Review

Interpersonal perception as a mediator of the depression–interpersonal difficulties link: A review

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ABSTRACT

Our review proposes interpersonal perception as a mediator of the association between depression and interpersonal difficulties. Research suggests that such perception occurs on two levels. The first (Emotional Sharing System; ESS), basic and automatic, involves perceiving cues from others' nonverbal behavior. The second (Mental State Attribution System; MSAS), effortful and deliberate, involves inferring others' inner states using various sources of information. Evidence shows that depression is associated with lower accuracies at both levels of interpersonal perception, which in turn are associated with greater interpersonal difficulties. Gender differences found both in the depression–interpersonal difficulties link and in the depression–interpersonal perception link suggest it as a central moderator for consideration. We identified two main lacunae in the literature. First, ESS was not examined within close relationships whereas MSAS was not examined within clinical samples. Second, the role of interpersonal perception in the association between depression and interpersonal difficulties has rarely been tested.

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Individuals with depression have less satisfying and more problematic social relationships than individuals without depression (e.g., Coyne et al., 1987; Nezlek, Hampton, & Shean, 2000; Rehman, Gollan, & Mortimer, 2008). Compared with individuals without depression, they have fewer social interactions (Gotlib & Lee, 1989), enjoy these interactions less (Nezlek et al., 2000), and experience more interpersonal difficulties, including marital discord (Rehman et al., 2008). In this review, we propose a mediation model for explaining the association between depression and interpersonal difficulties. We use the latter term as an umbrella term covering both distal negative social outcomes (e.g., relationship dissatisfaction; Whitton & Kuryluk, 2012) and proximal negative behavioral tendencies that contribute to these outcomes (e.g., deficient support seeking behaviors; Rehman, Ginting, Karimiha, & Goodnight, 2010).

A leading theoretical model explaining the association between depression and interpersonal difficulties is the stress-generation model (Hammen, 1991). According to this model, individuals with depressive symptoms, characteristics, and behavioral tendencies contribute to the generation of a subtype of stressful events, ones that are influenced by the individual (which are termed *dependent stress*). These difficulties, which are usually interpersonal and conflictual in nature, erode the close relationships of individuals with depression, subsequently exacerbating their depression. Thus, the stress-generation model highlights a bidirectional association between depression and interpersonal difficulties, which are thought to play a role in both the etiology and maintenance of

the disorder (Joiner, 2002). This model has received substantial support in studies conducted on a variety of populations of different ages, and is relevant both to clinically diagnosed depression and to sub-clinical depressive symptoms (Hammen, 2006; Liu & Alloy, 2010).

Intimate relationships are especially susceptible to the detrimental effects of depression (Joiner, 2002; Segrin & Flora, 1998). Individuals with depression have a higher tendency to ask for repeated reassurance, but also to only believe the negative feedback they receive (Pettit & Joiner, 2006). Additionally, as evident from lab observations of romantic couples, individuals with depression demand support in a hostile manner (Rehman et al., 2010), and display less positive behaviors (e.g., a reduced tendency to smile; Rehman et al., 2008). Consequently, individuals with depression often burden or alienate their partners (Benazon & Coyne, 2000), with their intimate relationships being those that suffer the most (Coyne et al., 1987; Marcus & Nardone, 1992).

There is a paucity of research on the processes that underlie the link between depression and interpersonal difficulties (Hammen, 2006). A review of social cognitive processes in depression published more than a decade ago noted that most of the research addresses self-related processes, with a relative paucity of work on other-related (i.e., interpersonal) cognitive processes (Mineka, Rafaeli, & Yovel, 2003). In subsequent years, the role of interpersonal–cognitive processes in the onset or maintenance of depression has remained relatively understudied. In this review we focus on one such process that has been increasingly considered as a mediator of the association between depression and interpersonal difficulties, namely interpersonal perception (e.g., Bouhuys, Geerts, & Gordijn, 1999a; Gadassi, Mor, & Rafaeli, 2011; Lee, Harkness, Sabbagh, & Jacobson, 2005).

