Attitudes and Evaluation: Toward a Component Process Framework

William A. Cunningham\textsuperscript{1} & Marcia K. Johnson\textsuperscript{2}

\textsuperscript{1}Department of Psychology, University of Toronto
\textsuperscript{2}Department of Psychology, Yale University

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\textit{Address Correspondence to}
William A. Cunningham
Department of Psychology
University of Toronto
100 St George Street
Toronto, ON M5S 3G3
CANADA

phone: 416.978.4243
fax: 416.978.4811

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One of the most exciting developments in social psychology is the recent increase in interest in integrating theories and methods of social psychology, cognitive psychology, and cognitive neuroscience. Just as the social cognitive revolution which began in the 1980’s provided new insights into social processes, an additional level of analysis – identifying the neural correlates of these processes – promises a more complete understanding of important constructs such as attitudes, prejudice, and emotional regulation.

In this chapter we review social neuroscience research, examining the evaluative processes that underlie attitudes. It is difficult to think of a social psychological concept more central than attitudes (Eagly & Chaiken, 1993). The sense that something is good or bad, positive or negative, pleasant or unpleasant, or to be approached or avoided is critical to almost any behavior. Indeed, the processes of evaluation and associated behavioral choice are ubiquitous though often invisible in daily life. Yet, as is increasingly clear, even simple evaluations are often the integrated outcome of multiple affective and cognitive component processes.

EVALUATIVE PROCESSES AND ATTITUDES

Attitudes, most simply put, are our likes and dislikes (Bem, 1970). Although such a definition can conjure images of valence tags (the equivalent of little pluses and minuses) associated with representations of objects, events, concepts, and so forth, Allport (1935) highlighted the importance of not defining attitudes as rigid, tightly bound responses to a particular stimulus. That is, attitudes are not simple if-then rules that operate as an S-R association between the perception of a stimulus and a specific feeling, opinion, or behavior. Rather, he suggested that the concept of attitude must include the idea of flexibility and defined an attitude as "a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with
which it is related." Allport additionally suggested that the way to achieve dynamic, flexible attitudes that may include ambivalence, was by "reducing attitudes to small enough components." Following this line of thinking, by making representations of attitudes small enough (e.g., breaking a representation-attitude association [R-A] into R₁-A₁, R₂-A₂, R₃-A₃, etc.) a simple concept of attitude might be retained and combinations of attitude representations would permit levels of attitude complexity.

We take a similar approach in this chapter, suggesting that attitude processes can be reduced to more elemental units. That is, we suggest that attitudes are the outcome of multiple affective and cognitive processes, variously recruited and/or tuned to meet situational and motivational constraints. Although few attitude theorists would deny the flexible nature of processes underlying attitudes, there has been a (perhaps only implicit) representation focus in most of social psychology. Attitudes tend to be treated as representations directly retrieved from memory in response to perceptual cues. Admittedly, the distinction between representation and process may be somewhat artificial, but we want to shift the emphasis from attitudes as retrieved to attitudes as constructed dynamically within particular contexts (e.g., situational, cognitive, motivational). Thus, attitudes and evaluations, and especially the subjective experience associated with attitudes, comes from a cognitive/affective system that likely operates in a dynamic and integrated fashion.

An analogy can be made between the concept of an attitude and the concept of a memory. According to the source monitoring framework (Johnson, Hashtroudi, & Lindsay, 1993; Johnson & Raye, 1981) remembering is not simply retrieval of a trace, but rather an attribution about the nature of a mental experience (see also Jacoby, Kelley & Dywan, 1991). Mental experiences result from a combination of associative and more constructive processes, and attributions or
judgments about them are based on a weighted average of various features or types of
information, including additional information that may be retrieved in the service of monitoring
the origin of the mental experience (e.g., imagination or perception). Furthermore the weights
associated with different features or other types of evidence are affected by current context (e.g.,
motivational state, hypotheses, etc.). The activation of information can occur relatively
automatically or via more reflective processes, and the activated information can be evaluated
relatively automatically or by more reflective processes (i.e., although information that arises
relatively automatically is often evaluated relatively automatically, and information that arises
more reflectively is evaluated more reflectively, it is not necessarily the case). Similarly,
attitudes can be viewed as the result of a weighting of the affective qualities associated with
currently activated information. Some evaluative qualities arise more automatically, and some
with more reflective effort (e.g., Johnson & Multhaup, 1992) and some contribute to the attitude
more automatically and some with more reflection.

