes. After participants provided informed consent, a digital photograph of the participant’s face was taken. The participants were asked to stand against a white wall in the lab and asked to give a neutral expression while a digital photograph was taken. After the photographs were taken, participants were asked to sit across a computer in one of the available booths in the laboratory and asked to answer online self-report questionnaires, which were presented through QUALTRICS.

During the time between the first and second appointments, the primary investigator and research assistants worked on editing the image of the participant’s face. The images of the participants’ faces were converted to gray scale and mirror transposed. A gray template and Photoshop editing tools were used to remove non-facial attributes (e.g., background, hair, ears). Subsequently, a computerized morphing procedure was implemented (Abrasoft Fantamorph) to produce a sequence of photos in which the participant’s face merged with another person’s face. The participant’s face was morphed with eight faces of different races and genders. All eight faces were chosen from a face stimulus set (i.e., NimStim). These chosen faces were edited on Photoshop and converted to gray scale. A gray template and editing tools were used to remove non-facial attributes (e.g., background, hair, ears). Lastly, using the computerized morphing procedure, Fantamorph, the participant’s faces were morphed with these faces to varying extents: 0% (no morph), 20%, 40%, 60%, 80%, 100% (stimuli).

During the second appointment, participants were asked to complete the FM-SOD task (Karan et al., 2016). During the FM-SOD task, participants viewed the facial morph images and
were asked to make self/other judgments on these images on a Likert scale of 1 (100% other) to 5 (100% self), assessing how much the image looks like oneself or the other.

### 3.3. Measures

Table 5

<table>
<thead>
<tr>
<th>Self-Report Measures</th>
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<tr>
<td><strong>Criterion</strong></td>
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<tr>
<td>D-RS scale</td>
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<tr>
<td>IOS</td>
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<td>SOD</td>
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Table 5 depicts the self report measures that we used in our study in order to assess the validity of the FM-SOD task as well as investigate personality traits and related psychopathology in relation to SOD.

**Self-report measures:** To establish the validity of our measure, we used various self-report measures. To assess criterion validity, we used the D-RS (Diamond et al., 1995), an interviewer-rated measure based on the ORI (Blatt et al., 1979). To establish the construct validity of the measure, we assessed convergent and divergent validity. To assess convergent validity, we used the IPO (Kernberg & Clarkin, 1995), a self report measure to assess defenses, identity and reality
testing of the individual, the IOS (Aron et al., 1992), a single item pictorial measure of closeness, and the SOD (Olver et al., 1989), an 11-item true-false scale of separated sense of self. To assess divergent validity, we used the CES-D (Radloff, 1977), a 20 item screening test for depression, the POMS (McNair et al., 1971), a list of 65 adjective describing one’s mood during the last week, and the RSES (Rosenberg, 1965).

3.3.1. Criterion Validity Measure

The Differentiation Relatedness Scale (D-RS; Diamond et al., 1995) and Object Relations Inventory (ORI; Blatt et al., 1979). The ORI (Blatt et al., 1979) is a systematic open-ended interview in which the experimenter asks four statements: “Describe your mother, father, self, and a significant other” to elicit a response from the participant. Although the ORI is often administered individually as a semi-structured interview, investigators use a written format to facilitate administering it to a large number of people for research purposes (Diamond et al., 1995). Although a written format does not permit inquiry, it has been shown that it produces reliable and valid data, demonstrated by Blatt’s previous investigations (e.g., Blatt et al., 1979; Blatt, Chevron et al., 1988 cited in Diamond et al., 1995) and in the work of other researchers (e.g., Priel, 2005 cited in Diamond et al., 1995). For our study, we used a computerized version of the written ORI. The participants were presented with a box on the computer. The instructions included “Describe your mother (or a primary caregiver), father (or a secondary caregiver), an important person in your life (such as a romantic partner, or best friend) and yourself. Next to those instructions, we provided statements: “Tell what kind of a person he or she is, or tell what kind of a person you are” to help elicit the fullest description possible. The participants were asked by the experimenter to write down anything that comes to mind about the self and significant others, a procedure derived from the five minute speech sample developed by
Gottschalk (1968). They were also asked to try to fill the box up to mid point in order to maximize free association in the absence of a person-to-person inquiry (Diamond et al., 1995).

The ORIs were scored using the D-RS (Diamond et al., 1995), which is a 10-point ordinal scale designed to assess the developmental quality of open-ended, spontaneous descriptions of self and significant others generated in response to the ORI (Blatt et al., 1979). Studies have supported the inter-rater reliability of the D-RS. In unpublished theses (Stayner, 1992, 1994), the D-RS was found to have an adjusted intraclass correlation coefficient of .83 (cited in Diamond, 1995). Similar reliability estimates were found by Vermote (2005) with judges rating descriptions provided by severely disturbed inpatients with personality disorders and by Vermote, Lowyck, Luyten and colleagues (Vermote et al., 2009, 2010a, 2010b). The validity of the D-RS scale has been extensively supported. Diamond and her colleagues (1995) stated that D-RS has validity in three different ways: (1) D-RS is able to distinguish between psychiatric patients and healthy controls (2) D-RS is sensitive to identifying the clinically significant change followed by psychotherapy in personality and interpersonal functioning, and (3) D-RS is able to show the relationship between changes in D-RS and how it is associated to changes in personality and interpersonal functioning (for a review, see Diamond et al., 1995). However, given that the computerized version of the ORI has not been used previously, there are no reliability and validity studies conducted on the computerized version scoring of the D-RS scale.

Two PhD students, Noia Efrat and Josh Weinstein, scored the participants’ write ups. They were blind to any information regarding the participants. The author assigned a random set of ID numbers to each participants’ write ups and randomized the set of the participants before assigning them to ensure the randomization and blinding of the study. Inter-rater reliability were established between two students (both of whom have been trained beforehand by the authors of
the ORI manual) with an Intraclass Correlation Coefficient (ICC; random set). And this number was compared to the ICC that has been found by previous studies (Vermote, 2005; Vermote & Lowyck, 2009). Scoring discrepancies between Noia Efrat and Josh Weinstein were resolved through consensus ratings achieved through consultation with Dr. Diana Diamond, the primary author of the D-RS manual.

3.3.2. Convergent Validity Measures

To assess convergent validity, we used self-report measures including the Identity Personality Organization (IPO; Kernberg & Clarkin, 1995), the Inclusion of Other in the Self Scale (IOS; Aron et al., 1992) and the Self Other Differentiation Scale (SOD; Olver et al., 2001).

Identity Personality Organization (IPO; Kernberg & Clarkin, 1995). The IPO is a 5-point Likert-type self-report questionnaire designed to measure constructs driven by Kernberg’s (1975) theory of borderline personality organization. The scale consists of three primary subscales including the Primitive Defenses subscale (16 items), the Identity Diffusion subscale (21 items), and the Impaired Reality Testing subscale (20 items). Items from these three subcales include: “When everything around me is unsettled and confused, I feel that way inside,” (from the Reality testing scale); “I feel that my tastes and opinions are not really my own, but have been borrowed from other people” (from the Identity Diffusion scale); “I act in ways that appear to others as unpredictable and erratic,” (from the Primitive Defenses scale). The higher scores in all subscales indicate more pathological and less healthy responses. The IPO scales displayed adequate internal consistency: the Identity Diffusion subscale ($\alpha = .84-.90$), the Reality Testing subscale ($\alpha = .85-.87$), and the Primitive Defenses subscale ($\alpha = .80-.87$), as well as adequate short-term test-retest reliability in community adults: the Identity Diffusion subscale ($r = .83$), the Reality Testing subscale ($r = .80$), and the Primitive Defenses subscale ($r = .81$), (Foelsch et
al., 2000 cited in Lenzenweger, Clarkin, Kernberg & Foelsch, 2001). Lenzenweger and his colleagues (2001) conducted a study with a nonclinical sample of young adults, and there was acceptable internal consistency in all three scales including the Primitive Defenses subscale ($\alpha=81$), the Identity Diffusion subscale ($\alpha=88$) and the Reality Testing subscale ($\alpha=88$). The 4 week test-retest correlations were found for the Reality Testing subscale ($r = .73$), the Identity Diffusion subscale ($r = .78$), and the Primitive Defenses subscale ($r = .72$).

