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This time with motivation: The implications of social neuroscience for research on motivated self- and other-perception (and vice versa)

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Abstract Early neural research on self-evaluation began testing whether self-evaluation was somehow neurally different than evaluations of other people and inanimate objects. Self-evaluation was lauded as potentially unique partially because of motivational and affective influences. Despite the acknowledgement that motivation influences social cognition such as self-perception, neural models of self-perception have been conspicuously silent on how motivational states affect the neural level of analysis. What can be learned by examining motivational influences on the neural systems underlying social cognition including self-perception? An emerging body of neural research on self-enhancement motivation (i.e., the motivation to see one's self in a positive light) is described and its implications for longstanding psychological questions about self-enhancement are discussed. Finally, several additional avenues for using the neural level of analysis to test questions about motivational influences on social cognition are discussed.

Keywords Motivation · Emotion · Self-enhancement · Brain · fMRI · Frontal lobe · Social cognition · Self · Bias

Introduction

Do you trust someone to describe themselves accurately in a job interview or their dating profile? For that matter, do you trust your friends when they describe someone they want you to meet as "attractive?" Both intuition and decades of research will tell you that impressions of the self and other people are subject to numerous motivations. The example above illustrates how people are motivated to see themselves and certain other people in a positive light (e.g., self-enhancement and other-enhancement: Murray and Holmes 1997; Sedikides and Gregg 2008; Taylor and Brown 1988). And research has shown that social cognition is subject to a number of other motivations as well. Sometimes people want to verify their current self-views or stereotypes they hold about outgroup members (e.g., Swann et al. 1990; Cunningham et al. 2004). And other times, people are primarily focused on gathering information about the self or other people (e.g., Trope 1980). Despite the abundant evidence that myriad motivations influence self- and other-perception, many questions remain. The recent influx of research using neuroscience methodologies to investigate psychological phenomena raises the question of whether the neural level of analysis might be useful to researchers interested in motivated social cognition (Beer 2007; Beer and Ochsner 2006; Cacioppo and Berntson 1992; Klein and Kihlstrom 1998). Although very little attention has been paid to motivated self-perception in the neural literature, one emerging body of literature has begun to examine the neural systems that support unrealistically positive social cognition. Regions within the frontal lobes, including the medial prefrontal cortex (Brodmann's Area (BA) 9/10), the orbitofrontal cortex (BA 11/47), and the ventral anterior cingulate cortex (BA 24/25), are modulated by self-serving social cognition. These regions are associated with a number of functions including self-processing (MPFC: see Ochsner et al. 2005 for a review), executive function (OFC: Beer et al. 2004), and discrimination of valence (Hughes and Beer 2011a; Moran et al. 2006). The findings from this preliminary body of work provide (a) further information for the debate over the mechanism underlying unrealistically positive

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social cognition and (b) a different perspective on how sensitivity to pleasure and pain is associated with the motivation to see someone in a positive light.

Working hard or hardly working for unrealistically positive social cognition?

Do we work hard or hardly work for the unrealistically positivity that pervades self-perceptions and perceptions of close others? People report that they have significantly better personalities than the average person, that they are more successful than their task performance suggests, and take credit for success but not failure (e.g., Alicke et al. 1995; Dunning et al. 1989; Moore and Healy 2008; Taylor and Brown 1988). Intuitively, it is appealing to think about this positive slant arising from active attempts to distort information about the self in a flattering manner. However, researchers have recently pointed out that active distortion may not always account for unrealistic positivity. Instead, unrealistic positivity may reflect judgments that rely on heuristic shortcuts (e.g., Chambers and Windschitl 2004; Moore and Healy 2008; Moore and Small 2007). In other words, people may not actively dismiss negative information about the self or pick out the positive information from a mixed bag of good and bad information. Instead, a 'cognitive miser' perspective suggests that people may rely on easily accessible information when making judgments about themselves. Researchers have speculated that information that tends to be accessible is exactly the kind of information that would lead to unrealistically positive evaluations (e.g., Chambers and Windschitl 2004; Moore and Small 2007). People's increased attention to positive information about themselves illustrates how certain kinds of information are likely to become more easily accessible. People pay attention to positive information about themselves first and most often (e.g., Ditto et al. 1998; Swann et al. 1990). Increased attention to positive information about the self increases its elaboration and accessibility (e.g., Chambers and Windschitl 2004; Dunning et al. 1989). If information beyond the easily accessible is not sought out, then positive attributes can become overemphasized in judgments. In this way, self-evaluations may become tinged with unrealistic positivity because of conservation of cognitive resources rather than active attempts to distort information at the time the judgment is made.