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To test our proposed *conceptual* mediation, we adopted the recommended steps to empirically examine mediation[1] (Preacher & Hayes, 2004). First, we reviewed (in the paragraphs above) the unmediated association of depression and interpersonal difficulties. Second, we examine the association between depression and the proposed mediator (interpersonal perception); in doing so, we introduce recent models distinguishing between two levels of interpersonal perception, and then review the findings linking depression to both of these levels. In accordance with the third step of mediation testing, we briefly review evidence of the association between the mediator and the outcome (interpersonal perception and interpersonal difficulties, respectively). Finally, in accordance with the fourth step of mediation testing, we review the (very limited) literature that speaks to the full mediation model: namely, studies examining depression as well as interpersonal perception as predictors of interpersonal difficulties.

Throughout the review we have chosen to canvass not only the literature on individuals suffering from clinical depression, but also on those suffering from depressive symptoms, and those who have a history of depression. This choice has two main reasons. The first is that a history of depression, as well as elevated levels of depressive symptoms, are both risk factors to clinical depression (e.g., Cuijpers & Smit, 2004; Monroe & Harkness, 2011). The second is that because our model aims to explore processes involved in stress generation (which may contribute both to onset and to maintenance or recurrence of depression), we must also consider individuals who are at risk for relapse. Indeed, if impaired interpersonal perception is to be found only among those who are currently suffering from depression (and not those who have a history of depression or have elevated depressive symptoms) we would have to conclude that it is only a concomitant of depression and not part of the recurrence mechanism (Liu & Alloy, 2010).

1. Two levels of interpersonal perception

Interpersonal perception is a broad construct and encompasses varied processes ranging from identifying fleeting emotional facial expressions to deciphering complex social interactions (Bernieri, 2001). Various authors have used terms such as *interpersonal sensitivity*, *empathy*, *mentalization*, *social cognition*, and *theory of mind* to refer to various (often overlapping) aspects of interpersonal perception. Two recent reviews of the interpersonal perception literature have attempted to organize these constructs (Shamay-Tsoory, 2011; Zaki & Ochsner, 2011), and both distinguished between two levels of interpersonal perception. The first, termed *emotional empathy* (Shamay-Tsoory, 2011) or the *Emotional Sharing System* (ESS; Zaki & Ochsner, 2011), involves the basic and automatic perception of cues from others' nonverbal behavior. The second, termed *cognitive empathy* (Shamay-Tsoory, 2011) or the *Mental State Attribution System* (MSAS; Zaki & Ochsner, 2011), involves the effortful and deliberate inference of others' inner states using various sources of information.

The division proposed in both reviews between the two levels of interpersonal perception is highly similar to the division found in the theory of mind literature between lower and higher levels of theory of mind (Tager-Flusberg & Sullivan, 2000). The first level of theory of mind includes decoding of mental states from observable social information (e.g., facial expression). The second level of theory of mind includes reasoning about mental states (e.g., explaining or predicting behavior) by integrating contextual information about a person (Harkness, Sabbagh, Jacobson, Chowdrey, & Chen, 2005; Wolkenstein, Schönenberg, Schirm, & Hautzinger, 2011). These two levels are sometimes referred to as affective and cognitive theory of mind (Mathersul, McDonald, & Rushby, 2013).

The more basic of these two levels (ESS) is the ability to share the emotional states of the other. It involves perceiving others' inner states, which automatically evoke similar states in oneself; indeed, perceivers often automatically adopt bodily postures, facial expressions, and self-reported emotional states of targets (Zaki & Ochsner, 2011)[2]. Similarly, brain regions activated when experiencing one's own emotion or pain (e.g., amygdala, insula, posterior inferior frontal gyrus, dorsal premotor cortex, and rostral inferior parietal lobule) are also activated when seeing someone else experiencing these (Decety, 2011; Shamay-Tsoory, 2011; Spunt & Lieberman, 2012; Zaki, Hennigan, Weber, & Ochsner, 2010; Zaki & Ochsner, 2011). This neural system, sometimes referred to as the mirror system is activated when individuals are requested to identify emotional expressions (Spunt & Lieberman, 2012).

The ESS is assessed mostly in paradigms that require the accurate perception of nonverbal cues, often pictures of strangers with prototypical facial expressions (e.g., Bouhuys, Geerts, & Gordijn, 1999b). These paradigms have shown the ESS to be basic in several respects. First, it can be observed starting in infancy (Vaish, Carpenter, & Tomasello, 2009). Second, it is automatic — the ESS often occurs outside of awareness (Dijksterhuis & Bargh, 2001; Neumann & Strack, 2000), and is unaffected by conscious motivation (Hall, Blanch, et al., 2009). Third, ESS processes rely on ancient systems of intersubjectivity that developed earlier in the evolution process (Decety, 2011). Finally, animal research shows that the ESS is evident in rodents (Langford et al., 2006) and primates (Call & Tomasello, 2008).