**Inclusion of Other in the Self Scale (Aron et al., 1992).** The IOS is a single item, pictorial measure of closeness. In the IOS scale, participants select the picture that best describes their relationship from a set of Venn-like diagrams. Each diagram represents different degrees of overlap between two circles. The diagrams were designed so that the total area of each diagram is the same, and the degree of overlap increases linearly in a 7-step interval level scale. The 2-week test-retest reliabilities were $r(97)=.83$ overall; $r(13)=.85$ for family; $r(31)=.86$ for friendship; and $r(48)=.85$ for romantic relationships (Aron et al., 1992). Convergent validity of the IOS was established with other measures that measure the same construct (closeness) and used different methods such as multi-item and verbal. Divergent validity of IOS was established with measures that use the same method to assess different constructs (e.g., anger and sadness) (Aron et al., 1992).

**Self-Other Differentiation Scale (Olver et al., 1989).** The SOD measures a differentiated sense of self with 11-item true-false scales. The sample items include, “I find it hard to decide how I feel about something until I have discussed it with those close to me” and “I find it difficult to feel good about myself when I do not get affirmation from other people.” Participants were asked to read each statement and choose whether or not it describes them. True responses are scored as 1 and false responses are scored as 0. Scores can range from 0 to 11, with higher scores
indicating lower self-other differentiation. All items were found to have item-scale correlations greater than .20. The scale showed satisfactory internal consistency (α = .76 for the university sample) (Olver et al., 1989). A recent study (Ingoglia, Faraci, Musso, Lo Coco & Liga, 2018) demonstrated its reliability and measurement invariance between genders.

3.3.3. Divergent Validity Measures

To assess divergent validity, we used self report measures including the CES-D (Radloff, 1977), the RSES (Rosenberg, 1965), and the POMS (McNair et al., 1971).

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item screening test for depression and depressive disorders. Participants rated how often over the past week they experienced symptoms associated with depression, such as restless sleep, poor appetite, and feeling lonely. Response options range from “Rarely or none of the time (less than 1 day), Some or a little of the time (1-2 days), Occasionally or a moderate amount of time (3-4 days), Most or all of the time (5-7 days).” Scores range from 0 to 60, with high scores indicating greater depressive symptoms. The scale was found to have high internal consistency with Cronbach’s alpha (coefficients .85 with a normal population and .90 with a patient population) across studies, acceptable test-retest reliability, excellent concurrent validity by clinical and self-report criteria, and substantial evidence of construct validity (Radloff, 1977).

Profile of Mood States (POMS; McNair et al., 1971). The POMS consists of a list of 65 adjectives. Respondents indicated the degree to which each adjective describes them during the last week using a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The POMS yields a global distress score which is referred to as the Total Mood Disturbance as well as scores for six subscales: Fatigue-Inertia, Vigor-Activity, Tension-Anxiety, Depression-Dejection, Anger-Hostility, and Confusion-Bewilderment. The internal consistency reliability for
four of the six POMS scales was .90 or greater, and .84 or greater for two of the shorter scales, Vigor and Confusion. Test-retest reliabilities of the POMS scales for psychiatric patients over a 20-day period ranged between .65 and .74, and stability coefficients of .43 to .53 were obtained over approximately nine weeks (Spielberg, 1972). The validity of the scale has been evidenced and reported in the test manual (McNair et al., 1971).

Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965). The RSES is a measure of global self-esteem. The scale has ten items, with items answered on a four point Likert scale ranging from strongly agree to strongly disagree. Five of the ten items are negatively worded. Higher scores indicate higher levels of self-esteem. Research demonstrated satisfactory convergent and discriminant validity and reported that the Cronbach coefficient was .91 for the overall sample (N= 503), representing the approximate characteristics of the general US population (Sinclair et al., 2010).

3.3.4. Psychopathology Measures

To assess the association between personality psychopathology and the relationship between perceptual sensitivity and discriminability on the FM-SOD task, we used various self report measures including the SCID-II-SQ (First et al., 1997), the PNI-52 (Pincus et al, 2009) and the ZAN-BPD scale (Zanarini, 2013).

The Structured Clinical Interview for DSM-IV Axis II screening questionnaire (SCID-II-SQ; First et al., 1997). The original SCID-II Questionnaire consists of 117 yes-no questions, each corresponding to a criterion of one of the personality disorder diagnoses. For example, the questions include “Have you often become frantic when you thought that someone you really cared about was going to leave you?” to diagnose BPD and “Do most people fail to appreciate your very special talents or accomplishments?” to diagnose NPD. We use a 4-point dimensional
scoring of the SCID (0 = never or not at all, 1 = sometimes or a little, 2 = often or moderately, 3 = very often or extreme), which was previously used in another study (Meyer, Pilkonis, & Beevers, 2004). Higher scores indicate higher levels of psychopathology. Ouimette and Klein (1995) reported reasonable stability of the SCID-II-SQ scales over 10 weeks with a nonclinical sample. They also found that responses were not strongly influenced by state depression and tended to concur with informant reports. Meyer and colleagues (2004) reported internal consistency (Cronbach’s α): the 7-item avoidant scale was .79; the 15-item borderline scale was .86; and the 6-item schizoid scale was .55. The results suggested that even though the last coefficient indicated potentially problematic internal consistency, it was above the minimally acceptable threshold of .50 (Nunally, 1978 cited in Meyers et al., 2004).

Pathological Narcissism Inventory (PNI-52; Pincus et al., 2009). The PNI is a 52-item self-report measure. Participants were asked to choose how well each statement describes them on a 5-point Likert scale (0 = not at all like me to 5= very much like me). There are 7 dimensions of each of the pathological narcissism subscales. The two subscales include narcissistic grandiosity and narcissistic vulnerability. The narcissistic grandiosity subscale includes Exploitativeness (EXP), Grandiose Fantasy (GF), and Self-sacrificing Self-enhancement (SSSE). The narcissistic vulnerability subscale includes Contingent Self-esteem (CSE), Hiding the Self (HS), Devaluing (DEV), and Entitlement Rage (ER) (Pincus et al., 2009). The Coefficient alphas for the seven PNI scales were CSE (.93), EXP (.77), SSSE (.77), HS (.85), GF (.87), DEV (.91), and ER (.85). The PNI structure was validated via confirmatory factor analysis. The PNI correlated negatively with self-esteem and empathy, and positively with shame, interpersonal distress, aggression, and borderline personality organization (Pincus et al., 2009).
Zanarini – Borderline Personality Disorder Scale (ZAN-BPD, 2003). The ZAN-BPD scale is comprised of questions that are adapted from the BPD module of the Diagnostic Interview for DSM-IV Personality Disorders (DIPD-IV). The questions ask about BPD symptoms experienced during the past week. This is the first clinician-administered scale for the assessment of change in DSM-IV borderline psychopathology. Each of the nine criteria of BPD are rated on a five-point anchored rating scale of 0 to 4, yielding a total score of 0 to 36. The convergent validity of the ZAN-BPD was found to be highly significant. The discriminant validity of the various scores of the ZAN-BPD were also found to be highly significant, easily discriminating the 139 patients who met the DSM-IV criteria for BPD from the 61 patients who did not. In addition, internal consistency of the ZAN-BPD was found to be high (Cronbach’s α=0.85). All intraclass correlations were in the good to excellent range.

3.3.5. The Facial Morphing Task to Assess SOD

The Face Morphing task (FM-SOD; Karan et al., 2016). Participants were asked to view a series of images, which comprised features of the self and other to varying extents (0%, 20%, 40%, 60%, 80%, 100%, with 0% being “no morphing of self”), and to make self/other judgments on these images on a Likert scale of 1 (100% other) to 5 (100% self), assessing how much the image looked like themselves and the other. Images were presented via PsychToolbox-MatLab, which recorded self-other ratings and response times. We instructed participants to respond as quickly as possible based on their first impressions of the facial stimuli.