THE ATTITUDE SYSTEM

As in the social cognitive tradition that underlies much social neuroscience research, we
assume that in order to understand attitudes, one needs to understand the cognitive architecture
that underlies perception and thought. However, even before fully specifying the component
cognitive processes that give rise to our mental experiences, we can move toward a component
process framework by considering two general ways that components could be defined—in
terms of types of information processed, or in terms of the type of operation engaged. With
respect to type of information, historically in the attitude/emotion domain, stimuli have been
assumed to include two key attributes—valence and intensity. With respect to type of process,
as in cognition in general, in the attitude/emotion domain, the distinction between implicit and
explicit processes has been important. Here we consider recent evidence that either or both of these two simple ways of conceptualizing components of attitudes are reflected in identifiable neural areas or circuits. In addition, we also briefly consider the relation between attitudes and emotion, whether there are separate neural correlates of positively and negatively valenced stimuli, the possibility that the same neural systems flexibly process positive and negative stimuli depending on motivational goals, and how ambivalence is reflected in brain activity.

**Attitudes and Emotion**

The psychological study of attitudes has been naturally linked to the study of affect and emotional processing. Thurstone (1931) provided a parsimonious definition of attitudes as simply “the affect for or against a psychological object.” Research spanning almost a century has indicated that our self-perceived bodily states provide a powerful input into our evaluative judgments (Bem, 1972; Damasio, 1995; James, 1884). For example, extending findings that electrodermal activity (e.g., the skin’s ability to conduct electricity) varied as a function of the emotionality of presented stimuli (Smith, 1922), electrodermal activity has been found to vary with attitude extremity (Dysinger, 1931) and agreement with presented attitude statements (Dickson & McGinnies, 1966). In addition, other psychophysiological methods have been developed that are sensitive to attitude valence and extremity, such as facial EMG (e.g., changes in electrical potentials over particular muscles in the face; Cacioppo, Petty, Losch, & Kim, 1986). More recently, research using event related potentials (ERP) and functional magnetic resonance imaging (fMRI) has demonstrated links between neural activity in regions associated with emotion and attitudes (e.g., Cunningham, Johnson, Gatenby et al., 2003; Cunningham, Raye, & Johnson, 2004).

**Arousal and Valence**
For some time, emotion researchers have found that apparently discrete emotional experiences can be characterized along two orthogonal dimensions. Although the names of these dimensions vary from theory to theory, they typically involve a dimension of positivity and negativity (valence), and a dimension of intensity or arousal (Russell, 1979). This distinction between valence and arousal has had a long history in social psychology. In their two factor theory of emotion, Schacter and Singer (1962) suggested that emotions are derived from a combination of arousal and cognitions used to explain the arousal. In several studies, participants who were experimentally aroused (e.g., given a dose of epinephrine) reported experiencing greater emotional responses consistent with their situations, but only when they were unaware of the effects of the arousal manipulations. Such findings suggest that one first experiences a visceral autonomic response to a stimulus or situation that is devoid of valence, and then one cognitively interprets this bodily state and generates a specific positive or negative emotion (see also Cannon, 1929; James, 1884).

