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Affect as Information About Liking, Efficacy, and Importance

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(6012 words)

Sunny Spring days are associated with reports of greater life satisfaction (Schwarz & Clore, 1983), greater agreement with persuasive arguments (Sinclair, Mark, & Clore, 1994), and even greater profits from stock and bonds (Saunders, 1993). Indeed, stock trades from 26 exchanges around the world between 1982 and 1997 showed that profits were up 24.8% on unseasonably sunny days compared to cloudy days (Hirschleifer & Shumway, 2003). Unseasonably sunny weather appears to elicit positive affect, which is then reflected in positive judgments. In this chapter, we discuss such findings from the standpoint of the affect-as-information approach (Clore, Schwarz & Conway, 1994).

Affective reactions, in this view, provide embodied information about value, that is, about goodness and badness (Clore, Wyer, Dienes, Gasper, Gohm, & Isbell, 2001). Through the lens of positive affect, stocks, life satisfaction, and other objects of judgment seem more positive, and our sense of efficacy on tasks seems higher. In addition, the experience of affective arousal makes situations seem more

important. The flashes of affective feeling that we experience thus govern our attitudes, provide red and green lights for different thinking styles, and guide attention and memory.

In our view, these affective influences are functional (Clore, in press), in contrast to the prevailing view of affect as a source of irrationality and bias in the judgment and decision-making literature. Several other lines of work (e.g., Barrett, Mayer, & Salovey, 2003; Damasio, 1994; Hazelton & Ketelaar, this volume) also suggest the adaptive value of affect as information for making judgments and decisions.

This review is organized into three sections devoted to recent investigations of affective influences on Judgment, Processing, and Memory. We focus on new research from this perspective on judgment (see Forgas, this volume), processing (see Bless & Fiedler, this volume), and memory (see Eich, this volume).

AFFECT AND JUDGMENT

Mood influences our judgments of consumer products (Adaval, 1997), political candidates (Ottati & Isbell, 1996), risks (Gasper & Clore, 1998), and life satisfaction (Schwarz & Clore, 1983), as well as many other kinds of evaluations (e.g., Esses & Zanna, 1995; Forgas, Bower, & Krantz, 1984; Forgas & Moylan, 1991; Keltner, Locke, & Audrain, 1993). To determine whether such evaluations really reflect the influence of affect rather than of cognitive content, investigators often use films, music, and other techniques to vary feelings independently of thoughts about the object of judgment. The results show that affect does influence

evaluative judgment quite readily, even when objectively irrelevant to the object of judgment. Since affective feelings usually are reactions to something in particular, affect that has no salient object (e.g., mood) tends to be experienced as a reaction to whatever is in mind at the time, a process that Clore et al (2001) referred to as the Immediacy Principle. Of course, such affective promiscuity (in which objectless affect attaches itself to substitute objects) was also a cornerstone of Freud's (1959/1915) theory.

Affect-as-Information

The affect-as-information approach (e.g., Schwarz & Clore, 1983, 1988, 1996; Clore, et al, 2001) rests on the idea that affective processes mainly occur outside of awareness. As a result, we are "strangers to ourselves" (Wilson, 2002), and the experience of affect is therefore crucial for providing us with conscious information about our unconscious appraisals. Affective feelings thus allow us to learn about our own implicit judgments and decisions.

Traditionally, investigators of judgment and decision-making emphasized the role of accessible information about objects of judgment and decision alternatives. Such stimulus information is important, of course, but it has gradually become apparent that the proximal factor in judgments and decisions is really a person's actual and anticipated affective reactions to that information (e.g., Schwarz, & Clore, 2005; Baumeister et al, this volume).