The two views suggest that unrealistically positive self-evaluations may be achieved through different magnitudes of cognitive resources yet it has been difficult to draw strong conclusions about whether this is the case. Cognitive load is often used to illuminate whether processes draw on sufficiently low levels of cognitive resources that they persist even in the face of other processing demands. While some studies find that cognitive load increases unrealistic positivity (e.g., Beer and Hughes 2010; for easy tasks, Kruger 1999; Paulhus et al. 1989; Lench and Ditto 2008), other studies find no effect (Alicke et al. 1995; Falk et al. 2009; Lalwani 2009) or decreased positivity (Fischer et al. 2007; Vohs et al. 2005). Furthermore, it is unclear whether moderators known to affect unrealistic positivity achieve their effect by increasing cognitive processing or making it difficult to sustain active distortion. For example, people are less likely to make unrealistically positive self-evaluations when they are asked to introspect about their negative qualities or when they are held personally accountable for their evaluations (Sedikides et al. 2002, 2007). It may be that thinking about negative qualities balances out the easily accessible positive information about the self or it might be that focusing on the negative makes it difficult to ignore that information.

Another way to gain purchase on this question is to examine whether the neural systems underlying unrealistically-positive social cognitions are similar to the neural systems underlying active distortion of emotional stimuli or the conservation of cognitive resources. Although very little neural research has examined unrealistic positivity in social cognition, most of the extant studies are arguably more consistent with a conservation of cognitive resources account (Beer et al. 2006, 2010; Beer and Hughes 2010; Blackwood et al. 2003; Somerville et al. 2010). In contrast to a positive relation between emotion regulation and orbitofrontal cortex activation (Beer 2009; Ochsner and Gross 2005), the most consistent neural marker of unrealistically-positive social cognition is a *reduction* in orbitofrontal cortex activation.

The relation between reduced orbitofrontal cortex function and unrealistically-positive social cognition holds regardless of whether unrealistic positivity is operationalized as discrepancies between self- and other-perceptions, self-confidence and actual task performance, attributions for task success compared to task failure, and base rates and evaluations of social comparisons. For example, one fMRI study found that reduced orbitofrontal cortex activation predicted overestimation of success on a trivia task at the trial level and person level (Beer et al. 2010). Participants answered trivia questions and then estimated their confidence that their answer was correct. On trials that were answered incorrectly, a region of medial orbitofrontal cortex (BA 11) was negatively modulated by confidence level. In other words, orbitofrontal cortex activation dropped in relation to higher and higher levels of confidence when answers had actually been incorrect. This relation could not be explained by confidence level alone; there was not a significant relation between confidence level and orbitofrontal cortex activation for trials that were answered correctly. Furthermore, the more participants tended to be overconfident about their answers across the task, the less likely they were to activate medial orbitofrontal cortex (BA 11). Two lesion studies also find a relation between unrealistically positive social cognition and reduced orbitofrontal cortex function (BA 11/47). One study found that patients with orbitofrontal damage were more likely to feel proud after a social interaction task even though they had performed more poorly than healthy control participants (Beer et al. 2003). For example, patients with orbitofrontal cortex damage were much more likely to generate offensive nicknames and invade the personal space of a social interaction partner. Yet they were also likely to report feeling greater pride in their social interaction than healthy control participants. Another study found that patients with orbitofrontal cortex damage were likely to overestimate their social skills on a social interaction task when compared to patients with lateral prefrontal cortex damage (BA 9/46) or healthy control participants (Beer et al. 2006). Participants had to engage in a semi-structured conversation with a stranger. Although all participants reported that social norms dictate that certain kinds of personal information should be held back when speaking with strangers, patients with orbitofrontal cortex damage were likely to introduce personal information into the conversation. Patients with orbitofrontal damage were much less likely to note the inappropriateness of their conversation when compared to blind judges' perceptions. Taken together, these studies suggest that the more you view yourself through rose-colored glasses, the less you are using your orbitofrontal cortex for self-evaluation tasks. However, none of these studies provided participants with feedback about their task performance. Therefore, it is possible that the relation between orbitofrontal cortex and unrealistically positive estimations are specific to ambiguous situations (i.e., situations in which people are uncertain about how to estimate their behavior in the absence of explicit feedback). If the relation does not hold when feedback is available, then orbitofrontal cortex may simply be tracking certainty or ambiguity rather than something about self-evaluation.