In this conception, arousal is associated with an experienced bodily state and valence with a cognitive appraisal. Of course, these autonomic and cognitive responses could overlap in time rather than being serial and they could interact in producing specific emotions and attitudes. Converging evidence for the distinction between arousal and valence has been provided by recent functional neuroimaging studies. In three fMRI studies that manipulated or parametrically analyzed both valence and arousal such that the two could be examined orthogonally, different brain areas were associated with valence and arousal (Anderson, Christoff, Stappen et al., 2003; Cunningham et al., 2004; Small, Gregory, Mak et al., 2003). In each of these studies, arousal was associated with amygdala activation and negative valence was associated with right prefrontal activation. In addition, Adolphs, Russell, and Tranel (1999) asked both a patient with bilateral
amygdala damage and controls to rate the valence and arousal of various stimuli. The amygdala patient rated stimuli to have the same valences as controls, but rated the emotional intensity of stimuli differently.

**Positive and Negative Substrates?**

In addition to evidence dissociating valence and arousal, other evidence suggests that positive and negative components of valence may also be processed distinctly (Cacioppo & Bernstein, 1994). For example, Davidson and colleagues have found using EEG that there appear to be separate systems for approach and avoidance related behavior (Davidson & Irwin, 1999). Viewing or thinking about negative information results in greater right-sided EEG activity than viewing or thinking about something positive (Cunningham, Espinet, DeYoung, & Zelazo, in press; Davidson et al., 1990, Jones & Fox, 1992). Interestingly, anger, which is a negative but approach-related emotion, is associated with greater left than right EEG activity (Harmon-Jones & Allen, 1998). Thus, laterality does not appear to be synonymous with positivity or negativity per se, but rather behavioral tendencies associated with evaluative processing.

In the imaging domain, Sutton et al. (1997) found using PET that viewing negatively valence pictures was associated with activation in the right orbital frontal cortex and the right inferior frontal cortex, whereas viewing positively valenced pictures was associated with activation in the left pre- and post-central gyri. More recently, evidence for right lateralized processing of negative information has been found using fMRI (Anderson et al., 2003; Cunningham et al., 2003; Cunningham, Raye, & Johnson, 2004). Specifically, areas of the right inferior frontal cortex and anterior insula consistently appear to be involved more in processing negative than positive valenced stimuli. Other studies have found that areas of the orbital frontal cortex (Anderson et al., 2003; Nitschke, Nelson, Rusch, Fox, Oakes, & Davidson, 2003;
Kringelbach, O’Doherty, Rolls, & Andrew, 2003) and basal ganglia (Delgado, Nystrom, Fissell, Noll, & Fiez, 2000) are involved primarily in the processing of positive affect (see Wager, Phan, Liberzon, & Taylor, 2003 for a meta-analysis). Although such findings do not necessarily imply that the processing of positive and negative information is fully dissociated, this suggests that they may involve at least partially separable circuits.

To the extent that the processing of positive and negative information relies on different brain regions, an important question to resolve regards the different processing time associated with each. Predictions based on the idea of a negativity bias propose that negative information takes priority in processing, both in terms of more rapid responses and greater overall influence (Cacioppo & Bernstein, 1994; Cacioppo & Gardner, 1999; Ito et al., 1998). Thus, one might expect negative stimuli to be processed more quickly than positive stimuli in terms of brain activity. Although several studies have investigated potential differences in response time to negative and positive stimuli, the answer to this question remains unclear.

Several studies have found that the processing of negative information may occur quite rapidly in the processing stream. For example, Kawasaki, Kaufman, Damasio et al. (2001) found that the processing of negative, but not neutral or positive, stimuli occurred 120-160ms after stimulus presentation in single cell recordings of the human orbital frontal cortex. In addition, negative stimuli appear to be differentiated from positive stimuli in posterior perception areas as indexed by the early P1 component (Smith, Cacioppo, Larsen, & Chartrand, 2003). Some have suggested that negative information is privileged such that it is processed more quickly than positive information – a temporal negativity bias (Cacioppo & Gartner, 1999). Providing support for this idea, Carretie, Martin-Loeches, Hinojosa, & Mercado (2001) using magnetoencephalography (MEG) found that negative stimuli were processed 200ms more
quickly than positive stimuli in the OFC. Similarly, some ERP components such as the P200 appear to occur more rapidly to negative than positive stimuli (Carretie, Mercado, Tapia, & Hinojosa, 2001). Yet, other studies have suggested a primacy for positive stimuli. In a study using faces with various expressions, Batty and Taylor (2003) found that the N170 component occurred more quickly to faces with pleasant emotional expressions than negative emotional expressions.