Integral Affect. The widespread acceptance of the role of affect means that it is no longer mandatory to induce irrelevant moods in order to vary affect

independently of cognitive content. Thus, some studies now focus on integral, as opposed to incidental, affect (e.g., Pham, 2004; Harber, 2005). Does the affect-as-information position apply to integral affect studies, since they involve neither irrelevant mood nor misattribution? It does, because the theory is not really about mood, but is rather a general account of affective influences. Mood manipulations have simply provided investigators with a convenient source of unassigned affect. The larger idea is simply that when making evaluative judgments, people often attend to their feelings, as if asking themselves, "How do I feel about it?" (Schwarz & Clore, 1988). When they do, they generally like what they feel good about and dislike what they feel bad about. But the link between affect and liking ultimately depends on its information value. The information value depends in turn on tacit attributions about the source and apparent meaning of the affect (Schwarz & Clore, 1983). In addition, it depends on the context, so that sad affect during a sad movie, for example, would be expected to increase rather than decrease evaluation of the film (Martin, 2001).

Heuristics. Following the "How do I feel about it?" heuristic suggested by Schwarz and Clore (1988), Slovic, Finucane, Peters, and MacGregor (2003) proposed a similar "affect heuristic," and Monin (2003) proposed a "warm glow heuristic." Slovic et al. suggest that the affect heuristic leads to "probability neglect." That is, when potential outcomes are highly emotionally desirable or undesirable, people tend to ignore information about how probable or improbable they are, as illustrated by the rush to buy lottery tickets when large jackpots are announced.

Monin's (2003) "warm glow" heuristic, on the other hand, concerns the mere exposure effect. But whereas the mere exposure effect concerns liking after familiarization, Monin found that people also judge attractive faces and other liked stimuli as familiar. Using the affect-as-information approach, Monin suggested that people sometimes attribute the warm glow of positive feelings from liking as due to familiarity.

In a related way, various other investigators also assume that the attributional processes outlined in the feelings-as-information approach govern the construction of a variety of kinds of judgment situations. These include the impact of value from regulatory fit (Higgins, Idson, Freitas, Spiegel, & Molden, 2003), the role of ease of retrieval in belief and attitude judgment (Schwarz, 2003), and the influence of affect from processing fluency in mere exposure and other situations (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). To illustrate the wide applicability of such affective processes, we consider next affective influences on perception.

Research

Perception. In the 1950's, investigators of what was called the "New Look" (Bruner (1957) proposed that perception was not a passive registration of external reality, but an adaptive process reflecting internal expectations and motivations. Fifty years later, research is again examining how internal factors, including emotion, have an impact on perception of the physical world. For example, research shows that when people are elderly, tired, or are simply wearing a heavy backpack, they perceive hills as steeper and distances as farther (e.g.,

Proffitt, Creem, & Zosh, 2001; Witt, Proffitt, & Epstein, 2004). In addition, some research has examined how negative affect can also cause people to make mountains out of molehills. For example, Reiner, Stefanucci, Proffitt, and Clore (2003) had participants listen to happy or sad music as they stood at the base of a relatively steep hill and made multiple judgments of the degree of incline. They discovered that sad mood led people to overestimate steepness when it was assessed verbally and visually, but not when assessed haptically, through the use of a paddle board that participants adjusted by feel rather than by sight. Affective feelings thus appear to inform explicit, but not implicit measures of perception.

Specific Emotions. In addition to studies of happy and sad mood, investigators are also increasingly examining specific emotions (e.g., Tiedens & Linton, 2001). For example, Lerner, Small, and Loewenstein (2004) found that disgust eliminates the endowment effect (the tendency to put a higher selling price on something one owns than one would have been willing to pay for it initially). The phenomenon indicates that mere ownership confers value. Feelings of disgust, however, appeared to *contaminate* the object, since both sellers and buyers reduced their prices.

Disgust has also been a focus of work by Haidt (2001) on morality. He proposed that moral judgments reflect emotional responses rather than deliberative moral reasoning, as assumed since Kohlberg (1969). In his studies of "moral dumbfounding," Haidt asks students to consider a variety of odd behaviors, such as siblings having sex or a person eating his pet dog after it is killed in an accident. Participants find such acts

immoral, but they are unsure why. Haidt suggests that the judgments of immorality are based on reactions of disgust, and that the reasons people give for their judgments are really afterthoughts. Evidence comes from two experiments by Schnall, Haidt, and Clore (2005) who found that inducing feelings of disgust led to more severe moral judgments among people who routinely attend to their own bodily cues. For example, disgust was induced by having participants work in a dirty environment (e.g., sitting at a dirty desk next to an overflowing garbage can, etc). Results suggest that, at least for individuals who attend to their bodily cues, feelings of disgust were experienced as moral indignation, suggesting that moral judgments may indeed be based on affect.