The ESS may partly underlie more complex and effortful processes of interpersonal perception, namely the MSAS, which is the complex ability to cognitively infer another person's internal state (e.g., Spunt & Lieberman, 2012). Still, viewing the ESS as the foundation of the MSAS may over-simplify the matter (Shamay-Tsoory, 2011; Zaki & Ochsner, 2011). Specifically, in many cases, it is problematic to accurately infer others' mental state based on their nonverbal behaviors: at times, targets are not interested in being understood, or are actively motivated to remain opaque (e.g., when experiencing socially unacceptable emotions; Zaki, Bolger, & Ochsner, 2009). Moreover, even targets not trying to conceal their feelings may inadvertently produce ambiguous nonverbal cues.

The MSAS involves the deliberate and conscious efforts to accurately infer another's internal states. It is a capacity affected by motivation (Hall, Blanch, et al., 2009; Zaki & Ochsner, 2011), and although it may use nonverbal information, it relies to a great extent on verbal input (Hall & Schmid-Mast, 2007). MSAS processes involve activation of brain regions that differ from those engaged in ESS processes (dorsomedial and ventromedial prefrontal cortices, medial prefrontal cortex, temporoparietal junction, posterior cingulate cortex, and medial temporal poles; Shamay-Tsoory, 2011; Spunt & Lieberman, 2012; Zaki & Ochsner, 2011). They support cognitive functions that require self-other differentiation, emotional self-reflection, and autobiographical memory (Shamay-Tsoory, 2011). For example, these regions, sometimes referred to as the mentalizing system, have been shown to be activated when individuals are asked to infer the social cause for another person's emotional state (Spunt & Lieberman, 2012).

2. Depression and the ESS

Studies assessing ESS functioning in depression have assessed it in two main ways. One approach uses self-reports — most commonly, the Interpersonal Reactivity Index (IRI; Davis, 1980). A recent review

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[1] As Kazdin and Nock (2003) have noted, testing a proposed mechanism (i.e., mediator) involves more than the demonstration of statistical associations; for example, it requires demonstrating the specificity of the mechanism, as well as its dose–response relation. In the review, we focus on the first condition for mediation, but return to Kazdin and Nock's suggestions later.

[2] ESS processes may be related to what have been called "mirror neurons", a set of neurons that fire both when an action is performed and when it is witnessed (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996). Mirror neurons have been documented in macaque monkeys; still, evidence for a comparable mirror neuron system in humans is still indirect, and their role in the ESS is yet unclear (Decety, 2011).

of the literature examining the association between self-reported empathy and both clinical and sub-clinical depression (Schreiter, Pijnenborg, & Aan Het Rot, 2013) has identified two IRI subscales (namely, *empathic distress* and *empathic concern*) as ones thought to reflect ESS functioning. The review found that empathic distress was higher in both clinical and subclinical samples, whereas empathic concern had weaker and less consistent ties with depression across sample type.

An alternative and widely used approach to assessing ESS functioning utilizes the facial expression recognition task. Earlier studies using this approach presented either schematic drawings or still photos with prototypical facial expressions, which participants viewed for an unlimited duration, until identifying the supposed emotion depicted. This method suffers from low ecological validity, as expressions in real life are rarely as clear, and often vanish quickly (Gadassi et al., 2011). Consequently, recent facial expression recognition studies have used more ecologically valid techniques — for example, morphed (and therefore non-prototypical) expressions (Gilboa-Schechtman, Foa, Vaknin, Marom, & Hermesh, 2008; Gollan, McCloskey, Hoxha, & Coccaro, 2010), or pictures with limited visual information (e.g., recognition based only on the eye region of the face; Lee et al., 2005; Wang, Wang, Chen, Zhu, & Wang, 2008).