There are several potential explanations for these discrepancies. First, if positive and negative information are processed by different brain areas, these separable aspects of information may be processed at different rates for different processes. Thus, for some processes, negative information may be processed more quickly, and for others positive information may be processed more quickly (Cunningham et al., in press). Second, we might expect motivational goals to affect the time courses of the processing of valence. In other words, it may not be that positive or negative information is processed more quickly per se, but rather that motivation and attention may determine whether positive or negative information is processed more quickly depending on situational and motivational factors. Third, valence may be confounded with some other variable, such as emotional intensity or motivational significance and differences reflect this other variable.

Flexible tuning of arousal and/or valence components?

Presumably, increased states of arousal direct attention toward motivationally salient stimuli in complex environments and prepare an organism for behavior. Because different stimuli may be deemed “important” at different times, a general arousal or vigilance system that is itself independent of valence might function most efficiently. This system presumably is involved in monitoring the environment, detecting potentially relevant changes, and redirecting
attention, such that significant emotional stimuli can receive enhanced processing. Either after attention has been directed, or perhaps in parallel, whether a stimulus is positive or negative is computed. Consistent with the idea of a functional connection between arousal and attention, studies have demonstrated similar effects for both positive and negative stimuli in brain areas associated with attention, such as the anterior cingulate gyrus and visual sensory areas (Schupp, Junghofer, Weihe, & Hamm, 2003).

Recent evidence suggests that chronic differences in tuning for valenced information (positivity vs. negativity bias) as well as situational variables may direct attention and the perception of emotional intensity. We (Cunningham, Raye, & Johnson, in press) presented participants with positively and negatively valenced stimuli during fMRI scanning. After scanning, participants completed an individual differences measure of their prevention and promotion focus orientation (i.e., participants indicated whether they were more motivated by positive or negative stimuli, e.g., see Higgins, 1997). As participants were more promotion focused, greater activation was observed in the amygdala, anterior cingulate gyrus, and extrastriate cortex for positive stimuli. As participants were more prevention focused, greater activation was observed in these same regions for negative stimuli. Thus, amygdala and attentional brain regions were tuned not toward a particular valence, but rather toward stimuli that were motivationally important. Similarly, Canli, Sivers, Whitfield, Gotlib, & Gabrieli (2002) found that amygdala activation for happy faces was correlated with extraversion and Mather, Canli, English et al. (2004) found that whereas amygdala activation was greater for negative stimuli for young adults, it was greater for positive stimuli for older adults. Presumably, happy faces signal an important environmental cue for extraverts (more so than for introverts) and positive stimuli are more important for older adults than for younger adults, consistent with other
evidence of an age shift in the relative salience of negative and positive stimuli (Charles, Mather, & Carstensen, 2003). Thus, although the motivational significance of stimuli may differ between people, similar structures are involved in processing these stimuli.

**Implicit and Explicit Processes in Attitudes**

Most current social cognitive theories of attitude propose that two sets of processes/systems underlie evaluation (see Chaiken & Trope, 1999). Although these models use different names for the processes and seek to explain different aspects of attitudes (e.g., structure, function, persuasion, etc.), they typically propose one system that operates relatively automatically and effortlessly, and another that requires more cognitive attention or effort (Chaiken, 1980; Gilbert, Pelham, & Krull, 1988; Fazio, 1990; Greenwald & Banaji, 1995; Petty & Cacioppo, 1984). Often the second, more effortful, system is proposed to play a corrective role in attitudinal processing by updating or modifying an initial response or judgment deemed to be inappropriate or suboptimal given current motivational and situational constraints (Devine, 1989; Fazio, 1990; Petty & Wegener, 1993). Following this logic, dominant models of attitude have suggested that attitudes reflect dissociated memory representations (Greenwald & Banaji, 1995). That is, automatic processes activate implicit attitudes and controlled processes activate explicit attitudes.