The effects of fear and anger on judgments have also been examined in studies of attitudes toward outgroups (Mackie, Devos, & Smith, 2000). Different emotions mediated different reactions in that groups that were feared tended to be avoided, whereas groups that made people angry tended to elicit aggressiveness. Similarly, DeSteno, Dasgupta, Bartlett, and Caidric (2004) found that anger increased implicit prejudice toward an outgroup, whereas sadness and neutrality did not.

Fear and anxiety have been the focus of research on risk (e.g., Butler & Mathews, 1987; Gasper & Clore 1998). Indeed, Loewenstein, Weber, Hsee, and Welch (2001) proposed a "risk-as-feeling model," which is quite similar to affect-as-information approaches. They suggest that risk estimates are more often guided by internal feelings than by objective evidence about risks and probabilities. For example, when deciding whether to get insurance against floods or earthquakes, people tend to overestimate the likelihood

of such events if they are exposed to vivid examples that elicit affect.

Individual Differences. The pervasiveness of such influences lead one to ask whether all evaluative judgments and decisions are based on affect and emotion. Some investigators seem to assume that they are (e.g., Cabanac, Guillaume, Balasko, & Fleury, 2002; Loewenstein, 1996; Pham, 2004). But studies of mood and political choice (Isbell & Wyer, 1999; Ottati & Isbell, 1996) found mood effects on candidate evaluations mainly for individuals with little political knowledge. Mood effects were not found among those who were more politically informed. Individual differences in emotional intelligence also play a role (for a review of relevant scales see Gohm & Clore, 2000). For example, people who attend to their feelings, compared to those that do not, show mood effects (Gasper & Clore, 2000), as do people high in self-esteem, compared to those low in self-esteem (Harber, 2005). For example, Harber (2005) asked respondents to rate how distressed infants seemed to be during a circumcision operation on the basis of their recorded cries. He found that only high esteem individuals relied on their own affective reactions as information about the distress of the infants.

Unconscious Processes. We have emphasized the role of experienced affective cues, but it turns out that similar effects can be found with primed concepts. For example, Winkielman, Zajonc, and Schwarz (1997) found that subliminally exposed happy or angry faces influenced liking for novel Chinese ideographs presented immediately afterward. Clore and Colcombe (2003) also reported mood-like effects after unconscious priming with

happy and sad words. Such studies show that affective stimuli outside of awareness can influence judgment in a manner similar to that of affective feelings.

The parallel effects of affective mood and unconscious affective primes could have several meanings. They could mean that mood effects are generally mediated by mood-congruent conceptual primes (Bower, Montiero, & Gilligan, 1978; Isen, Shalke, Clark, & Karp, 1978; Forgas & Bower, 1988). The findings could also mean the reverse, namely, that affective priming is effective because it elicits unconscious affect (Bargh, 1997; Winkielman, Zajonc, & Schwarz, 1997). However, we favor a different possibility. Induced mood and subliminal affective primes have similar effects simply because both are compelling forms of affective information (Clore & Colcombe, 2003). The contribution of the affect-as-information perspective lies in the discovery that it is not affective feeling *per se*, but the compelling nature of the evaluative information that such feeling conveys. However, when confronted with an attitude object, we can also be informed by the emergence of positive or negative thoughts or inclinations toward it as a result of conceptual priming. The critical element is whether or not such feelings, thoughts, and inclinations are experienced as spontaneous reactions to the object of judgment. We construct our explicit attitudes by being visited by such affective information. These considerations raise larger issues about the role of conscious and unconscious processes more generally, a topic that we touch upon next.