Research based on the both prototypical and modified versions of the facial expression recognition task has shown that individuals with depression are usually less accurate than those without depression (for a meta-analysis, see Bistricky, Ingram, & Atchley, 2011). Specifically, the vast majority of these studies, conducted on individuals with clinical depression, found them to assign more negative than positive emotions to facial expressions, thus showing a negative bias (e.g., Bouhuys et al., 1999a, 1999b; Gilboa-Schechtman et al., 2008; Gollan, Pane, McCloskey, & Coccaro, 2008; Hale, Jansen, Bouhuys, & van den Hoofdakker, 1998; Kan, Mimura, Kamijima, & Kawamura, 2004). The strength of this bias is associated with greater depression severity (Hale, 1998), less improvement during treatment (Bouhuys et al., 1999a), greater likelihood of relapse (Bouhuys et al., 1999b), and hyper-activation of certain brain areas (e.g., the amygdala; Stuhrmann, Suslow, & Dannlowski, 2011) in response to negative stimuli. Subclinical samples yield similar findings: accuracy is negatively associated with depressive symptoms (for a meta-analysis see Hall, Andrzejewski, et al., 2009; cf., Harkness et al., 2005), as well as with induced negative mood (Ambady & Gray, 2002).

If the general pattern of findings with clinical and sub-clinical levels of depression points quite conclusively to reduced accuracy, a different pattern emerges in the (admittedly few) studies that have examined individuals with past depression, with three studies finding such individuals to be more accurate than those without a history of depression. First, in a study comparing women with or without previous depression, those with past depression were less likely to confuse the valence of negative and positive morphed emotional faces than were those without past depression (LeMoult, Joormann, Sherdell, Wright, & Gotlib, 2009; interestingly, when examining a different aspect of accuracy, these authors found that women with past depression – compared to ones without it – required happiness to be more intensely present in morphed pictures so as to identify it; the same was not the case for sadness or anger). A second study found individuals with a history of depression to be more accurate in reading emotions from the eye region compared with individuals without a history of depression (Harkness, Jacobson, Doung, & Sabbagh, 2010). Finally, a third study using facial emotion recognition found that individuals with a history of depression correctly identified emotions more often than either individuals with current depression or individuals without a history of depression (Anderson et al., 2011). Thus, it appears that interpersonal perception among individuals with past depression is more accurate than that found among individuals with no such history. Still, the paucity of studies clearly calls for further research on this issue.

Why should past depression be tied to greater accuracy? One possibility is that the experience of depression, with its attendant problematic social environment, sensitizes individuals to social information. A similar position (though one focused on mild-to-moderate levels of depression) was presented by Weary (1990). Importantly (and in accordance with the finding reviewed earlier regarding clinical depression), Weary (1990) contended that this hypersensitivity would not be evident in individuals with severe depression, because they experience a severe impairment in motivation which also decreases their accuracy motivation.

3. Depression and the MSAS

In contrast to the large number of studies of depression and the ESS, only few have focused on depression and the MSAS (Ladegaard, Larsen, Videbech, & Lysaker, 2014; Weightman, Air, & Baune, 2014). Like the ESS, MSAS functioning has been assessed in several ways. One line of work uses self-reports. Typically, though not exclusively, such studies use the perspective taking subscale of the IRI (Davis, 1980). Self-report studies have yielded mixed results in both clinical and subclinical samples (for review, see Schreiter et al., 2013).

A second line of work is based on standardized tests. This method usually includes tasks in which participants view short video vignettes depicting interactions between actors, and are asked to answer a set of questions regarding these interactions to which there is a correct or incorrect response (e.g., the Awareness of Social Inference Test; McDonald, Flanagan, Rollins, & Kinch, 2003). Studies using this type of tasks have usually found individuals with clinical depression to have impaired MSAS functioning (e.g., Ladegaard et al., 2014; Wolkenstein et al., 2011; for a review see Schreiter et al., 2013; Weightman et al., 2014). The same has been found for individuals with elevated depressive symptoms (e.g., Ambady & Gray, 2002).

A third line of work uses text-based tasks which examine higher order theory of mind (e.g., stories where it has to be understood that one character has thoughts/beliefs about another character's thoughts; Perner & Wimmer, 1985). A recent review of these (few) studies shows that in general, higher-order theory of mind seems impaired in depression — particularly among women (Schreiter et al., 2013).