3.4. Data Acquisition and Analysis

PsychToolbox-MatLab was used to present Facial Morphs, which ranged from 0% (no morph), 20%, 40%, 60%, 80%, to 100% (stimuli). PsychToolbox-MatLab is a set of functions to help researchers carry out research investigating vision on computers. It was used to record
participants’ self/other judgments on the facial morphs and their response time as they made those judgments. Matlab 6.1 was used to perform graphical analyses on this psychophysical data that is recorded by PsychoToolbox. It then yielded the collected data to psychometric parameters of sensitivity, discriminability and bias (described above). In order to do analyses with Matlab, we used the strategies modeled after previous research studies of our laboratory (Fertuck, Grinband & Stanley, 2013; see below) to analyze the psychophysical data.

**Matlab Analysis**

With Matlab, we computed sensitivity, discriminability and response range from the records of the participants’ self-other ratings. **Sensitivity** was assessed by computing the point of subjective equivalence (PSE), which corresponds to the morph position at which subjects respond with a rating of (min + max)/2, or the midpoint of the psychometric function.

The PSE is the “point of subjective equality”, when two stimuli (Test and Standard) are perceived to be similar by the observer, leading the observer to choose randomly between the test or the standard stimuli. Thus, the PSE is the 0.5 probability point. The POE refers to the “point of objective equality” which corresponds physically to the “Standard” stimulus saturation. “(Kim et al., 2014)

*Figure 3. The Point of Subjective Equality*

**Discriminability** was assessed by computing the slope of the psychometric function at the PSE as: slope = (rating75-rating25)/50 where rating25 is the rating at a morph value of 25%.

**Response Range** is the variance of the participants responses.
After psychophysical analysis were completed by MatLab, we ran correlational analysis including Pearson correlation and multiple regression with SPSS. We decided to run these analyses given that we are interested in the nature of the relationship between the independent and dependent variables of each of our hypotheses. To run these analyses, several assumptions need to be met. The assumptions of the Pearson Correlation include 1) level of measurement, 2) related pairs, 3) absence of outliers, 4) normality of variables, and 5) homoscedasticity.

1) Level of measurement for Pearson Correlation requires that each variable should be continuous. The variables should be interval or ratio measurements. Given that the variables for each of our hypotheses are continuous and interval measurements, this assumption was met.

2) Related pairs refer to the pairs of variables. Each participant should have a pair of values. In our study, each participant had psychophysical data including discriminability, sensitivity and response range, as well as self report measures to assess criterion, convergent and discriminant validity. In our study, the pair of values for each participant was psychophysical data and data from the self report measures.

3) Absence of outliers. If there is an outlier, it can skew the distribution of the variable: the outliers pull the line of best fit formed by correlation too far in one direction or another. We explored the outliers in each variable data set, and excluded them before running our analysis.

4) The normal distribution. We assessed normality by asking for boxplot, histogram, and normality probability plot (normal Q – Q plot) along with normality test.
5) Linearity refers to the shape of the values formed by the scatter plot. When there is a line to be drawn between the dots from left to right on the scatter plot, the line should be straight. We tested this assumption by using scatter plots on SPSS.

6) Homoscedasticity refers to the distance between the points to the straight line between the variables. The shape of the scatter plot should be a tube-like shape. To test the homoscedasticity assumption, we tested for equal variances on SPSS.

If these assumptions had not been held, we would have first tried to correct problems of nonnormality and unequal variances (heteroscedasticity) by using transformation (e.g., log transformation, square root transformation) on the variables that do not hold these assumptions. If the transformations had not helped to hold normality and homoscedasticity, we would have used a Spearman rank correlation. Spearman rank correlation is a non-parametric test that is used to measure the degree of association between two variables. Also, it does not make any assumptions around the distribution of the data.

In addition to these assumptions, Multiple Regression requires assumptions of independence of errors and no multicollinearity assumption. Independence of errors assumption refers to the fact that errors are independent of one another, which indicates that participants respond independently. We checked this assumption by box plot in SPSS. Multicollinearity assumption assumes that the independent variables are not highly correlated with each other. This assumption was tested by the Variance Inflation Factor (VIF) statistics. If this assumption had been violated, a) we would have removed one variable from the multiple regression b) increased the sample size or c) transformed the variables (e.g., log transformation, square root transformation) ("Assumption Violation Multicolinearity," 2009).
Aim 1: We investigated the criterion related validity of the FM-SOD task. To assess the criterion validity, we looked at the patterns of intercorrelations between the D-RS Scale (D-RS; Diamond et al., 1995) –the comparison “gold standard” measure—and the psychophysical parameters (i.e. discriminability, sensitivity, and response range) of the FM-SOD task.

H1: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the D-RS (Diamond et al., 1995) will be associated with lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task.

To assess H1: We ran correlation analysis by using SPSS between the scores of D-RS (Diamond et al., 1995) and the discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task.

H2: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the D-RS (Diamond et al., 1995) will be associated with poorer sensitivity (i.e., the likelihood of rating oneself versus the other) on the FM-SOD task.

To assess H2: We ran correlation analysis by using SPSS between the scores of D-RS (Diamond et al., 1995) and the sensitivity (i.e., the likelihood of rating oneself versus the other) on the FM-SOD task.

H3: The lower developmental quality (i.e., lower differentiation-relatedness scores) of self and other representations on the D-RS (Diamond et al., 1995) will be associated with narrower response range on the FM-SOD task.

To assess H3: We ran correlation analysis by using SPSS between the scores of D-RS and the response range on the FM-SOD task.
Aim 2: We investigated the construct validity of the FM-SOD task, which involves convergent and divergent validity as subtypes of this category.

**Convergent Validity:**

H4: Lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task will be associated with the more impaired scores on the IPO (Kernberg & Clarkin, 1995), more enmeshed scores on the IOS (Aron et al., 1992), and lower scores on the SOD (Olver, et al., 1989) scale indicating poorer SOD.

*To assess H4:* We ran multiple regression analysis by using SPSS between the discriminability on the FM-SOD task and the scores on the IPO (Kernberg & Clarkin, 1995), on the IOS (Aron et al., 1992), and on the SOD (Olver, et al., 1989).

H5: Poorer sensitivity (i.e., the likelihood of rating oneself versus the other) will be associated with more impaired scores on the IPO (Kernberg & Clarkin, 1995), more enmeshed scores on the IOS (Aron et al., 1992), and lower scores on the SOD scale indicating poorer SOD (Olver, et al., 1989).

*To assess H5:* We ran multiple regression analysis by using SPSS between the sensitivity on the FM-SOD task and the scores on the IPO (Kernberg & Clarkin, 1995), on the IOS (Aron et al., 1992), and on the SOD scale (Olver, et al., 1989).

H6: Narrower response range will be associated with more impaired scores on the IPO (Kernberg & Clarkin, 1995), more enmeshed scores on the IOS (Aron et al., 1992), and lower scores on the SOD scale indicating poorer SOD (Olver, et al., 1989).

*To assess H6:* We ran multiple regression analysis by using SPSS between the response range on the FM-SOD task and the scores on the IPO (Kernberg & Clarkin, 1995), the IOS (Aron et al., 1992), and the SOD scale (Olver, et al., 1989).
Divergent Validity:

**H7:** There will be no significant correlation between discriminability, sensitivity and response range scores of the FM-SOD task and depression scores on the CES-D (Radloff, 1977), self-esteem scores on the RSES (Rosenberg, 1965), and mood scores on the POMS (McNair et al., 1971).

**To assess H7:** We ran multiple regression analysis by using SPSS between discriminability, sensitivity and response range scores of the FM-SOD task and the scores on the CES-D (Radloff, 1977), the RSES (Rosenberg, 1965), and the POMS (McNair et al., 1971).

**Aim 3:** We aimed to examine the relationship between perceptual sensitivity, discriminability and response range on the FM-SOD task and individuals’ scores on personality pathology, such as borderline personality features and pathological narcissism

**H8:** Lower levels of discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) will be associated with higher scores on the SCID-II BPD Questionnaire (First et al., 1997), higher BPD scores on the ZAN-BPD (Zanarini, 2003), and higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).

**To assess H8:** We ran multiple regression analysis by using SPSS between the discriminability on the FM-SOD task and the scores on the SCID II-BPD Questionnaire (First et al., 1997), on the ZAN-BPD (Zanarini, 2003), and on the PNI-52 (Pincus et al., 2009).