Consciousness. If we need affective feelings to inform us about what we like and dislike, then it would seem to follow that the liking and disliking itself

must occur out of awareness. If so, then feelings may only be correlated with, and not necessarily causal in, the formation of (implicit) liking. The role of consciousness of attitude objects and feelings would then mainly serve to ensure that explicit judgments are consistent with already formed implicit judgments. If so, *implicit* liking may be thought of as an unconscious association between some hormonal (e.g., dopamine) release in response to a neural representation of an attitude object. *Explicit* liking would then be the conscious association of the experience of that affect and the experience of the attitude object.

Crick and Koch (1998) have speculated about the basis and function of consciousness. They note that part of the brain acts like a zombie by producing motor output from visual input without being able to say what was seen. For example, lore has it that tennis players can react to a fast serve before they can see the ball, and that the seeing might come afterward. They suggest, however, that we are probably not guided merely by a collection of unconscious, specialized zombie systems for specific tasks, because that would be an inefficient arrangement. Instead, they proposed that our single, conscious representation of visual scenes has the benefit of reducing hesitation as the brain chooses among possible plans for action.

Does the same logic hold for emotion? Since most emotional processing is unavailable to awareness, could emotional tasks be handled by an unconscious affective zombie system? No, we suggest that the conscious feelings that do accompany emotions too are important as they motivate attention and action,

influence choice, and alert us about what is of value.

Summary

We noted that the general acceptance of affective influences has led to an increase in studies relying on integral affect, and that the affect-as-information approach is equally applicable to instances of incidental and integral affect. The general applicability of the approach has led to the postulation of similar heuristics and to its use in a wide variety of social cognitive explanations. We reviewed research on the influence of sad affect on perception of the inclines of hills (Rainer, et al 2003), and reviewed a variety of studies of specific emotions with judgment outcomes, including disgust, fear, and anger. For example, some findings indicate that anger leads to different orientations toward outgroups than does fear (Mackie, et al, 2000) or sadness (DeSteno, et al., 2004). In other research, disgust was shown to lower the desirability of associated objects (Lerner et al, 2003), but to heighten the sensitivity to moral infractions (Schnall et al, 2005). Anxiety was also found to elevate risk estimates (Loewenstein, et al, 2001). Some research shows individual differences in affect use. For example, Harber (2005) suggested that low esteem individuals tend not to base their judgments on their feelings, because they do not find their feelings to be a credible source of information. But individuals who habitually attend to their feelings appear especially likely to use them in judgment (Gaspar & Clore, 2000).

We next discussed unconscious factors in affective influences on judgment (e.g., Winkielman, Zajonc, & Schwarz, 1997). We examined the parallel results of unconscious affective priming and

conscious mood manipulations, suggesting that each reflects the activation of affective meanings which are compelling and easily misattributed (Clore & Colcombe, 2003). We noted that the reason one needs the information conveyed in one's affective reactions in the first place is that the actual processes of liking and attitude formation are unconscious. We suggested that implicit liking reflects unconscious affective reactions, but explicit liking is a construction that relies on the conscious experience of affect (Clore, Storbeck, Robinson, & Centerbar, in press). We turn next to a consideration of the influence of affect on styles of information processing.

AFFECT AND COGNITIVE PROCESSING

Positive and negative feelings are essentially our attitude toward whatever is in focus at the time. The basic rule of affect in judgment is, "If it feels good, it is good." But when we are focused on a task instead of an object of judgment, then our positive affect may be experienced as feelings of efficacy instead of as feelings of liking. Such positive feedback promotes reliance on one's own beliefs, expectations, and inclinations. The basic rule of affect in problem solving tasks, therefore, is, "If it feels good, just do it." Depending on one's focus of attention, affective valence can provide information that an object of judgment is good or bad or that one's knowledge, expectations, and inclinations are adequate or inadequate for a task. In that case, rather than conveying attitude, affect guides how we process information. Positive affect promotes interpretive or "relational" processing; negative affect leads to detailed, stimulus-bound, or "referential" processing.

The general idea is that everyday information processing involves a constant interplay of perception and cognition. Neisser (1976) characterized this as a “perceptual cycle.” In this cycle, he proposed that whatever schema is active guides information search, information search then provides new data, and new data in turn modifies the active schema, and so on. Piaget (1954) also proposed that the developing child both assimilates incoming information to existing schemas, and accommodates new information by changing existing schemas. Visual perception too is assumed to involve a constant interplay of top-down and bottom-up processes (e.g., Palmer, 1975).