In another line of work relevant to MSAS functioning, a series of text-based social information processing studies has demonstrated that, among undiagnosed college students, depressive symptoms are associated with a greater number of inferences based on social information (e.g., Gleicher & Weary, 1991), more extensive searches for diagnostic information regarding the targets (Edwards, Weary, von Hippel, & Jacobson, 2000; Hildebrand-Saints & Weary, 1989), and less biased attributions (Yost & Weary, 1996). An experimental study lent further support to this possibility, showing that induced depressed mood results in better performance in a social-reasoning task (Badcock & Allen, 2003). Thus, individuals with higher levels of depressive symptoms do seem to invest more effort in processing social information. However, to our knowledge, none of these tasks have been tested in clinical samples.

A major shortcoming of the extant literature reviewed above is that it assesses interpersonal perception outside of an actual interpersonal context. This shortcoming is especially problematic since interpersonal difficulties most frequently occur in the real-life interactions between individuals with depression and actual close others (e.g., Hammen, 2006). One way to address this shortcoming comes from the empathic accuracy paradigm (Ickes, 1993).

In empathic accuracy studies, a dyad is videotaped while having a discussion; subsequently, each member of the dyad separately views the recording, reporting their own and inferring their partner's thoughts or feelings within the interaction. A complementary approach involves experience-sampling data (Howland & Rafaeli, 2010; Wilhelm & Perez, 2004). In this approach, partners provide daily reports of their own (and infer their partners') moods, feelings, or motivations over several weeks. In both approaches empathic accuracy reflects the similarity between perceivers' inferences and targets' actual reports. Empathic accuracy procedures call for inferences based on a wide range

of interpersonal information and therefore offer a more ecologically-valid perspective on interpersonal perception.

To our knowledge, only five studies have investigated the association of depression and the MSAS using empathic accuracy procedures (Gadassi et al., 2011; Gauthier, Thibault, & Sullivan, 2008; Overall & Hammond, 2013; Papp, Kouros, & Cummings, 2010; Thomas, Fletcher, & Lange, 1997), and only two (Gadassi et al., 2011; Overall & Hammond, 2013) did so using experience-sampling.

Thomas et al. (1997) used a lab-based conflict–resolution task, and found depressive symptoms to be unrelated to empathic accuracy in a sample of married couples. However, this study also failed to find the well-established link between empathic accuracy and relationship satisfaction. Similar results were obtained in a study of couples in which one of the partners suffers from chronic pain (Gauthier et al., 2008). Pain-related empathic accuracy (assessed as the discrepancy between the patient's pain level when performing a task and their spouses' estimates of their pain) was unrelated to both the patients' and their spouses' depressive symptoms, but again, was also unrelated to relationship satisfaction.

The absence of a link between empathic accuracy and satisfaction in both studies is puzzling, but might be understood by considering the multi-faceted nature of empathic accuracy. As Howland and Rafaeli (2010) note, empathic accuracy should not be considered a unitary construct; at the very least, accuracies towards positive and towards negative target moods or emotions are different entities (Rafaeli, Gadassi, Howland, Boussi, & Lazarus, under review). In other words, what may have happened in both the Thomas et al. (1997) and the Gauthier et al. (2008) studies is that the use of an omnibus measure of empathic accuracy masked actual associations (both with satisfaction and, possibly, with depression).

Evidence consistent with this idea comes from three recent studies conducted on committed couples. One used the lab-based empathic accuracy paradigm (Papp et al., 2010), another used the diary-based empathic accuracy paradigm (Overall & Hammond, 2013), and the third used both (Gadassi et al., 2011). All three studies revealed that elevated depressive symptoms are associated with decreased accuracy regarding the partners' mood or commitment level. Two of these studies showed that this decreased accuracy was more pronounced among women (Gadassi et al., 2011; Papp et al., 2010), and that the valence of the target mood moderated this association (specifically, a stronger negative association was found with accuracy regarding negative moods). Notably, depressive symptoms were also tied with increased accuracy in certain ways. Specifically, among women (but not men), depression was tied to greater accuracy regarding positive moods in one study (Papp et al., 2010). Moreover, it was also found to be positively tied to one form of accuracy (namely, tracking accuracy) in another study (Overall & Hammond, 2013).

Taken together, these studies suggest that the association between depression and MSAS functioning within relationships is moderated by the perceiver's gender, the valence of the target mood or behavior, and the type of accuracy assessed. The inconsistencies between these studies highlight the need for more research on depression and MSAS functioning within intimate relationships.

Thus far, we reviewed studies supporting the first two steps in the conceptual mediation we are proposing: that depression is associated (a) with interpersonal difficulties and (b) with interpersonal perception. Next, in the third step, we review studies that support the association between the conceptual mediator (interpersonal perception) and outcome (interpersonal difficulties).