In fact, the negative relation between orbitofrontal cortex and unrealistically positive social cognition holds when specific feedback is given (Somerville et al. 2010) or self-generated (Blackwood et al. 2003). Participants were provided feedback about whether ostensible peers had formed a favorable impression of the participant based on their photograph. The more participants overestimated how much other people liked them, the less they activated medial orbitofrontal cortex (BA 11) when encoding positive feedback in comparison to negative feedback. Orbitofrontal cortex activation is also reduced when people choose to account for their behavior in an unrealistically-positive manner (Blackwood et al. 2003). Participants were asked to imagine that they had experienced social success or social failure. Taking credit for success and dismissing self-responsibility for failure was associated with less lateral orbitofrontal cortex activation (when compared to dismissing responsibility for success and taking credit for failure).

Finally, the association between reduced orbitofrontal cortex activation and unrealistically-positive evaluations is not limited to the self suggesting a more general role in motivated social cognition. A series of fMRI studies show that orbitofrontal cortex activation (BA 11/47) is negatively modulated by unrealistically-positive social comparisons of self and close others (Beer and Hughes 2010; Hughes and Beer 2011a). Participants compared themselves to an average peer (Beer and Hughes 2010) or compared their romantic partner and roommates to an average peer (Hughes and Beer 2011a) across 200 personality traits. People are likely to have unique levels of some personality traits but the average peer is also likely to be unique in some ways. Therefore, social-comparative ratings that reveal a significant difference between the average peer and the self (or average peer and a close other) across a large body of traits are considered to reflect unrealistically-positive social cognition (Chambers and Windschitl 2004). The more people tended to see themselves or their romantic partners as having significantly more positive traits and significantly fewer negative traits than the average peer, the less they activated orbitofrontal cortex (Beer and Hughes 2010; Hughes and Beer 2011a). In contrast to self-evaluations and evaluations of close others, participants tended to see roommates as having a comparable personality to an average peer. Whereas unrealistically positive evaluations of self and close others had reduced orbitofrontal cortex activation, the "about average" evaluations of roommates were accompanied by significant activation within that orbitofrontal cortex region (Hughes and Beer 2011a).

What are the psychological implications of the negative relation between orbitofrontal cortex and unrealistically-positive social cognition?

Can these findings resolve the debate about whether unrealistic positivity reflects active distortion or cognitive conservation? While it is not possible to infer a psychological function on the basis of neural activation (i.e., reverse inference: Poldrack 2006), the findings do contribute to the debate by providing data that is arguably more consistent with a cognitive miser perspective. Orbitofrontal cortex activation is associated with a number of executive functions (for a review see Beer et al. 2004). Therefore, the negative relation between orbitofrontal activation and unrealistically-positive social cognition may reflect relatively less reliance on these executive functions (at least when compared to social cognition that is not so positively skewed). One of the executive functions associated with orbitofrontal cortex is the ability to integrate diverse information into a coherent response (DeMartino et al. 2006; Fellows 2007). For example, orbitofrontal cortex predicts gambling decisions that surpass the use of salient but incomplete information about gambling options (DeMartino et al. 2006). Additionally, orbitofrontal cortex is critically involved in integrating both positive and negative information when making decisions such as choosing an apartment (Fellows 2007). This account of orbitofrontal cortex function is consistent with a cognitive miser perspective which suggests that unrealistically-positive social cognition may reflect a tendency to overemphasize easily accessible information when judging the self. If unrealistic positivity is attenuated when people draw on information that is more diverse than the easily accessible positive information, then orbitofrontal cortex may attenuate unrealistic positivity by integrating both positive and negative (or just more) information about the self.

An alternate, but less likely, perspective is that the orbitofrontal cortex is important for suppressing or inhibiting the desire to see one's self positively and, therefore, is increased when self-evaluations reflect less of this motivation. Studies of emotion regulation, for example, show that regions of lateral orbitofrontal cortex are important for suppressing emotional responses (see Beer et al. 2004; Ochsner et al. 2002). This account is difficult to understand in relation to the social comparison study with roommates (Hughes and Beer 2011a). The personalities of roommates were viewed as similar to the personality of an average peer and these comparisons significantly activated orbitofrontal cortex. The suppression account of orbitofrontal cortex function would mean that people are actively suppressing a desire to see their roommates positively. Instead, it seems likely that people do not have the same kind of attentional biases when storing information about roommates as they might for themselves or romantic partners. Therefore, the increased orbitofrontal cortex activation for roommate social comparisons may arise because those judgments may involve the integration of easily accessible information that is more likely to be both positive and negative in nature.