**H9:** Poorer sensitivity (i.e., the likelihood of rating oneself versus the other) will be associated with higher BPD scores on the SCID-II BPD Questionnaire (First et al., 1997), higher BPD scores on the ZAN-BPD, and higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).
To assess H9: We ran multiple regression analysis by using SPSS between the sensitivity on the FM-SOD task and the scores on the SCID-II BPD Questionnaire (First et al., 1997), on the ZAN-BPD (Zanarini, 2003) and on the PNI-52 (Pincus et al., 2009).

H10: Narrower response range will be associated with higher BPD scores on the SCID-II BPD Questionnaire (First et al., 1997), higher BPD scores on the ZAN-BPD (Zanarini, 2003) and higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).

To assess H10: We ran multiple regression analysis by using SPSS between the response range on the FM-SOD task and the scores on the SCID-II BPD Questionnaire (First et al., 1997), on the ZAN-BPD (Zanarini, 2003) and the PNI-52 (Pincus et al., 2009).

CHAPTER IV

Results

4.1. Demographics of Sample

Eighty-seven participants (38% female) completed both of the two sessions of the study. The age range was between 18 to 42 (M = 21.37, SD = 4.6). Fifty-seven percent of the sample reported a low income household, 30% reported middle class and 10% reported upper middle class. Forty-seven percent identified themselves as Hispanic or Latinx. Twenty-nine percent identified themselves as more than one race, 23% identified as White, 15% identified as Black/African American, 24% identified as Asian and 6% identified as other racial categories (e.g., Indian Native or Other Pacific Islander).

4.2. Testing the Hypotheses

4.2.1. Criterion Validity Results

H1 & H2 & H3: The lower developmental quality (i.e., lower differentiation-relatedness scores) on the D-RS (Diamond et al., 1995) will be associated with lower discriminability (i.e., the
ability to make finer distinctions in rating faces of the self and the other) and poorer sensitivity (i.e., the likelihood of rating oneself versus the other) and with narrower response range on the FM-SOD task.

There was no significant correlation between the DR-S scores of mother, father, significant other, or self with discriminability \((r(86) = 0.03, p = 0.78; r(86) = 0.06, p = 0.58; r(86) = 0.09, p = 0.42; r(86) = 0.04, p = 0.74, \text{respectively})\). In addition, no significant correlation was found between the DR-S scores of mother, father, significant other and self with sensitivity \((r(86) = 0.30, p = 0.78; r(86) = -0.06, p = 0.58; r(86) = 0.12, p = 0.12; r(86) = -0.34, p = 0.76, \text{respectively})\). There was a significant correlation found with response range and the DR-S scores of mother \((r(86) = 0.34, p < 0.01)\) indicating that the lower developmental quality on the DR-S scores of mother is significantly associated with narrower response range. Analysis of the DR-S scores and response range also showed a trend with the DR-S self scores \((r(86) = 0.21, p = 0.06)\) and the DR-S significant other scores \((r(86) = 0.21, p = 0.06)\), however no significant correlation was found with the DR-S father scores \((r(86) = 0.16, p > 0.05)\). When we controlled for depression scores assessed by the CESD, the correlation with response range and the DR-S scores of mother remained significant \((r(86) = 0.35, p = 0.01)\). Our results demonstrated mixed support for our hypotheses. Discriminability, the ability to make finer distinctions in rating faces of the self and the other, and sensitivity, the likelihood of rating oneself or other, were not significantly associated with lower developmental quality scores on the DR-S. This does not support the hypothesis that individuals with R-SOD impairments will demonstrate difficulties in P-SOD. Thus, we were not able to provide criterion validity for our task. However, our results showed that individuals who have difficulties in R-SOD offered a constricted response range in
the FM-SOD task, partially supporting our hypothesis that individuals with R-SOD impairments similarly experience P-SOD impairments.

**Figure 3.** Scatterplot for Response Range by Mother scores on Developmental Quality.

Individual differences in response range, as measured by the FM-SOD task, and differences in participants’ developmental quality, as measured by the DR-S. Consistent with our hypothesis research, participants with lower developmental quality in mother representations offered a constricted response range in rating themselves and others on the FM-SOD task.

### 4.2.2. Convergent and Divergent Validity Results

#### 4.2.2.1 Convergent Validity Results

<table>
<thead>
<tr>
<th>FM-SOD scores:</th>
<th>Convergent Validity measures:</th>
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<tr>
<td>Discriminability</td>
<td>IOS</td>
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<tr>
<td>Sensitivity</td>
<td>IPO</td>
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<td>Range</td>
<td>SOD</td>
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H4: Lower discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other) on the FM-SOD task will be associated with lower scores of the SOD (Olver, et
al., 1989), more enmeshed scores on the IOS (Aron et al., 1992), and more impaired scores on the IPO scale (Kernberg & Clarkin, 1995), indicating less SOD.

No significant correlation was found with discriminability and scores on the SOD scale ($p = 0.29$), the IOS ($p = 0.08$) and the IPO scale including the IPO total ($p = 0.73$), the Primitive Defenses ($p = 0.39$) and the Identity Diffusion ($p = 0.85$), as well as the Reality Testing subscales ($p = 0.95$).

H5: Poorer sensitivity (i.e., the likelihood of rating oneself versus the other) will be associated with more impaired scores on the IPO (Kernberg & Clarkin, 1995), more enmeshed scores on the IOS (Aron et al., 1992), and lower SOD scores on the SOD scale (Olver, et al., 1989).

There was no significant correlation found with the IOS measures and the FM-SOD measures of sensitivity ($p = 0.39$). However, there was a significant negative correlation between the PSE (sensitivity) scores and scores on the SOD scale. The lower scores on the SOD scale, suggesting SOD impairment, was associated with higher scores on sensitivity ($r(86) = -.29$, $p = 0.01$). When we controlled for depression scores assessed by the CESD, the correlation with scores of sensitivity and scores on the SOD scale remained significant ($r(86) = -.22$, $p < .05$). This suggests that individuals with SOD impairments (feelings of enmeshment with other) in self-reports tend to see themselves more in the facial morphs.
Figure 4. Scatterplot for sensitivity by the SOD scale. Individual differences in sensitivity, as measured by the FM-SOD task, and differences in participants’ self-report on the SOD scale. Consistent with our hypothesis, participants with lower scores on the SOD (e.g., indicating higher levels of difficulties in separating themselves from others) rated seeing themselves more than others in facial morphs.

Additionally, we found that there was a significant correlation between the FM-SOD sensitivity scores and the IPO total scores ($r(86) = .22, p = 0.03$). This significant correlation was also evident in subscales of Primitive Defenses ($r(86) = .22, p = 0.04$) and Identity Diffusion ($r(86) = .24, p = 0.02$) but not in the Reality Testing subscale ($p > .05$). When we controlled for depression scores assessed by the CESD, the correlation with scores of sensitivity and scores on the IPO total, Primitive Defenses subscale and Identity Diffusion subscale did not remain significant ($p > .05$).

In summary, our results showed mixed support for the convergent validity hypothesis. Discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the
other) on the FM-SOD task did not show any significant correlations with convergent validity measures including the SOD, IOS and IPO. In line with these findings, sensitivity on the FM-SOD task also did not show any correlation with the IOS. However, we found a significant negative correlation between sensitivity and the SOD scale, indicating that people with difficulties with separating themselves from others rated themselves more often than rating others in the facial morphs. We also found that the IPO scale and its subscales (i.e., Primitive Defenses and Identity Diffusion) showed negative correlations with sensitivity, indicating that the lower level of defenses one employs, the more likely they see themselves in morphs (i.e. higher sensitivity). However, the IPO results did not remain significant after controlling for depression. Thus, we only found that after controlling for depression, there was a significant correlation with sensitivity and the SOD self-report scores.

\[ r(86)=.22, \ p = .04 \]

*Figure 5.* Scatterplot for sensitivity by the IPO total. Individual differences in sensitivity, as measured by the FM-SOD task and differences in participants’ self-report on the IPO. Consistent with our hypothesis, participants with higher scores on the IPO (e.g., indicating lower levels of
personality organization) rated seeing themselves more than others in facial morphs. However, after controlling for depression, this finding was no longer significant.