The influence of affect can be thought of as privileging one or the other of these processes. For example, positive affective cues appear to trigger assimilation, top-down, or theory-driven processing, whereas negative affect elicits accommodation, bottom-up, or data-driven processing (e.g., Clore et al, 2001; Fiedler, 2001). Other related characterizations emphasize that affect conveys information about task situations as benign or as problematic, which elicits cognitive tuning (Schwarz & Clore, 1996). In that view, when positive affect signals a benign situation, people engage in heuristic processing, whereas when negative affect signals a problematic situation, people engage in more systematic processing. A variation is to suggest that that positive affect, but not negative affect, results in reliance on general knowledge structures (Bless, Clore, Golisano, Rabel, & Schwarz, 1996). Our own current view is that positive affect leads to “relational” processing, and negative affect to “referential” or item specific processing (Storbeck & Clore, in press). These accounts make generally similar

predictions. One phenomenon explained by these accounts is the influence of affect on global vs. local processing, to which we turn next.

Research

Global vs. Local Processing.

Gaspar and Clore (2002) found that individuals in happy moods were more likely than those in sad moods to match geometric figures on the basis of global rather than local similarities. In addition, Gaspar (2004) found that as happiness increases, people are also faster at making global matches, whereas increases in sad mood speeds local matches. This finding is interesting, because one might have expected sad moods to slow instead of speed up reaction times. In addition, Gaspar (2004) manipulated attributions and showed that, consistent with expectations from the affect-as-information approach, the effects of mood on global vs. local focus depend on the apparent information value of the happy and sad feelings.

Other experiments also suggest that mood affects global and local attention. For example, Isbell, Burns, & Haar (2005) demonstrated that affect influences the extent to which individuals select global versus specific social information when forming impressions. They found that happy participants were more likely to form impressions of others by examining global information (e.g., traits) before they looked at more specific information (e.g., behaviors). The results suggest that affect influences the types of information that individuals *seek out* when forming impressions of others.

Stereotypes. The idea that positive affect elicits a focus on global rather than

local stimuli can also be applied to the relationship between mood and stereotype use. Research has demonstrated that happy moods lead to increased stereotyping, while sad moods lead to reduced stereotyping (e.g., Bodenhausen, Kramer, & Susser, 1994; Isbell, 2005). In addition, Bodenhausen, Sheppard, and Kramer (1994) showed that angry participants behaved like participants in happy moods. Both groups were more likely than sad participants to use an ethnic stereotype to convict a defendant in a mock trial situation. This result is somewhat surprising until one considers that both anger and happiness imply that one's own perspective is correct. Anger appears to be an emotion specifically concerned with asserting the rightness of one's own perspective. Indeed, angry individuals, even more than those in positive moods, may feel empowered to rely on their own beliefs, expectations, and inclinations.

Egalitarianism. According to the affect-as-information approach, happy mood serves as a green light and sad mood as a red light for relying on accessible cognitions and inclinations. If so, the fact that stereotypes are so often accessible in the society at large suggests that individuals in happy (or angry) moods are likely to use stereotypes in everyday life. However, some research suggests that the effect of mood on stereotyping may depend critically on perceivers' goals.

Dunn and Clore (2004) reasoned that people who are chronically motivated to be egalitarian might exhibit less stereotyping in a happy mood, because positive mood promotes responding on the basis of one's accessible inclinations. If their inclination is to avoid stereotypical thinking, then positive feelings may act as a green light

and negative affect as red light for that inclination. If so, then in contrast to the usual pattern, chronic egalitarians might show less stereotyping in happy moods and increased stereotyping in sad moods, as negative affect blocks their egalitarian inclinations. This is exactly what they found, chronic egalitarians in happy moods reduced stereotyping towards women in a lexical decision task, whereas controls in happy moods revealed more stereotyping of females in the same task. Thus, rather than exerting a direct influence on stereotyping, positive affect enhances dominant responses, which in the case of chronic egalitarians, is to avoid stereotyping.