Taken together, this neural research shows that unrealistically positive social cognition is marked by a reduction in orbitofrontal cortex activity (Beer et al. 2003; 2006; 2010; Blackwood et al. 2003; Somerville et al. 2010). This effect holds regardless of whether unrealistic positivity is operationalized by self-evaluations compared to task performance, task feedback, or normative base rates so it is not paradigm-bound. Furthermore, unrealistically positive social cognition is evident for healthy individuals who do not engage their orbitofrontal cortex as well as for individuals who have damage to this region. Finally, the negative relation between orbitofrontal cortex and unrealistically positivity is not bound to the self. The relation holds when people make unrealistically positive evaluations of their significant others.

Through the rose-colored glasses darkly: Unrealistically positive social cognition is associated with increased discrimination between good and bad

Why don't people just see themselves and their close others for who they are all the time? The answer seems simple when you consider that people are fundamentally motivated to approach pleasure and avoid pain. But what is pleasurable and what is painful? The answer to that question is clearly dependent on the motivation(s) influencing social cognition in any given instance. For example, self-verification is theorized to reward people with feelings of control and the reduction of uncertainty about the self (e.g., Swann et al. 1990). On the other hand, self-enhancement and other-enhancement makes it possible for people to see themselves or close others in a positive light in spite of any less than flattering aspects of the self (e.g., Sedikides and Gregg 2008). For example, people may self-enhance by preferentially forgetting negative feedback about themselves (Sanitioso and Wlodarski 2004) and preferentially remembering flattering exemplars of about one's behaviors (Sanitioso et al. 1990). This work generates the hypothesis that enhancement motivations may increase sensitivity to whether information about the self or close others is flattering or not (rather than verifying or not, etc.). In other words, although enhancement motivations may result in evaluations that are less than precise, they may simultaneously generate more precise characterization of the valence of incoming information.

Consistent with the hypothesis that enhancement motivations increase sensitivity to valence, recent evidence suggests that motivation to see someone positively may modulate at least one neural region responsible for encoding the desirability of personal attributes. Specifically, it may be that the ventral anterior cingulate cortex (BA 25) is especially likely to distinguish desirable attributes from undesirable attributes to the extent that people want to assign positive attributes to a target (Hughes and Beer 2011a; Moran et al. 2006). A series of studies have found that ventral anterior cingulate cortex is significantly activated when processing positive stimuli compared to negative stimuli. For example, ventral anterior cingulate cortex is associated with evaluating desirable personality traits compared to undesirable personality traits (Beer and Hughes 2010; Hughes and Beer 2011a; Moran et al. 2006) and with evaluating the likelihood that the self will experience positive events in the future compared to negative events in the future (Sharot et al. 2007). Intriguingly, the role of ventral anterior cingulate cortex in distinguishing good from bad appears to be especially strong in situations where we care about attributing the good to the self or someone we care about. Ventral anterior cingulate cortex (BA 25) is especially likely to distinguish desirable from undesirable personality traits for the traits that people consider highly self-descriptive (Moran et al. 2006). For traits that are not considered to be highly self-descriptive, ventral anterior cingulate cortex does not show a significant difference between desirable and undesirable traits. Furthermore, another study found that ventral anterior cingulate cortex (BA 25) distinguishes desirable personality traits from undesirable personality traits to the extent that people liked the person they had to attribute the traits to (i.e., their assigned roommate in college: Hughes and Beer 2011a). It is important to note that unlike orbitofrontal cortex activation (BA 11/47), ventral anterior cingulate cortex (BA 25) activation did not predict whether people saw themselves, their significant others, or their roommates as significantly more desirable than an average peer (Beer and Hughes 2010; Hughes and Beer 2011a). In other words, the activation reflected discrimination between desirable and undesirable traits but did not predict the extent to which subsequent social comparisons were unrealistically positive or not. It is also important to note that none of these studies asked participants to rate the valence of traits or future events. Instead, ventral anterior cingulate cortex distinguished between positive and negative valence as a function of how motivated the participants were to discount negative attributes and associate positive traits with the self or another person. Taken together, these findings illustrate one way that motivational states may modulate neural regions' sensitivity to aspects of the environment. More research is needed to understand how and when these modulations influence social cognitive processes.