Figure 6. Scatterplot for sensitivity by the IPO Primitive Defenses scale. Individual differences in sensitivity, as measured by the FM-SOD task, and differences in participants’ Primitive Defenses on the IPO. Consistent with our hypothesis, participants with higher scores on the Primitive Defenses subscale of the IPO (indicating employing lower levels of defenses) rated seeing themselves more than others in facial morphs. However, after controlling for depression, this finding was no longer significant.
Figure 7. Scatterplot for sensitivity by the Identity Diffusion scale. Individual differences in sensitivity, as measured by the FM-SOD task and differences in participants’ scores on the Identity Diffusion scale of the IPO. Consistent with our hypothesis, participants with higher levels of identity diffusion on the IPO rated seeing themselves more than others in facial morphs. However, after controlling for depression, this finding was no longer significant.

H6 : Narrower response range will be associated with more impaired scores on the IPO (Kernberg & Clarkin, 1995), more enmeshed scores on the IOS (Aron et al., 1992), and less SOD scores on the SOD scale (Olver, et al., 1989).

Furthermore, we conducted analysis to assess the association between response range on the FM-SOD with the SOD, IOS and IPO. There was no significant correlation found between the FM-SOD response range and IOS and SOD scores ($p = 0.25; p = 0.67$, respectively). However, the FM-SOD response range was significantly negatively correlated with the IPO total score ($r(86) = -.27, p = 0.01$), Primitive Defenses subscale ($r(86) = -.27, p = 0.01$) and Identity Diffusion subscale ($r(86) = -.26, p = 0.02$) but not the Reality Testing Subscale ($r(86) = -.19, p = 0.07$).
These results indicate that participants with more impaired scores on the IPO provide more constricted response range while identifying themselves and others on facial morphs. When we controlled for depression scores assessed by the CESD, the negative correlation with scores of response range with the IPO total score ($r(86) = -0.27, p = 0.01$) and the Primitive Defenses subscale ($r(86) = -0.30, p = 0.01$) and the Identity Diffusion subscale ($r(86) = -0.29, p = 0.02$) all remained significant. This suggests that participants who have more impaired scores on the IPO with lower defense organization and higher identity diffusion scores provide more constricted response range on the FM-SOD task. The Reality Testing subscale ($r(86) = -0.19, p = 0.07$), which was not found to be significantly correlated, became significant after controlling for depression ($r(86) = -0.22, p = .05$). This suggests that participants with a lower level of reality testing provide a narrower response range in rating facial morphs.

Figure 8. Scatterplot for response range by the IPO total. Individual differences in response range, as measured by the FM-SOD task and differences in participants’ self-report on the IPO. Consistent with our hypothesis, participants with higher scores on the IPO (e.g., indicating lower
levels of personality organization) offered more constricted response range in rating themselves and others on the FM-SOD task.

**Figure 9. Scatterplot for response range by the IPO primitive defenses.** Individual differences in response range, as measured by the FM-SOD task, and differences in participants’ self-report on the IPO Primitive Defenses subscale. Consistent with our hypothesis, participants with higher scores on the Primitive Defenses subscale (e.g., indicating lower levels of defenses) offered more constricted response range in rating themselves and others on the FM-SOD task.
Figure 10. Scatterplot for response range by the IPO Identity Diffusion. Individual differences in response range, as measured by the FM-SOD task, and differences in participants’ self-report on the IPO Identity Diffusion subscale. Consistent with our hypothesis, participants with higher scores on the Identity Diffusion subscale (e.g., indicating higher levels of identity diffusion) offered more constricted response range in rating themselves and others on the FM-SOD task.

\[ r(86) = -0.29, p = 0.02 \]

Figure 11. Scatterplot for response range by the IPO Reality Testing subscale. Individual differences in response range, as measured by the FM-SOD task, and differences in participants’ self-report on Reality Testing subscale of the IPO. Consistent with our hypothesis, participants

\[ r(86) = -0.22, p = 0.05 \]
with lower scores on Reality Testing (e.g., indicating lower levels of reality testing) offered more constricted response range in rating themselves and others on the FM-SOD task.

### 4.2.2.1 Divergent Validity Results

<table>
<thead>
<tr>
<th>FM-SOD scores:</th>
<th>Divergent Validity measures:</th>
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<tr>
<td>Discriminability</td>
<td>CESD</td>
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<tr>
<td>Sensitivity</td>
<td>POMS</td>
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<td>Range</td>
<td>RSES</td>
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**H7:** There will be no significant correlation between discriminability, sensitivity and response range scores of the FM-SOD task and the scores on the CES-D scale (Radloff, 1977), on the RSES (Rosenberg, 1965), and on the POMS (McNair et al., 1971).

To establish divergent validity, we analyzed depression scores on the CESD, self esteem scores on the RSES and mood states on the POMS with FM-SOD scores. We found that there was no significant correlation between depression scores on the CESD and discriminability \((p = 0.97)\) and response range \((p = 0.99)\). However, we found a significant correlation between sensitivity and depression scores on the CESD \((r(86)= 0.24, p = 0.03\) see Figure 13). Secondly, we found no significant correlation between the RSES self esteem scores and discriminability \((p = 0.35)\), sensitivity \((p = 0.07)\) and response range \((p = 0.31)\). Lastly, we found no significant correlation with the POMS and discriminability, sensitivity or response range \((p = 0.550, p = 0.226, p = 0.679, \text{ respectively})\). Our findings provided partial support for divergent validity. Our results suggest that discriminability, sensitivity and range on the FM-SOD task are not correlated with self-esteem and mood states, indicating divergent validity for the FM-SOD task. Furthermore, discriminability and response range was also not correlated with depression scores on the CESD. However, sensitivity on the FM-SOD task was found to be correlated with depression scores on
the CESD. Thus, our results suggest that discriminability, sensitivity and response range on the FM-SOD task measure different constructs than self-esteem, mood states and depression (except for sensitivity on the FM-SOD).

![Figure 12. Scatterplot for sensitivity by the CESD total. Individual differences in sensitivity, as measured by the FM-SOD task, and participants’ depression scores on the CESD. Consistent with our hypothesis, participants with higher scores of depression rated seeing themselves more often than others in facial morphs.](image)

### 4.2.2.3 Psychopathology Results

<table>
<thead>
<tr>
<th>FM-SOD scores:</th>
<th>Psychopathology Measures:</th>
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<tbody>
<tr>
<td>Discriminability</td>
<td>SCID</td>
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<tr>
<td>Sensitivity</td>
<td>ZAN-BPD</td>
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<tr>
<td>Range</td>
<td>PNI-52</td>
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**H8, H9 & H10:** Lower levels of discriminability (i.e., the ability to make finer distinctions in rating faces of the self and the other), poorer sensitivity, and narrower response range will be associated with higher scores on the SCID-II BPD Questionnaire (First et al., 1997), higher BPD...
scores on the ZAN-BPD (Zanarini, 2003), and higher pathological narcissism scores on the PNI-52 (Pincus et al., 2009).

4.2.2.3.1 Borderline Personality Features Results

There was no significant association between the levels of discriminability, sensitivity, and response range with borderline features on the SCID ($p > .05$). We ran an analysis to see the association between BPD features on the ZAN-BPD scale and sensitivity, discriminability, and response range. We found that sensitivity for rating self versus others was significantly correlated with higher BPD scores on the ZAN-BPD scale ($p = .02$). When we controlled for the depression scores, which were assessed by the CESD via partial correlation analysis, this association did not remain significant ($p > .05$). However, response range became significant with BPD features on the ZAN-BPD scale, demonstrating a significant negative correlation. This result showed that participants with higher BPD features on the ZAN-BPD scale offered more constricted response range in differentiating between themselves and others ($r(86) = -25, p = .02$).

In summary, our results provided partial support for our hypotheses regarding lower levels of discriminability, poorer sensitivity, and narrower response range will be associated with higher levels of BPD features. When we controlled for depression, there was no correlation found between discriminability and sensitivity with BPD features on the SCID-II and ZAN-BPD scale. However, after controlling for depression response range became significantly correlated with BPD features on the ZAN-BPD scale.