Priming. Affect-as-information approaches have typically examined explicit processes, but the approach should also apply to implicit processes. To examine this possibility, Storbeck and Clore (2005) induced either positive or negative moods with music and then had participants complete either an evaluation priming task, a categorization priming task, or a lexical decision priming task. They found that happy moods promoted the typical priming effects in each task, whereas sad moods inhibited priming. These effects were observed for all three priming tasks and for multiple prime presentation durations. Other researchers have found similar mood effects on priming and Stroop-like tasks (Corson, 2004; Hanze & Hesse, 1993; Hermsen, Holland, and van Knippenberg, 2004). Collectively, these studies suggest that mood may influence cognitive processes at an implicit, automatic level.

False Memory Effects. The activation of implicit semantic associations observed in priming effects has also been proposed as the mechanism behind the

Deese-Roediger-McDermott false memory paradigm (Roediger, Bolata, and Watson, 2001). Based on this assumption, positive moods should promote such implicit associations and negative mood should impair implicit associations, thereby reducing false memory effects. Storbeck and Clore (in press) found support for this prediction. That is, when exposed to lists of words, each of which was associated with a different critical lure, individuals in happy moods recalled more critical lures, which had never been presented, compared to individuals in sad moods. For example, happy individuals were more likely to recall the word “sleep” (a critical lure) after studying associated words such as bed, pillow, awake, rest, wake, etc. Moreover, further experiments provided evidence suggesting that these effects were due to mood influences on encoding, rather than on retrieval processes.

Mood Effects Without Mood.

Before leaving the topic of affect and processing, it is important to note that sources of affective information other than mood often have similar influences. For example, evidence from Clore and Colcombe (2003) suggests that without changing people’s moods, unconsciously primed affective thoughts can have mood-like effects on information processing. The same has been found for making happy and sad facial expressions (e.g., Schnall & Clore, June 2002; Strack, Martin, & Stepper, 1988), and even for “happy” and “sad” colors (Soldat, & Sinclair, 2001). Of course, unconscious priming, posed expressions, and related stimuli sometimes do affect mood, but in these instances their effects were not mediated by mood. Hence, it appears that various different kinds of affective cues can have similar effects.

Similar effects can be expected to the extent that cues from diverse sources all convey information about goodness or badness (Clore & Colcombe, 2003). Indeed, even in studies of felt mood, we assume that the active agent is not the feelings themselves, but their information value, as discussed earlier. The spontaneity and compellingness of the evaluative information is more important than whether the medium of the information consists of is facial muscles, motor actions, visceral feelings, or thoughts. Thus, the influence of affective feedback on judgment and processing is not limited to feelings, because such affective information can be represented in multiple embodied media.

Relevant Neuroscience

Behavioral research by Gray (2001) found that positive moods increased performance on verbal working memory tasks, while negative moods decreased performance. A follow-up study done by Gray and colleagues (Gray, Braver, & Raichle, 2002) found that such mood and task manipulations led to changes within lateral prefrontal cortex, suggesting that moods paired with a task shifted processing to different neural areas. A study by Baker, Frith, and Dolan (1997) found that sad individuals performing a verbal fluency task showed reduced activation of areas relevant to verbal working memory. These findings are consistent with the neurological models proposed by Drevets (2000), Mayberg, Liotti, Brannan, McGinnis, Mahurin, Jerabek, Silva, Tekell, Martin, Lancaster, & Fox (1999), and George, Ketter, Parekh, Herscovitch, & Post (1996). This brief look at activation patterns in the brain during positive and negative emotional states highlights some of the connections

between emotional and cognitive areas (Drevets, 2000; Drevets & Raichle, 1998; Mayberg, 1997). In negative moods, one sees greater activation of limbic and emotional areas and less activation of areas relevant to working memory and attention. This pattern is consistent with the affect-as-information idea that sad mood leads to referential or item-specific processing. That is, individuals in sad moods tend to focus on perceptual data from the environment and are less concerned with cognitive associations in memory. In positive moods, the reverse is true. Limbic and emotional areas become less active, and the prefrontal areas associated with working memory and attention become more active. This pattern is consistent with the affect-as-information idea that happy moods lead to relational processing. That is, they are focused on relating incoming information to accessible cognitions in memory.