We suggest that thinking about attitudes as having both implicit and explicit components is useful as a heuristic, but attitudes very likely do not break down into a simple implicit/explicit dichotomy. At a coarse-grained level of analysis, some processes can be thought of as being relatively automatic, reflexive, and not initiated consciously. Others involve more conscious deliberation, and usually require more time to initiate. But some “implicit” processes are more automatic than others, and some “explicit” processes require more deliberation than others. Thus,
we suggest that implicit/explicit or automatic/controlled are not dichotomous categories and that they likely do not operate in an all-or-none fashion. Different explicit (or implicit) evaluations may recruit different processes and brain systems. Moreover, we suggest that these implicit and explicit processes begin to interact or become integrated throughout the processing stream. For example, as time increases between the initiation of evaluative processing and the response we measure, additional component processes can be engaged that may provide a richer and more elaborate attitude. In fact, some researchers suggest that at least some attentional processing is necessary for emotional processing to initiate (Pessoa & Ungerleider, 2005). Thus, although we refer to the relative automaticity of processes for the purposes of description, we endorse neither a rigid dichotomy nor a single-factor continuum.

Early/Unaware emotional processing. Given the importance of arousal in directing attention, it is not surprising that these computations occur at a very early stage of information processing. In a study of face perception, Asley, Vuilleumier, & Swick (2004) found that ERP signals differed between emotional and non-emotional faces as early as 120 to 160ms after stimulus presentation (see also Pizzagalli et al., 2002; Eimer & Holmes, 2002). In fact, ERP differences to emotional stimuli compared with neutral stimuli have been observed as early as 94ms after stimulus presentation in occipital regions (Batty & Taylor, 2003). What is particularly interesting about this rapid emotional processing is that structural processing and identification of facial features is thought to not occur until 170ms after stimulus presentation (Sagiv & Bentin, 2001), suggesting that the processing of emotional expression, a signal which can denote safety or danger, may occur in parallel with facial structural encoding processes. In other words, emotional significance may be processed before a stimulus has been fully identified (e.g., see Niedenthal & Kitayama, 1994).
Moreover, not only are these early emotional processes relatively automatic, they also may occur in the absence of conscious awareness. Several studies have now demonstrated psychological signs of emotional processing to stimuli that participants do not report even having seen. For example, skin conductance and ERP signals have been detected to the subliminal presentation of emotional faces as rapidly as 100ms after stimulus presentation (Ohman & Soares, 1996; Williams, Liddel, Rathjen, et al., 2003). fMRI studies have found amygdala activation to subliminal presentations of fearful faces (Whalen et al., 1998) and angry faces that have been previously associated with an aversive stimulus (Morris et al., 1996).

**More complex emotional processing.** Because some aspects of emotional intensity can occur relatively automatically does not mean that all of emotional processing is automatic, unconscious, or inevitable. As more time is available for evaluation, additional processing components can be brought to bear. Explicit evaluation may induce both more cognitively complex attitudes and more affectively complex attitudes. For example, simple emotions (e.g., fear, joy) can arise from relatively automatic processing of a stimulus, whereas more complex emotions (e.g., remorse, jealously, empathy) typically involve more reflective processing (e.g., Johnson & Multhaup, 1992). Cunningham, Raye, & Johnson (2004) found that some brain regions (e.g., an area of the orbital frontal cortex and the temporal pole) were associated with emotional intensity only when participants were making a reflective evaluation. Thus, the emotional qualities accompanying an evaluative judgment made with or without reflection may be qualitatively distinct. For example, for some people, affirmative action may elicit relatively simple feelings of fear or anger arising from automatic processing, and guilt, jealousy, hope or other complex emotions arising with reflective processing.
Additional evidence for differences in the functional roles of emotional processes (e.g., gut responses versus more cognitive aspects) in evaluation comes from work by Bechara and colleagues using the Iowa Gambling Task (see Bechara, 2004 for a review). In this task, participants select cards from different decks of cards with different reward contingencies. Some decks provide high immediate gains, but overall are disadvantageous (providing, on average, fewer rewards), whereas others provide small rewards, but overall are advantageous (on average providing higher rewards). Although orbital frontal patients showed normal skin conductance responses (SCRs) when receiving rewards and punishments, they did not show anticipatory SCR prior to their decisions. This dissociation suggests that some emotional processes are involved in the planning and simulation of emotional experience to make a decision, and others are involved in the processing of current rewards and punishments.