4.2.2.3.1 Narcissistic Personality Features Results

There was no significant association between the levels of discriminability, sensitivity, and range with narcissism scores on the SCID-II ($p > .5$). We conducted an analysis with the PNI-52 narcissism scale and found no significant association between the levels of discriminability, the
ability to make finer distinctions between the self and others, and narcissism scores on the PNI-52 scale \( (p > .05) \). The response range and narcissism scores were also not significantly correlated \( (p > .05) \). However, sensitivity for rating self versus others was found to be significantly correlated with the higher narcissism scores on the pathological narcissism scale (PNI-52; Pincus et al., 2009) \( (r(86) = 0.21, p = 0.05) \). Next, we ran the analysis for two main subscales of the PNI-52, vulnerable and grandiose narcissism. We found that higher narcissism scores on the vulnerable narcissism subscale but not grandiose narcissism subscale were significantly associated with higher sensitivity scores \( (r(86) = .23, p = 0.03) \). This suggests that individuals who are high on vulnerable narcissism are prone to perceiving self features and less likely to perceive the other’s features in the range of morphs. In our findings, individuals who were higher on vulnerable narcissism were found to more likely rate the morphs as “self” or “more like self” than people who score lower on vulnerable narcissism. However, this pattern was not found in grandiose narcissism. That is, individuals who score high or low in grandiose narcissism do not show propensity to rate the morphs as “self” or “more like self.” Importantly, we ran a partial correlation to control for depression in assessing for an association between narcissism and sensitivity to identify whether the association is specific to narcissistic pathology. After controlling for depression which was assessed by the CESD, the significant results between sensitivity and depression did not remain significant \( (p > 0.05) \). Our study found a significant correlation between narcissism and depression. Specifically, depression, as assessed by the CES-D, was significantly correlated with pathological narcissism \( (r(87)=.49) \), grandiose narcissism \( (r(87)=.28) \) and vulnerable narcissism \( (r(87)=.55) \) as assessed by the PNI-52.
CHAPTER V

Discussion

5.1. Main Findings

5.1.1. Criterion Validity

Our first aim was to provide support for criterion validity for the FM-SOD task. Criterion validity is defined as the degree to which a new measure (i.e. FM-SOD task) has the ability to assess a construct compared to the best measure (i.e. DR-S scale) of that construct. Our results did not provide support for criterion validity of the FM-SOD task by utilizing the DR-S scale. Specifically, our results did not show that individuals with R-SOD impairments evidenced by lower developmental quality scores in the DR-S also show impairments in P-SOD as assessed by the FM-SOD task.

First, we found that neither discriminability, the ability to make finer distinctions in rating faces of the self and the other, nor sensitivity, the likelihood of rating oneself versus the other were significantly associated with lower developmental quality scores on the DR-S. This does not support the hypothesis that people with difficulties in R-SOD will demonstrate difficulties in differentiating themselves from an other at the perceptual level. However, importantly, we showed that people with lower developmental quality with respect to self-other differentiation—based on their descriptions of their mothers on the ORI—provided a more constricted response range in the FM-SOD task. This suggested partial support for criterion validity of the FM-SOD task that people with R-SOD impairments may demonstrate P-SOD impairments.

Notably, we only found a significant correlation between participants’ constricted response range use on FM-SOD with DR-S scores of participants’ mother descriptions. This
suggests that impairments in R-SOD manifested as a lack of flexibility and black and white response pattern in perceptual tasks. Furthermore, developmental psychologists have demonstrated in research investigating attachment that mother-infant attachment and mother representation are found to be stronger than the parallel constructs with respect to the father (van Ijzendoorn, 1995; van Ijzendoorn, Kranenburg, Zwart-Woudstra, van Busschbach, & Lambermon; 1991). These studies’ results are in line with Bowlby’s (1969) suggestion of a hierarchy in the organization of internal working models of attachment figures. Therefore, the attachment relationship with the father may be lower in the hierarchy. It follows that our results found only the DR-S scores of subjects’ mother descriptions were significantly correlated with lower response range, suggesting that participants with higher maternal developmental quality representations will rate facial morphs with a broader response range. However, this hierarchical relationship of maternal and paternal and infant attachment was not supported in every domain including pre-school behavior such as sociability (van Ijzendoorn et al., 1991). Thus, the hierarchy of maternal and paternal representation can also be different depending on the domain. Also, it is important to note that studies in support of a maternal hierarchy in the organization of internal working models were done utilizing the Adult Attachment Interview (AAI) rather than the ORI, the instrument we employed.

5.1.2. Construct Validity

Our second aim was to provide evidence for convergent and divergent validity of our FM-SOD.

5.1.2.1 Convergent Validity

To establish convergent validity, FM-SOD should positively correlate with the measures of theoretically related constructs (Campbell & Fiske, 1959). In our study, convergent measures
included the SOD, the IPO and the IOS. Our results showed some support for convergent validity of the FM-SOD task, indicating a significant correlation between sensitivity of the FM-SOD task with the IPO. We found that participants with higher scores on the IPO total and its subscales (i.e. Identity Diffusion and Primitive Defenses)—indicating lower level of personality organization, lower level of defenses, and higher level of identity diffusion—showed poorer sensitivity, i.e. a greater propensity to “see” themselves on facial morphs. After controlling for depression, these results did not remain statistically significant. However, we believe that these findings are still important to consider in terms of the FM-SOD’s convergent validity. Notably, depression and the IPO (IPO total, Primitive Defenses, Identity Diffusion and Reality Testing) were previously found to be significantly correlated (Lenzenweger, Clarking, Kernberg, & Foelsch, 2001). Similarly, in our study, the IPO total score and its subscales of Primitive Defenses, Identity Diffusion and Reality Testing, were all significantly correlated with depression ($r(87)= 49, r(87)=46, r(87)=45, r(87)=42$, respectively) as well as depression and sensitivity scores on the FM-SOD task ($r(86)=.24$). Nevertheless, it is hard to conclude whether participants who “see” themselves more on the facial morphs do so because of their depression scores or due to their lower levels of defenses, higher levels of identity diffusion and lower levels of personality functioning as assessed by the IPO. It is reasonable to assume that depression as a marker of general pathology might mask the relationship between IPO and impaired sensitivity on the FM-SOD task.

Furthermore, we showed convergent validity of FM-SOD with sensitivity and self-report SOD scores. We found a significant negative correlation between sensitivity and the SOD scores indicating that participants who tend towards greater enmeshment with others showed poorer sensitivity to others’ features, i.e., they had a greater propensity to “see” themselves in facial
morphs than other participants. After controlling for depression, the finding that participants with impaired SOD, assessed with the SOD scale, had poorer sensitivity to others’ visual features remained statistically significant. Our finding suggests that it is more likely for individuals with impairments in SOD, who tend to experience greater vulnerability in response to others’ assessments and base their self-worth on others’ opinion, to see “themselves” in the facial morphs. It suggests that there is a higher likelihood that people whose self-esteem is inordinately affected by others’ opinion, and who report poorly differentiated sense of self, see their features more than others in the facial morphs. Lastly, we found no significant correlation with sensitivity and the IOS scores.

We examined response range with our study’s convergent validity measures. Our study found that response range on FM-SOD was significantly negatively correlated with IPO total score, the Primitive Defenses subscale, and the Identity Diffusion subscale. Essentially, our participants who demonstrated lower levels of personality organization, higher levels of identity diffusion and employed lower level defenses, offered more constricted response range on the FM-SOD task when rating the facial morphs. When we controlled for depression scores assessed by the CESD, the negative correlation between response range and the IPO total score, the Primitive Defenses subscale, and the Identity Diffusion subscale all remained statistically significant. Furthermore, the Reality Testing subscale, which had not previously been found to be significantly correlated with restricted response range, became significant after controlling for depression.

Lastly, we found no significant correlation between discriminability and self-report scale scores including the SOD, the IOS and the IPO scores, indicating an absence of convergent validity of discriminability of FM-SOD with our self-report measures. However, we found a
trend between discriminability scores on FM-SOD and the IOS scale. This could be due to the nature of the IOS scale. IOS is the only scale that visually represents SOD with Venn diagrams representing the physical proximity between self and other. Given that the nature of the IOS scale is visual—a facet of P-SOD—it is possible that the correlative trend between self-report (IOS scale) and discriminability of FM-SOD is reflective of a correlation between P-SOD and R-SOD.