The neurological data might imply that the relationship between affect and processing is really a neuro-anatomical rather than a psychological phenomenon. That is, perhaps good mood and relational processing occur together simply because they show the same neural address. The reality appears likely to be more complex, however, in part because attribution manipulations can so readily alter or reverse the mood-processing relationship. That is, awareness that one's affective feelings are irrelevant and do not represent efficacy feedback tends to reverse mood effects on processing (e.g., Dienes, 1996; Gasper, 2004, Isbell, 2004).

Summary

In this section, we discussed research on how affect influences cognitive processing. The research shows

that processing strategies can be influenced by happy and sad moods (e.g., Schwarz & Clore, 1996), by specific emotions (e.g., Tiedens & Linton, 2001), by feedback from emotional expressions (e.g., Schnall, Clore, & Ryan, 2005), and even by engaging in approach and avoidance actions (e.g., Friedman & Förster, 2000). According to the affect-as-information perspective (e.g., Clore et al, 2001), these affective cues serve as feedback about the task (or one's efficacy on the task), which elicits cognitive processing tuned to the kind of situation signaled by the affect.

Specifically, positive moods promote processing of items relationally, which should increase priming, false memory effects, creative problem solving, and accessibility of automatic attitudes. On the other hand, negative moods should promote referential or item-specific processing, which should reduce effects that rely on relational processing, such as priming and the false memory effect. We reviewed imaging studies that find activation of different neural substrates for positive and negative moods. Those data show that positive moods increase activity relevant to verbal working memory and verbal associations, task switching, and error detection, whereas negative moods increase areas concerned with spatial working memory and visual attention. Such patterns are compatible with the behavioral results of mood on processing.

AFFECT AND MEMORY

Mood and Memory

Some of the most influential studies of affect and cognition were early studies by Bower (e.g., Bower et al., 1978) and by Isen (e.g., Isen et al., 1978). Both programs of work focused on the idea that

mood activates valence-congruent material in memory. Bower (1981) suggested that moods act like nodes in memory that are capable of activating associated material in memory. Isen, who was focused more on judgment and behavior, suggested also that moods should activate mood-congruent material in memory, setting up a cognitive loop that would influence judgment (see also Eich, this volume).

An important difference between memory-based models and the affect-as-information approach lies in whether evaluative judgments are based on cognitive or affective factors. The memory-based models assume that affect operates through the concepts and beliefs that it brings to mind, whereas informational models assume that affect itself is often the critical stimulus. The issue is whether liking consists of having particular thoughts or particular feelings and inclinations?

One way to address the issue is to examine whether affect does activate affect-congruent material in memory. There is little doubt that feeling happy or depressed is often accompanied by similarly valenced thoughts. The question is whether such ideation is activated directly by affect or by cognitions about affect. A review of the mood and memory literature (Wyer, Clore, & Isbell, 1999) suggests caution in assuming that memory activation comes from the affect itself, as opposed to coming from cognitions inadvertently activated by mood induction procedures.

Of course focusing attention on one's feelings will result in feeling-congruent thoughts, just as focusing on a chair will result in chair-relevant thoughts. But that is an unremarkable claim. The

issue is whether background feelings of mood themselves should automatically activate mood-congruent material in memory (rather than whether thoughts about mood would do so). A recent review by Storbeck, Robinson, and McCourt (in press) suggests that memory is organized in terms of descriptive categories (e.g., animals, places, etc.) rather than in terms of evaluations (e.g., good, bad).

Studies that have varied mood and the salience of mood-relevant concepts (e.g., Parrott & Sabini, 1990) suggest that mood itself may not be the active agent determining which memories come to mind. In addition, although mood does appear to govern priming generally (Storbeck & Clore, 2005), it does not lead to mood-congruent priming. Also, the asymmetry seen in mood effects on memory are not mirrored in mood effects on judgment, suggesting that mood effects on judgment may not be memory-based. Indeed, a host of findings in the social cognition literature has long suggested that interpersonal judgments are surprisingly independent of the content of memories about people (for a review see Wyer & Srull, 1989). Thus, despite the popularity of the idea, it is not clear that mood effects on cognition are mediated by the activation of mood-congruent material in memory. However, new data do show that affective factors are crucial for understanding memory, as detailed below.