Future directions

Although the motivated nature of social cognition may seem self-evident to psychologists, motivation does not play a big role in most extant neural research on self-evaluation or, in fact, in current neural models of social cognition. The absence of motivation should not be mistaken for lack of interest. Instead, it belies the relative new emergence of social neuroscience approaches. Many opportunities exist for researchers interested in investigating motivated self-perception from the neural level of analysis as well as for those researchers interested in incorporating motivation into neural models of social cognition. As a new direction, neural studies of motivated self-perception hold the promise of providing additional insight into psychological questions and creating comprehensive neural models of social cognition. Here are just a few examples to illustrate the potential:

Neuroscience contributions to motivated social cognition research

Recent neuroscience evidence suggests that unrealistically-positive social cognition may be mediated by different underlying mechanisms depending on whether it is a reaction to an explicit self-esteem threat. Three fMRI studies suggest that self-esteem concerns may draw on a different neural profile than that associated with unrealistic positivity not elicited by self-esteem concerns (e.g., Hughes and Beer 2011b; Krusemark et al. 2008; Somerville et al. 2010). The study that examined neural discrimination of favorable compared to unfavorable social feedback found one neural profile related to individual differences in unrealistically positive memory for the social feedback and found a different neural profile in relation to individual differences in self-esteem (Somerville et al. 2010). More specifically, there is more to the story than the robust evidence for a negative relation between unrealistically positive social cognition and medial orbitofrontal cortex activation (BA 11). Self-esteem threat elicits unrealistic positivity in social comparisons that is neurally distinct from studies where threat is not manipulated. For example, participants compared their personalities to an average peer across 200 traits either after they had received feedback that their peers did not find them attractive (i.e., a threat condition) or did find them attractive (Hughes and Beer 2011b). The social comparison task was exactly the same as the task used in a previous study (Beer and Hughes 2010) except that unrealistic positivity was elicited as a reaction to manipulated threat rather than manipulating accessibility of positive self-information through trait construal. As a reaction to threat, individual differences in unrealistically positive social comparisons were *positively* associated with orbitofrontal cortex activation and positively associated with activation in an additional neural region, the medial prefrontal cortex (BA 10) (Hughes and Beer 2011b).

The positive relation between medial prefrontal activation and defensive self-enhancement in social comparison (Hughes and Beer 2011b) may be consistent with the findings from a study that did not study self-enhanced evaluations but rather neural activation in relation to social-evaluative feedback as a function of self-esteem change. Increased medial prefrontal cortex activation is associated with receiving negative social-evaluation feedback but only for those individuals whose self-esteem is negatively impacted by the negative feedback (Eisenberger et al. 2011). If unrealistically-positive social comparisons are related to different patterns of neural activation depending on whether threat is explicitly manipulated, then it is possible that different mechanisms achieve social comparisons that cast the self in a flattering light when self-esteem concerns are engaged or especially heightened. These recent neural findings could be consistent with the view that active distortion of information supports unrealistically positive social cognition when it is elicited by threat. The medial prefrontal cortex is associated with processing information about the self and other people (for a review see Ochsner et al. 2005) and medial orbitofrontal cortex has been associated with suppressing information (e.g., Beer et al. 2004; DeMartino et al. 2006). Therefore, their *increased* activation in relation to unrealistically positive social comparisons might reflect searches for flattering information about the self and the suppression of counterevidence. If active distortion of information is used to accomplish unrealistically positive social cognition under threat, then that would explain why some previous behavioral studies have found that mental load reduces positivity bias (Fischer et al. 2007; Vohs et al. 2005). Future research will be helpful in clarifying whether threat moderates the neural mechanisms underlying unrealistically-positive social cognition.