Ambivalence and Control. Explicit evaluation involves monitoring, manipulating, inhibiting, controlling, or differentially weighting evaluative information to reach an evaluative judgment. When contrasting tasks that require evaluative and nonevaluative judgments, we find greater activation in medial areas of the prefrontal cortex (PFC) when participants make evaluative judgments, and lateral areas of the PFC when participants make nonevaluative judgments (Cunningham et al., 2003, 2004). More importantly, several of the prefrontal regions were associated with the processing of attitude complexity (having simultaneous positive and negative responses) or control of an initial response. The functional role of more reflective/controlled evaluative processes may be to respond to and mitigate evaluative complexity by withholding responses until more information is available, integrating multiple sources of information, and/or deliberately retrieving additional memory representations.
Such processes are particularly important when stimuli are more complex; for example, when both positive and negative aspects are activated simultaneously (perhaps by different subsystems). This simultaneous state of feeling both positive and negative, or ambivalence, has been shown behaviorally when people win or lose at a task but do not win or lose as much as they could have; for example, when they only win $5 when $9 was possible (Larsen, McGraw, Mellers, & Cacioppo, 2004). At the neural level, an area of right orbital frontal cortex (BA47) shows greater activation when participants make Good/Bad judgments about ambivalent compared to non-ambivalent (e.g., neutral, clearly positive, or clearly negative) stimuli (Cunningham et al., 2003; Cunningham et al., 2004).

In such cases of attitude conflict, it is necessary to engage in control processes to reduce the cognitive or affective inconsistency that ambivalence brings (Festinger, 1954; Heider, 1946). As in monitoring memories (e.g., Johnson, Hashtroudi, & Lindsay, 1993), the functional role of more reflective or controlled processes in evaluation may be to withhold responding until more information is available, integrate multiple sources or dimensions of information, and/or retrieve additional information. Through these additional control processes, evaluations can be brought into line with personal values, motivational goals, or situational constraints.

Brain regions that are involved in the regulation of affective states, including areas of the anterior PFC and anterior cingulate gyrus (Cunningham et al. 2004; Ochsner et al., 2002) are similar to those involved in cognitive control more generally (Cohen, Botvinick, Carter, 2000; MacDonald, Cohen, Stenger, & Carter, 2000; Johnson, Raye, Mitchell et al., in press). Interestingly, several of these regions are involved in control whether one is downregulating (dampening) or upregulating (enhancing) emotional experience (Ochsner, Ray, Cooper et al., in press). Furthermore, the degree of prefrontal EEG asymmetry is correlated with a decreased
startle response to evocative stimuli, suggesting a direct role of the lateral PFC in the control of emotional states (Jackson, Mueller, Dolski, Dalton et al., 2003).