Arousal-as-importance

From the affect-as-information perspective, the valence of affect provides information about goodness and badness and the arousal component provides information about importance (Clore & Schnall, 2005; Frijda, Ortony, Sonnemons & Clore, 1992; Simon, 1967). Arousal

draws attention to salient environmental stimuli, thereby influencing what gets consolidated into long term memory. Arousal marks information as important both implicitly, through the action of adrenergic hormones, and explicitly, through the subjective experience of importance.

Research suggests that arousal will have its greatest influence on memory for events two days after encoding (see McGaugh, 2004; Christianson, 1984). Until recently, most relevant behavioral research has been limited to studies of arousal-congruent memory (e.g., Gilligan & Bower, 1984) and memory after relatively short delays (e.g., Varner & Ellis, 1998). Most of the relevant evidence comes from neuroscience data using rats, although some human data are beginning to appear.

Relevant Neuroscience

The implicit operation of arousal is mediated by the adrenergic hormonal system. Working with rats, McGaugh (2004) has found ample evidence that endogenous stress hormones directly and indirectly mediate amygdala activity. In turn, the amygdala then mediates the consolidation of long-term memories in the neocortex (e.g., hippocampus). Such a system presumably does not need the subjective experience of arousal to enhance memory (Cahill & Alkire, 2003). However, the activation of the amygdala by this system may be involved in drawing attention to stimuli in the environment. Back-projections from the amygdala to the visual cortex provide information about which features should be attended to and stored (Rolls, 1999).

The amygdala also modulates the long-term potentiation process that occurs in the hippocampus, which is necessary for the formation of declarative (experienced) memory (Abe, 2001). Consistent with such conclusions is the observation that patients with amygdala lesions fail to show enhanced memory for arousing stimuli (Adolphs, Cahill, Schul, & Babinsky, 1997). But amnesics with an intact amygdala do show enhanced memory for emotional stimuli (Hamann, Cahill, McGaugh, & Squire, 1997). Research in normal populations using imaging technology has also shown the amygdala to be involved in the enhanced memory for emotional stimuli. (Cahill, Haier, Fallon, Alkire, Tang, Keator, Wu, and McGaugh, 1996). Cahill et al. presented a series of affectively laden pictures and tested memory for the pictures 3 weeks later. They found an impressive correlation ($r = .93$) between amygdala activation during encoding and recall of those images (see Canli, Zhao, Brewer, Gabrieli, & Cahill, 2000; Cahill, McGaugh, & Weinberger, 2001; Guy & Cahill, 1999; Hamann, Ely, Grafton, & Kilts, 1999 for similar results).

In addition, Hamann and colleagues have observed similar memory enhancement effects for positive as well as negative images (1997, 1999). Ashby, Isen, and Turken (1999) suggested a similar modulatory role for positive affect on memory via dopamine. They proposed that dopamine modulates the release of excitatory neurotransmitters vital for increased consolidation. Such considerations suggest that emotional memory enhancement is not limited to negative emotions.

Summary

Emotional arousal appears to act at both encoding (attention and elaboration) and consolidation (Hamann, 2001). Moreover, the effect can occur for various types of stimuli including emotional words, pictures, and stories (Cahill, et al., 2001; Canli, et al., 2000; Guy & Cahill, 1999; Hamann, 2001; Kleinsmith & Kaplan, 1963). We noted that arousal appears to be the critical factor, as evident in results reported by Cahill, Prins, Weber, and McGaugh, (1994), who found that β -

adrenergic blocking agents (which block adrenergic stress hormones) eliminate enhanced memory for emotional material. The experience of arousal may serve as information to the system about importance, guiding attention and thus selecting the material to be retained or consolidated into long-term memory.

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