4. Interpersonal perception and interpersonal difficulties

Accurate interpersonal perception is essential for the formation and maintenance of social bonds (Zaki & Ochsner, 2011). Indeed, previous research has shown that both types of interpersonal perception (ESS and MSAS) generally show positive associations with social adjustment.

For example, a recent meta-analysis on the ESS (Hall, Andrzejewski, et al., 2009) finds accurate perception to be associated with better social adjustment (e.g., relationship quality). As with the ESS, the MSAS was found to be associated with adaptive social behaviors, including skillful support (Verhofstadt, Buysse, Ickes, Davis, & Devoldre, 2008), reduced intimate partner violence (Clements, Holtzworth-Munroe, Schweinle, & Ickes, 2007), and positive relationship feelings in romantic couples (Rafaeli et al., under review).

Still, greater MSAS accuracy is not always beneficial, and there may be situations in which individuals would be motivated to be inaccurate (Ickes & Simpson, 2001). For example, among married couples who were trying to resolve a problem in their relationship, accuracy towards thoughts perceived as non-threatening to the relationship was associated with increased feelings of closeness, whereas accuracy towards relationship-threatening thoughts was associated with a decline in closeness (Simpson, Oriña, & Ickes, 2003). This effect has received much attention in the empathic accuracy literature, but has not been examined specifically in relation to depression.

5. Interpersonal perception as a mediator of the depression–interpersonal difficulties link

As can be seen, numerous studies support the paths of the proposed conceptual mediation model. However, to date, no studies have assessed the full model. Two studies do come close to doing so (Bouhuys et al., 1999a; Overall & Hammond, 2013). In a longitudinal study of individuals with clinical depression, Bouhuys and her colleagues examined ESS accuracy and its interplay with interpersonal difficulties and with the responsiveness of the patients' depressive symptoms to treatment. Among women (but not men), depression was found to be tied to interpersonal distress and to ESS accuracy. However, ESS accuracy and interpersonal distress were unrelated in this study, and the full mediation model was not tested.

Overall and Hammond (2013) examined the link between depressive symptoms and MSAS functioning, focusing specifically on the accuracy of perceptions regarding one's partner's commitment and negative behaviors. Depressive symptoms were associated with a biased perception of one's partner, which itself resulted in increases in relationship insecurity (Overall & Hammond, 2013). Again, like in Bouhuys et al. (1999a), the full mediation model was not tested. Still, in this case, the possibility that MSAS functioning indeed served as a mediator is quite likely.

As these two studies come closest to testing a full mediation model, their divergent results merit some thought. The apparent support for mediation in Overall and Hammond (2013) and the apparent lack of support for it in Bouhuys et al. (1999a) may be attributable to differences in the mediators, the outcomes, or the populations studied. Specifically, whereas Bouhuys and her colleagues examined ESS processes, Overall and Hammond focused on MSAS processes (Bouhuys et al., 1999a). It may be that the MSAS plays a more central role in mediating the effects of depression. Alternatively, the different pattern of results may emerge from the studies' divergent focus on interpersonal difficulties experienced generally vs. within a specific relationship. Specifically, whereas Bouhuys et al. (1999a) examined general interpersonal difficulties, Overall and Hammond (2013) focused on actual interpersonal behaviors within identified interpersonal relationships (the same ones in which interpersonal perception was assessed).

6. Gender as a moderator in the depression–interpersonal perception–interpersonal difficulties model

The gender difference in depression's prevalence (with women twice as likely to suffer from it than men) is a robust finding (e.g., Van de Velde, Bracke, & Levecque, 2010). Moreover, gender appears to be a significant moderator of the depression–interpersonal difficulties link, and support for the stress-generation hypothesis was found for

women more often than for men (Hammen, 2006; Liu & Alloy, 2010). In this review, we argue that this link is, at least partially, mediated by interpersonal perception. To understand the moderation effect of gender on this mediated relationship, we would need to know whether gender moderates (a) the association between depression and interpersonal perception; (b) the association between interpersonal perception and interpersonal difficulties; and (c) the direct effect of depression on interpersonal difficulties with interpersonal perception factored out.