As in processes associated with arousal or valence, the processes associated with ambivalence and control are likely to occur with different temporal dynamics or at different points in the processing stream, with at least two sets of processes involved in the processing attitudinal ambivalence. With respect to cognitive conflict and control, Botvinick, Braver, Barch, Carter, and Cohen (2001) propose that there are separable conflict-detection and regulatory systems. Whereas the conflict-detection system is proposed to operate relatively automatically, the regulation system requires or is associated with more controlled processing. Providing support for this proposed distinction in the domain of evaluation, Cunningham, Raye, & Johnson (2004) found that some brain areas, such as ventrolateral PFC, correlated with self-reported ratings of control to particular stimuli, even when making nonevaluative judgments. Although this may suggest that these processes are automatic, when participants made explicitly evaluative Good/Bad judgments, these regions were significantly more active. In addition, other brain regions were active only when participants had an agenda to evaluate, such as areas in anterior PFC. This suggests that ambivalence, and the control induced by ambivalence, may be hierarchically organized, such that different degrees of reflection are necessary for different processes of control. Consistent with this idea, Amodio, Harmon-Jones, Devine, Curtin, Hartley, & Covert (2004) found ERP signals associated with control that occurred less than 200ms after the presentation of Black and White faces. Yet, despite signals that control was engaged, participants on average still showed evidence of prejudice in that they were more likely to misperceive a tool as a gun when it was preceded by a Black than a White face, suggesting that more time or additional processes are necessary for more complete control.
APPLICATIONS FOR PREJUDICE RESEARCH

An early focus for the social neuroscience study of attitudes has been the important domain of prejudice. Initial studies demonstrated a role for the amygdala in the processing of other-race faces. Hart et al. (2000) demonstrated that amygdala activation to supraliminal Black faces habituated more slowly than White faces for White participants, and the reverse pattern was found for Black participants. They concluded that all faces are processed immediately for their threat value, but that in-group faces are deemed safe more quickly than out-group faces. The role of the amygdala in inter-group perception was further demonstrated by Phelps, O’Connor, Cunningham et al. (2000) who showed that greater amygdala activation to Black than White faces was correlated with an indirect measure of race bias that reflects the extent to which Black is associated with Bad and White with Good, the race IAT. Interestingly, neither of these studies showed overall greater amygdala activation to Black faces relative to White faces for White participants.

One potential explanation for not finding the expected greater amygdala activation to Black than White faces is that control processes may inhibit or reconstrue an activated emotional response. That is, rather than automatic attitude being separate from controlled aspects of attitude, the two systems may be more dynamically linked. Thus, for participants viewing long blocks of Black or White faces (as in Hart et al., 2000 and Phelps et al., 2000), control processes may dampen any automatic effects that would otherwise be observed. Consistent with this hypothesis, Cunningham, Johnson, Raye et al. (2004) found that 12 out of 13 White participants had greater activation to Black than to White faces (which were randomly intermixed), but only when the faces were presented briefly and masked such that participants did not report seeing the faces. As one might expect given our control hypothesis, for faces that could be clearly seen, the
decreased activation to Black relative to White faces was accompanied by activation in areas of the PFC and the anterior cingulate gyrus – areas that are associated with cognitive control.

Interestingly, it appears that mental activities that counteract prejudiced thoughts may diminish control in other situations. According to Baumester, Bratslavsky, Muraven, and Tice (1998), regulation is a limited resource, and any act of control not only uses up resources at the time of control, but also for some time afterward while the system recuperates. Richeson and Shelton (2003) found that after nonprejudiced White participants interacted with a Black individual, they subsequently performed worse at the Stroop task, a task that requires cognitive control for incompatible trials (e.g., reporting that the word green is in a red print color). In a followup fMRI study, Richeson, Baird, Gordon et al. (2003) scanned White participants while they viewed Black and White faces using fMRI. Afterward, participants performed the Stroop task. As in Cunningham et al. (2004), greater activation was observed in the right lateral PFC while participants viewed Black compared with White faces. Furthermore, the degree of right PFC activity while viewing Black faces during the fMRI task predicted subsequent Stroop performance, with those with the most right PFC activity performing the worst later. Presumably, the cognitive cost of control was manifested in the subsequent cognitive task. This pattern of findings provides support for the idea that nonprejudiced participants attempt to regulate their emotional responses to Black faces.