The neural level of analyses is also useful for shaping hypotheses about how development affects motivated self-evaluation. Developmental differences in the capability of neural regions will likely influence how motivations are expressed in social cognition. For example, despite evidence that both children and older adults report unrealistically-positive self-evaluations (Cheng et al. 2007; Thomaes et al. 2009), nothing is known about how the magnitude of positivity compares across developmental stages. The frontal lobe regions currently shown to underlie many instances of unrealistically positive self-evaluation are not fully developed in childhood and begin to decline in function before other neural regions in older adulthood (e.g., Raz 2000; Reznick et al. 2008). This suggests that children and older adults may be especially prone to the unrealistically positive self-evaluation that is associated with decreased orbitofrontal cortex activation. Furthermore, differences in orbitofrontal function in children and older adults may impact calibration of social evaluations. However, unrealistically positive self-evaluation is likely to be more complicated than decreased activation in regions of the frontal lobes. Furthermore, many other motivations affect self-evaluation (e.g., self-verification: Swann et al. 1990; self-assessment Trope 1980) and nothing is known about their underlying neural systems. Therefore, hypotheses about development will benefit from future research that more thoroughly characterizes the neural systems that underlie the different motivations that shape self-evaluations.

Implications of motivation research for neural models of social cognition

Neuroscience methodologies may help contribute to psychological discussions of motivated social cognition but it is equally the case that neural models of social cognition must consider behavioral research on motivated social cognition (Beer 2007). At the moment, most discussions of the neural systems underlying self-evaluation have focused on identifying neural regions that may be unique to self-perception (compared to perceptions of other people) or to social targets (self and others compared to inanimate objects) (Beer and Ochsner 2006). Research elucidating the psychological mechanism of these regions has just begun and has mostly focused on understanding how these regions permit inferences about other people when using the self as a referent (Amodio and Frith 2006; Mitchell et al. 2006; Ochsner et al. 2005). This is important groundwork but it has yet to target one of the most interesting things about self-evaluation, namely, it is motivated. When we evaluate ourselves, we care about the answer albeit for a variety of different reasons. If a major goal of social neuroscience is to develop neural models of social cognition including self-evaluation, then motivations known to influence self-evaluation will need to be central factors in that model. So what can researchers do to make progress towards understanding how motivational states affect the neural systems associated with social cognition, in particular, self-evaluations?

One fruitful starting point is to build on the extant work examining how self-enhancement motivation modulates the neural systems associated with components of social evaluation. As mentioned above, the motivation to see the self or another person in a positive light appears to particularly engage ventral anterior cingulate cortex activation to discriminate desirable and undesirable attributes when encoding information (e.g., Hughes and Beer 2011b; Moran et al. 2006). In these studies, participants had to rate how much the attributes described themselves or another person. In this case, there was no evidence for a significant relation between individual differences in ventral anterior cingulate cortex activation and unrealistic positivity in social-comparison ratings. Therefore, it is unlikely that this region is important for helping people decide how much to increase their standing on a positive trait and dismiss their standing on a negative trait. Instead, it may be that this region is important for selective encoding because there is some evidence that it predicts memory for favorable compared to unfavorable information (e.g., Somerville et al. 2010). If ventral anterior cingulate cortex mediates greater attention to positive information about the self, then it may ultimately contribute to the increased accessibility of positive self-information. To test this question, future research might examine how ventral anterior cingulate cortex activity at encoding predicts self-evaluations that must rely on the encoded information.

In addition to deepening our understanding of the effect of self-enhancement on ventral anterior cingulate cortex activity, research should also examine its affect on other neural systems associated with social cognition. For example, people will self-enhance to the extent that they believe they can get away with it. Self-enhanced judgments will only be publically expressed if someone believes that they can convince others that the judgment is legitimate (Sedikides et al. 2002). Are neural regions that are sensitivity to inferring the mental states of others, such as medial prefrontal cortex and right temporal parietal junction (for a review see Beer and Ochsner 2006), modulated by the motivation to self-enhance?

Another important step will be to expand investigations beyond self-enhancement to the other motivations known to influence social cognition. For example, how do other motivations affect the extent to which ventral anterior cingulate cortex distinguishes the social desirability of personality traits? When people are motivated to verify a negative impression of themselves, does the ventral anterior cingulate cortex increase activation to negative personality traits? If this were the case, then it might indicate that ventral anterior cingulate cortex marks valence in relation to one's motivational state rather than positive valence per se.

Conclusion

Research that draws on neuroscience methodologies and behavioral research on motivation will be a critical step toward deepening our understanding of the myriad motivations that pervade social cognition. An emerging body of neural research has provided additional support for the view that unrealistically-positive social cognition may be accomplished in different ways depending on whether it is motivated by self-esteem concerns. Additionally, the neural level of analysis suggests that self-enhancement increases discrimination between desirable and undesirable information. Future research that takes both the psychological and neural levels of analysis into account will provide unique insight into questions that continue to puzzle motivation researchers and flesh out neural models of social cognition.

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