Overall, our study found that participants who showed lower levels of personality organization, higher levels of identity diffusion and employ lower level defenses, as assessed by the IPO, did not show any perceptual deficit in discriminating between morphs of self and other (i.e., discriminability), but showed poorer sensitivity i.e. a lesser propensity to “see” themselves on facial morphs. We also showed that these participants offered a constricted response range in rating facial morphs. Similarly, there was a higher likelihood that participants whose self-esteem was inordinately affected by others’ opinion, and who reported poorly differentiated sense of self (assessed by SOD scale) saw their features more than others in the facial morphs, but did not show any perceptual deficit in discriminating between morphs of self and other.

5.1.2.2 Divergent Validity

Our study provided support for divergent validity for FM-SOD sensitivity, discriminability and response range with the divergent validity measures, including mood states scores on the POMS, self-esteem scores on the RSES and depression scores on the CESD (except with depression and sensitivity). We found no significant correlation between the RSES self-esteem scores and discriminability, sensitivity, and response range. We also found no significant correlation with the POMS and discriminability, sensitivity or response range.
Nevertheless, we found a statistically significant correlation between sensitivity and confusion (one of the POMS’s items), which was in line with findings of the SOD scale and sensitivity. We previously mentioned that scores on the SOD scale reflective of impairment in SOD suggest confusion of self—i.e., boundary diffusion between self and other—and idealization or devaluation of the other. Thus, the significant correlation between the item of feeling confused on the POMS and poorer sensitivity of seeing others compared to self in facial morphs suggests that individuals with less differentiated sense of self, as suggested by the SOD scale, and who described their own mood as “confused” as assessed by the POMS, see “themselves” more in facial morphs.

Lastly, there were no significant correlations between depression scores on the CESD and discriminability and response range. However, we found a significant correlation between sensitivity and depression scores on the CESD.

Overall, our results suggest that discriminability, sensitivity and response range on FM-SOD measure different constructs than self-esteem or mood states (excepting depression), indicating divergent validity for the FM-SOD task. Discriminability and response range were not correlated with depression scores on the CESD, indicating that they measure different constructs. However, sensitivity on the FM-SOD task was found to be correlated with depression scores on the CESD. This might be due to the fact that in a nonclinical population, it might be hard to differentiate between depression and specific pathology that would impact a sensitivity parameter of the FM-SOD task.

5.1.3. Psychopathology and the FM-SOD
Our third aim was to examine the relationship between sensitivity, discriminability and response range on the FM-SOD task and individuals’ scores on SOD-related psychopathology such as features of BPD and pathological narcissism.

5.1.3.1. Borderline Personality Features and the FM-SOD

In terms of BPD features, there were no statistically significant associations between the discriminability, sensitivity, and response range with participants’ borderline features on the SCID-II. However, we found that impaired sensitivity, the likelihood of rating self versus others, was significantly correlated with higher BPD features scores on the ZAN-BPD scale (Zanarini, 2003). However, this finding did not remain significant after we controlled for depression. Notably, response range showed a significant negative correlation with BPD features as identified by the ZAN-BPD scale after controlling for depression. Participants with higher BPD features on the ZAN-BPD scale offered more constricted response range in differentiating themselves and others. In summary, our results provided some support for our hypotheses. When we controlled for depression, no correlation was found between discriminability and sensitivity with BPD features on the SCID-II and ZAN-BPD scale. However, response range was found to be significantly correlated not with SCID-II but with BPD features on the ZAN-BPD scale. And without controlling for depression, impaired sensitivity, the likelihood of rating self-versus others, was significantly correlated with higher BPD features scores on the ZAN-BPD scale (Zanarini, 2003).

To our knowledge, this is the first study examining a relationship between facial self-appraisal and BPD features. There is a vast body of research on facial emotion recognition within the BPD population suggesting perceptual biases. For instance, a recent research study (Meehan, De Panfilis, Cain, Antonucci, Soliani, Clarkin & Sambataro, 2018) on a morphed facial emotion
recognition task found that individuals with BPD features showed a greater ability to detect and label facial emotions of low intensity, and a greater propensity to inaccurately detect and mislabel neutral faces as emotional. Although these results may reflect perceptual bias, ours is the first study to suggest that individuals endorsing higher levels of BPD features in the past week showed less flexibility in their responses when rating themselves and others in facial morphing tasks. This narrower response range can be understood from the perspective of black and white thinking or the response style of individuals with BPD traits in terms of either-or, “me” or “not me” thinking. Lastly, in line with previous research (Gunderson & Philips, 1991; Luca, Luca & Calandra, 2012), our study found a significant correlation between depression and ZAN-BPD ($r(86)= .71$). Consequently, unlike the constricted response range and BPD features relationship, it is hard to know whether sensitivity on the FM-SOD task is related to BPD or depression, particularly given the significant correlation between depression and BPD (Gunderson & Philips, 1991; Luca, Luca & Calandra, 2012) and the fact that our sample is nonclinical.

5.1.3.2. Pathological Narcissism and the FM-SOD

Our results (see also Karan, Diamond, Grinband & Fertuck, in press) suggest that perceptual sensitivity, but not perceptual discriminability and a narrower response range, was associated with greater pathological narcissistic features. Individuals with high scores on narcissism, particularly vulnerable narcissism, were more likely to rate the facial morphs similar to themselves. These results suggest that there is a perceptual sensitivity among individuals with high vulnerable narcissism scores in which they demonstrate impairments in SOD consistent with psychoanalytic theory (Freud, 1925; Schmeir, 1975; Sandler & Rosenblatt, 1962).
Psychoanalytic models proposed the importance of understanding mental representations, particularly the lack of differentiation between aspects of the self and other at the intrapsychic level for understanding psychopathology, including narcissistic pathology (Blatt, 1991; 1995; 2008; Diamond, Yeomans, Stern & Kernberg, submitted; Kernberg, 1975; 2007). Additionally, our findings add to the literature on SOD as a substrate of personality pathology. Our results showed that individuals with high vulnerable narcissism showed P-SOD impairments on our FM-SOD task evidenced in their proclivity in seeing their own features in facial morphs. This suggests a relationship between R-SOD impairments and P-SOD impairments (Freud, 1925; Schmeir, 1975; Sandler & Rosenblatt, 1962; Rosenfeld, 1971).

In terms of clinical implications (see for further discussion Karan et al., in press) the proclivity to more readily see the self in facial morphs suggests that impairments in P-SOD may contribute to the difficulties with self and interpersonal functioning observed in individuals with pathological narcissism, including the lack of interest or investment in others (Kernberg 2004, 2018), the deficits in empathy for others (Baskin-Sommers, Krusemark, & Ronningstam, 2014; Kernberg, 2004; Ritter et al., 2011), and the deficits in the capacity for social cognition, particularly facial emotional recognition (De Panfilis et al., 2018; Marissen, Deen, & Franken, 2012; Miller et al., 2007; Ronningstam, 2016). These can contribute to serious troubled interpersonal relations that are so often witnessed in patients with NPD (Miller et al., 2007). The perceptual sensitivity differences in those with high levels of pathological narcissism may also speak to self-focus and lack of attention to others, including the therapist in clinical situations. This perceptual sensitivity may also account for an oft-noted transference disposition of narcissistic patients to see the therapist as more similar to themselves than they actually are (Bradley, Heim, & Westen, 2005; Kernberg, 2018).
However, our results and discussion on narcissism should be interpreted cautiously given that when we controlled for depression there was no correlation between sensitivity and narcissism or its subtypes. This could be related to a high correlation between depression and narcissism, particularly vulnerable narcissism in a nonclinical population (Tritt, Ryder, Ring & Pincus, 2010). Our study found a significant correlation between narcissism and depression. Specifically, depression was significantly correlated with pathological narcissism \(r(87)=.49\), grandiose narcissism \(r(87)=.28\) and vulnerable narcissism \(r(87)=.55\). Thus, it is difficult to conclude whether the likelihood of seeing oneself in facial morphs is driven by high levels of depression or high levels of narcissism.