It should be noted that the amygdala should not be considered the source of prejudice, but rather one component that may contribute to biased responses in the context of a larger attitude system. For example, Phelps, Cannistraci, and Cunningham (2003) reported on a patient who, despite bilateral amygdala damage, still showed evidence of automatic race biases on an indirect measure of automatic associations, suggesting that automatic evaluative responses are possible
without an amygdala. This should not necessarily be surprising as amygdala activation seems to now be better characterized as processing emotionally significant stimuli rather than simply negative, fearful, or threatening stimuli (Canli et al., 2004; Cunningham et al., 2004; Mather et al., 2004). In the processing of social groups, and people or objects in general, other areas are associated with processing emotional intensity and valence, notably, right prefrontal and orbital frontal cortex. Additional patient work examining which aspects of evaluative processing are impaired with particular forms of damage would be informative.

CONCLUSIONS

Evaluations arise from multiple component cognitive and affective processes that work in concert to make judgments about the world. Any given process does not typically work alone in an all or none fashion, but rather various combinations of processes generate qualitatively different evaluative outcomes. Different situational and motivational constraints, including whether or not an explicit evaluation is required, activate different component processes, resulting in different overall evaluations of a stimulus. Thus, the same stimulus can produce quite different subjective evaluative experiences (for example, a positive attitude in one circumstance and a negative in another). Attitudes can be thought of as the constructed output of combinations of currently active component processes.

Already, neuroimaging results suggest that different patterns of brain activity are associated with emotional intensity, positivity, negativity, ambivalence, and control, and that activity in different areas may have different temporal signatures. Furthermore, compared to implicit expression of attitudes, having an agenda to explicitly evaluate a stimulus results in additional brain areas associated with the processing of each of these aspects. Our evolving component process framework assumes that implicit and explicit evaluation are not wholly
independent; common processes may be involved both in the formation of quick-and-crude automatic judgments as well as more systematically derived reflective judgments. Future research is needed to understand how these basic processes work in more dynamic and integrated ways to construct attitudinal states.

A challenge for future research is to understand how disparate elements or processes become unified to give rise to phenomenal experience and behavior. It is likely that prefrontal regions, such as areas in medial PFC that receive inputs from throughout the brain, function as polymodal integration centers. To the extent that different processes unfold at different rates, this means that evaluations may vary from second to second (or millisecond to millisecond) as new information is processed. For example, if a judgment is required early in the processing stream, an evaluation can be based only on relatively automatic processing of simple emotional responses (initial arousal and/or valence). More reflective processing of these aspects typically requires time to initiate, as does regulation and control. Interestingly, with practice, regulation and control can be accomplished via more automatic processes (e.g., Gollwitzer, Wasel, & Schaal, 1999). Attitudes, in this framework, reflect the current processing of an integrated information processing system at any given time. At some point, a judgment may be required, and this state is the person’s attitude at that given moment. The particular ways in which information is constrained, weighed, and integrated as attitudes are constructed on line is a challenging problem. Also of particular interest are the conditions under which the result is not a unified evaluation—the conditions under which ambivalence persists.

Although understanding attitudes presents a considerable challenge for analysis, there is a rich history of relevant theoretical ideas and findings from social and cognitive psychology and intriguing new findings from social cognitive neuroscience. Variability in an individual’s
attitudes toward the nominally same stimulus may mean that there is more than one “true” attitude—that different attitudes reflect particular combinations of elements at different times to satisfy different constraints. As social neuroscience investigations of attitude and evaluation continue, it is likely that a clearer picture of this dynamic system will emerge yielding better understanding of how important aspects of attitudes arise from the intersection of emotional and cognitive processes. Attitudes are evaluative outcomes, reflecting the way that aspects of experience that are typically labeled as emotional (valence, intensity, ambivalence) arise from processes that are typically labeled as cognitive (perceptual and reflective). In other words, just as emotion and cognition (e.g., Johnson & Multhaup, 1992) and motivation and cognition (e.g., Johnson & Sherman, 1990), are interactively linked, attitudes are not something apart from the cognitive, affective, and behavioral processes that contribute to them and that they in turn contribute to. In this dynamic, integrated system, attitudes and emotions in turn influence cognitive processes (including in ways that we sometimes label as motivational).
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