To date, we are aware of a surprisingly small number of studies examining gender moderation of these links, all of which focused on the first of the three (i.e., gender as a moderator of the link between depression and interpersonal perception). For the most part, these studies support the role of gender as moderator of this link. Specifically, studies focusing on the ESS find depression to be associated with biased perception of facial emotional expressions more strongly among women (Bouhuys et al., 1999a; Wright et al., 2009) and girls (van Beek & Dubas, 2008) than among men and boys, respectively. Studies focusing on the MSAS report similar gender differences (for review, see Schreiter et al., 2013; cf. Overall & Hammond, 2013). Clearly, studies examining gender as a moderator of the other two links are in need.

7. Limitations of the existing literature

Our review suggests that there are several lacunae and puzzling inconsistencies in the extant research. One of the major inconsistencies emerges from the nomenclature used in the literature examining interpersonal perception. Indeed, as we noted above, there are over a dozen terms used to describe this concept — and a similar number of methodologies. This variety in concepts and methodologies poses a hindrance for researchers: it makes it difficult to properly canvass the relevant literature on which to base new studies, and it may lead researchers to conclude, incorrectly, that little prior work exists (e.g., Wolkenstein et al., 2011). Our hope is that empirical (e.g., Schreiter et al., 2013) as well conceptual (e.g., Shamay-Tsoory, 2011; Zaki & Ochsner, 2011) reviews of this important field will help add order and clarity to it; that was a major goal of our current review.

As we noted earlier, various paradigms have been used to assess both ESS and (even more so) MSAS functioning. However, few studies have used more than one paradigm simultaneously (e.g., Gadassi et al., 2011; Ladegaard et al., 2014). There is a clear need for more studies using multiple paradigms for assessing interpersonal perception simultaneously: these will allow us to examine whether the different terms we use are indeed assessing the same construct (e.g., Mathersul et al., 2013).

The most striking lacuna is the scarcity of studies fully testing the mediation model. Moreover, though several studies on depression and the ESS have been conducted on individuals with clinical depression, none have assessed the depression–interpersonal perception link in the context of close relationships. Conversely, while several studies on the MSAS have explored this link in romantic couples, none have used individuals with clinical depression. In short, studies assessing the depression–interpersonal perception link in the context of close relationships using clinical samples are needed, as are ones with simultaneous assessment of the ESS and the MSAS.

It is difficult to predict how the ESS and MSAS would fare as mediators when examined in this manner. A chain-like mediation possibility is that depression would exert its effect through ESS on the MSAS, with the latter system then exerting its effect on interpersonal difficulties. An alternative, multiple mediation, possibility is that both systems are responsible for (separate) parts of depression's effect on the outcome. A more likely finding would be of a complex model, in which depression has both direct effects on the ESS and the MSAS as well as an indirect effect on the latter through the former; and in which both systems have direct effects on interpersonal difficulties, with the MSAS also serving as a partial mediator of the effects of the ESS.

Another lacuna in the literature is the paucity of studies focused on past depression and its link to interpersonal perception. The few existing studies suggest increased accuracy among individuals with a history of depression. If that is indeed the case, might this increased accuracy buffer the effects of depression on interpersonal difficulties? If so, what precipitates its decline into the poor accuracy found during depressive episodes? Conversely, can this accuracy be excessive or misdirected towards the "wrong" information — for example, rejection or criticism (Ickes, 2011)? When considering depression from the stress-generation hypothesis perspective (Liu & Alloy, 2010), the latter possibility (i.e., that accuracy in the hands of an individual with a history of depression may backfire) seems more likely, but has yet to be directly tested; ideally, such a test will also identify at what point accuracy turns from help to hindrance.

8. Summary and implications

The literature reviewed largely supports the hypothesis that the link between depression and interpersonal difficulties is mediated by interpersonal perception. First, there is overwhelming evidence for an association between the predictor and the outcome: namely, depression, both at clinical and subclinical levels, is associated with increased interpersonal difficulties. Second, there is strong evidence for an association of the predictor and the mediator: namely, depression is associated with lower accuracies at both levels of interpersonal perception, although there is some evidence that suggests an opposite association, especially with past depression (e.g., Harkness et al., 2010). Third, there is strong evidence for an association of the mediator and the outcome: namely, both levels of interpersonal perception are associated with interpersonal difficulties.