5.1.4. Limitations

The greatest limitation of our study lies in the nonclinical characteristics of our sample. In fact, our results regarding criterion validity could be attributable to this limitation. Specifically, with respect to criterion validity our results did not show a correlation between the DR-S scores and discriminability, the ability to make finer distinctions in rating faces of the self and the other, and sensitivity, i.e. the likelihood of rating oneself versus the other as well as response range (except the DR-S mother scores). Importantly, DR-S is a 10-point ordinal scale designed to assess the developmental quality of open-ended, spontaneous descriptions of self and significant others generated in response to the ORI (Blatt et al., 1979); it can differentiate between a psychiatric and non-clinical population. With considerations for our sample consisting of only high functioning college students—a nonclinical sample—it may be that the range of their DR-S scores was so narrow that no possible correlations could be drawn. In fact, in our sample, DR-S scores mostly ranged from 5 to 6, with a handful of outliers rating either 4 or 7.
Furthermore, our study did not find any robust statistically significant results with respect to discriminability across our study hypotheses. This first can be related to differences between what sensitivity and discriminability measure. While sensitivity measures the propensity of seeing one’s features in facial morphs, discriminability measures the ability to make a finer distinction between self and other. Therefore, discriminability assesses a subject’s capacity to discern the just noticeable difference between the morphs across individuals. Given our sample’s nonclinical characteristics, it is likely that this just noticeable difference ranges between individuals at an imperceptible level, which is reflective of its quality as a human trait.

Our task includes linguistic and self-appraisal elements while measuring participants’ P-SOD. This inevitably adds a verbal component to the participants’ task, thus making it difficult to disentangle the perceptual and representational (i.e. linguistic) aspects of the participants’ answers. It follows that future studies should focus on purely perceptual processes of distinguishing self from other to solidify an understanding of P-SOD impairments and their relationship to R-SOD. Nevertheless, constructing such a study design has its challenges. As an example, participants could be asked to compare two faces in which their own features represent a distinct percentage of morphs (e.g. 10% versus 20%) and then decide which morph resembles themself more. One might argue that in asking subjects to make a rapid comparative decision between two fixed images in front of them, they will not access an internal mental representation of themselves in order to reach a conclusion. And yet, barring colossal advances in measurements of cognition, the researcher could never be certain to what extent linguistic processes are not contributing to the participants’ decision-making. Another approach to discerning between perceptual and representational SOD could rely on priming one group of participants by showing themselves their pictures and comparing them to a non-primed group to
understand whether priming will affect significant change in outcomes, as may be expected in participants whose psychopathology is characterized by P-SOD impairment. Lastly, recruiting participants with ADHD would eliminate the effect of attention on SOD, which could further a more nuanced understanding regarding discerning P-SOD from R-SOD. Still, it is important to note that any task that contains a linguistic component will by definition muddy attempts to disentangle P-SOD from R-SOD.

Additionally, in regards to our hypotheses on psychopathology, due to our sample’s nonclinical characteristics, it may also be that the ranges of psychopathology scores assessed by the SCID-II screener for BPD and ZAN-BPD scale, as well as the PNI-52 scale for narcissism, were too narrow to establish correlation with the FM-SOD task. As a result, no clear correlations between discriminability and BPD features or pathological narcissism could be drawn. Furthermore, one could argue that the use of self-report assessments has limitations, particularly regarding response validity and generalizability (Thomas et al., 2012). Specifically, explicit self-reported measures of pathological narcissism have long been criticized in terms of their validity and their inadequacy in capturing both vulnerable and grandiose types of narcissism (Miller, Lynam, & Campbell, 2016; Wright et al., 2013; Cain, Pincus & Ansell, 2008), although the PNI-52 is one of the most promising and valid instruments to date, particularly in assessing vulnerable narcissism (Miller et al., 2014). Given the limitations of explicit assessments of narcissism, our study could have been improved using implicit assessments to measure self-evaluations that may occur outside of one’s awareness as they simultaneously minimize the social-desirability biases often present in explicit measures (Fazio & Olson, 2003). However, we are not aware of any implicit measures of narcissism.
5.1.5. Summary of Results

First, even though we mostly could not establish criterion validity of the FM-SOD task with the DR-S scale, we found significant correlations between constricted response range in the FM-SOD task with the DR-S scores of participants’ mother descriptions. This result underscores the significance of maternal representations on the lack of flexibility in response range while rating theirs and other’s features in a facial morphing task. While investigating convergent validity, we also showed that participants who showed a lower level of personality organization, lower level defenses, and higher level of identity diffusion—all as assessed by the IPO—demonstrated constricted response range when rating facial morphs. These results can be understood from the perspective of black and white thinking/response style of individuals who show lower levels of developmental quality descriptions of their mothers on the DR-S scale, and who have a lower level of personality organization on the IPO.

Second, we provided evidence for convergent validity with sensitivity measures of FM-SOD with participants who showed lower levels of personality organization, lower level defenses, and higher level of identity diffusion—all as assessed by the IPO—and who tend to experience greater vulnerability in response to others’ assessments and base their self-worth on others’ opinion, as assessed by the SOD scale. Further, we showed that discriminability and response range on the FM-SOD task measure different constructs than self-esteem, mood states or depression, indicating divergent validity for FM-SOD. Furthermore, sensitivity on the FM-SOD task was found to measure different constructs than self-esteem and mood states except depression, given that sensitivity on the FM-SOD task was found to be correlated with depression scores on the CESD.
Third, we showed that FM-SOD sensitivity is correlated with borderline features, as assessed by the ZAN-BPD scale, and pathological vulnerable narcissism, as assessed by the PNI-52. However, as mentioned above, due to the significant correlation between sensitivity and depression, the significant correlations between sensitivity and the IPO, the SOD scale as well as psychopathology measures including ZAN-BPD and PNI-52 did not remain significant after controlling for depression. It is reasonable to assume that depression, as a marker of general pathology, masks the relationship between R-SOD impairment and sensitivity on FM-SOD. This may prevent showing a possible robust link between R-SOD and P-SOD, particularly in a nonclinical population.

5.1.6. Conclusion

This study allowed us to validate a measure which assesses perceptual (as compared to representational) aspects of SOD in an adult population. Notably, this is the first study which developed a methodology to investigate SOD impairments in a nonclinical population, particularly P-SOD impairments. What is more, it is the first study to explore the relationships between R-SOD and P-SOD. We found a relationship between P-SOD and R-SOD as evidenced by the correlation between FM-SOD and self report measures assessing R-SOD. Our results suggest that confusion in representational aspects of the self can be manifested in discerning the physical and perceptual aspects of the self. Therefore, P-SOD is a promising dimension that may shape our understanding of representational distortions in those with R-SOD related psychopathologies.

Our translational research study involves engagement with different disciplines – psychodynamic theory, psychophysics – and with qualitative and quantitative approaches to understanding PDs. Validation of our measure on the social cognitive mechanisms of facial
perceptual distortions as an index of perceptual SOD advances our understanding of P-SOD and related psychopathologies. Overall, our new measure helped us to learn about perceptual variability, and psychophysical biases in P-SOD and their link to R-SOD. Going beyond measuring symptomatic relief, our study’s significance lies in tapping into perceptual and structural changes which clinicians should aim to address in treating personality pathology (e.g., Transference Focused Therapy, Mentalization Based Therapy and Schema Focused Therapy). Our findings also help us to integrate perceptual aspects into a conceptualization of personality pathology. Additionally, we trust that our study will lead researchers and clinicians to develop earlier interventions to enhance individuals’ differentiated sense of self and work through their perceptual biases, which may lead to maladaptive coping strategies and problematic interpersonal relationships. This will help to prevent the development of certain psychopathologies related to P-SOD, such as BPD and narcissism.

The results of our study can function as a springboard to future research investigating new approaches to address perceptual representations. In the future, we will investigate the relationship between individuals’ performance on the FM-SOD task and their scores on other psychosocial related constructs such as rejection sensitivity, empathy, emotion regulation, attachment and childhood trauma. Also, clinical studies examining P-SOD within BPD and NPD will be necessary to further establish the clinical relevance of these findings. To that end, we are in the process of recruiting a clinical sample to understand BPD and NPD and their association with perceptual aspects of mental representations. Future studies should also investigate SOD impairments using different methodologies, such as interviews, informant reports, clinician reports, performance-based measures, and lab tasks, as well as different analytic techniques (e.g., person-centered approaches) as suggested by others (e.g. Thomas et al., 2012).
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