Although the evidence reviewed supports the conceptual mediation model, and demonstrates that the proposed mediator (interpersonal perception) is indeed tied to both depression and interpersonal difficulties, no studies have directly examined this mediation (though see our discussion of Bouhuys et al., 1999a; Overall & Hammond, 2013, above). Clearly, there is a need for additional studies testing the full mediation model. Studies which would examine both general interpersonal difficulties alongside deficits within specific relationships, and which would assess both ESS and MSAS processes simultaneously, will be particularly useful in further exploring the question of mediation.

Importantly, future mediation studies should strive to go beyond the demonstration of statistical mediation (Preacher & Hayes, 2004) to take into account additional conditions for demonstrating the mechanisms of action (Kazdin & Nock, 2003). In particular, many of the conditions outlined by Kazdin and Nock require a methodological shift to studies with repeated measurements; specifically, mediation models which aim to uncover processes unfolding over time call for studies examining temporally unfolding experience (e.g., repeated measures as in Overall and Hammond (2013) or longitudinal designs as in Bouhuys et al., (1999a)).

Several studies provide support for the proposed moderator, gender. Specifically, gender differences have been found both in the depression–interpersonal difficulties link and in the depression–interpersonal perception link. Additional studies are needed to examine whether gender also moderates the link between interpersonal perception and interpersonal difficulties, as well as the direct link between depression and interpersonal difficulties (Schreiter et al., 2013).

Like the stress-generation model (Hammen, 2006; Liu & Alloy, 2010) which has inspired and organized much of the research on the link between depression and interpersonal difficulties, the model we propose may well be bidirectional. Indeed, interpersonal difficulties are not the end-point of the process. First and foremost, the literature on depression recurrence shows that interpersonal difficulties have a role in the etiology of depression (e.g., occurrence of first episode is often preceded by relationship loss or bereavement) but also in its maintenance and recurrence (e.g., Stroud, Davila, Hammen, & Vrshek-Schallhorn, 2011). Importantly, because of a process referred to as "stress sensitization", stressors leading to recurrence are more likely to be less severe in intensity compared to those leading to the first episode (Stroud et al., 2011).

This strengthens the need to focus more on the interpersonal processes involved in depression recurrence.

Interpersonal difficulties may also be tied bi-directionally to interpersonal perception. In fact, several recent non-clinical studies support this notion, as they show that interpersonal difficulties are associated with altered interpersonal perception. For example, individuals with a stronger need to belong (Pickett, Gardner, & Knowles, 2004), or ones with fewer friends (Gardner, Pickett, Jefferis, & Knowles, 2005) had better ESS functioning and (in Pickett et al., 2004) improved MSAS functioning as well. Importantly, an experimental study showed that following a manipulation of social rejection, individuals had better ESS functioning (Bernstein, Young, Brown, Sacco, & Claypool, 2008). The findings of increased ESS and MSAS functioning following rejection suggest that the motivation to socially reconnect with others increases interpersonal perception, presumably because of the need to reconnect with others (e.g., Bernstein et al., 2008). However, with repeated rejection (Downey & Feldman, 1996) the thwarted need to belong may become so intense that it overpowers the cognitive and interpersonal capabilities of the individual. In that case, the unmet need and the pain that results from it numb interpersonal perception, instead of increasing sensitivity (Bernstein & Claypool, 2012). In some ways, that may be what an episode of depression entails: the numbing of interpersonal perception.

This review focuses specifically on depression. However, interpersonal difficulties are not specific to depression, and interpersonal perception may mediate the association between other forms of psychopathology and interpersonal difficulties. In fact, there is preliminary evidence that the stress-generation model is applicable to other disorders (e.g., anxiety; Uliaszek et al., 2012) that are also associated with biased interpersonal perception (e.g., Gilboa-Schechtman et al., 2008). Future research should examine our proposed model not only for depression but also for other disorders.

Our review has important implications not only for researchers, but also for clinicians. First and foremost, it is important that clinicians be aware of the possible role of interpersonal perception in the maintenance of depression. This insight can lead clinician to focus the therapy of clients suffering from depression (either clinical or subclinical) on this process. For example, clinicians may provide clients (or their clients' loved ones) psycho-education on the role of their impaired perception of others to their interpersonal difficulties. Specific interventions may focus on improving accuracy. Better yet, after increasing clients' awareness to the possibility their perception of others may be impaired, clinicians should consider directing clients to directly inquire about others' mental state instead of inferring it.

Acknowledgments

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