Johnson, M.K., & Weisz, C. (1994). Comments on unconscious processing: Finding emotion in the cognitive stream. In P.M. Niedenthal & S. Kitayama (Eds.), *The heart's eye: Emotional influences in perception and attention* (pp. 145-164). San Diego, CA: Academic Press.

# Comments on Unconscious Processing: Finding Emotion in the Cognitive Stream

**Marcia K. Johnson**
**Carolyn Weisz**
*Princeton University*

No matter what their domain of research, scholarship, or practice, or their theoretical orientation, most psychologists have at least a closet interest in unconscious processes. In recent years, the question is often framed (some might say "sublimated") as a contrast between automatic and controlled processes, where automatic processes are those that take place outside of conscious awareness, are fast and effortless, and are unlikely to be disturbed by competing task demands. Interest in unconscious processes can be seen in questions such as: Are all meanings of a word simultaneously and automatically activated? Is frequency (or spatial or temporal) information encoded automatically? In what ways does information that we cannot voluntarily recall or recognize nevertheless influence our thought and behavior on priming and other transfer tests? Can emotion arise automatically, unaffected by cognition?

Such questions often turn out to be especially tricky, both conceptually and methodologically. Yet, as the chapters in this volume illustrate, they are

The Heart's Eye: Emotional Influences in Perception and Attention
Copyright © 1994 by Academic Press, Inc. All rights of reproduction in any form reserved.

central to an understanding of how the mind works. In particular, these chapters explore the extent to which emotion operates at the "front end" of cognition—during a hypothetical, unconscious stage of processing where perception and attention seem to grab stimulus information from the environment. This is sometimes described as an efficient, inflexible, encapsulated, context-free phase of cognition, where "thought" and goals as we phenomenally experience them exert no control. At issue is whether and how emotion affects the detection, identification, and classification of words and nonverbal stimuli such as faces or random shapes, and whether these effects are automatic. Before turning to the studies of emotion and cognition, however, we begin with a tale of a rejected manuscript (Wang & Johnson, 1978). Although the manuscript was about unconscious processing of frequency information, not unconscious processing of emotion, it points out some common themes that arise in work on unconscious processing.

## *Unconscious Processing of Frequency Information?*

Wang and Johnson (1978) explored the intersect of two basic ideas. One was the suggestion that people may have some information about a stimulus even when they cannot tell the specific identity of the stimulus (e.g., Brand, 1971; Jonides & Gleitman, 1972; Postman, Bruner & McGinnies, 1948). The other was the suggestion that processes underlying the monitoring of recurrences, the recording of event frequency, and mechanisms controlling the availability of this information are likely central memory functions (e.g., Hasher & Chromiak, 1977; Johnson, 1977). The question Wang and Johnson (1978) investigated was whether subjects could draw on information reflecting word frequency even if they could not clearly identify a word (a possibility that had been raised, Broadbent, 1967; Brown & Rubenstein, 1961). The two experiments reported were relatively simple: high- or low-frequency four-letter words (e.g., MIND) were presented tachistoscopically and masked, followed by a forced-choice recognition test consisting of the target and a semantically unrelated high- or low-frequency distractor. Performance, measured by errors, response times, and confidence ratings, was better when target and distractor came from different frequency classes than when they came from the same frequency class. This overall pattern was obtained both when the test pairs were orthographically similar, differing in one letter (MIND–MEND) and when they were orthographically dissimilar and shared no letters (MIND–WORK).

The authors suggested that a sensitivity to frequency of occurrence which preceded conscious identification of an item would be a great value as a preattentive screening device for stimuli, allowing the unusual to stand out among the usual or vice versa. The ability to quickly differentiate the familiar

from the unfamiliar, even under degraded conditions (e.g., low illumination levels, peripheral vision, noise, etc.) would have obvious evolutionary usefulness. A sensitivity to the frequency with which one has previously experienced an event would permit one to attend selectively to either the familiar or unfamiliar, depending on the goals of the moment.

While the functional importance of a mechanism(s) for detecting familiarity is obvious, the nature of the mechanism is not. Wang and Johnson (1978) suggested that in some situations qualitative or quantitative aspects of *processing* of high- and low-frequency items may differ and people may be sensitive to, though not necessarily conscious of, such characteristics of their own cognitive operations. They considered the possibility that peripheral processing (e.g., the extraction of visual features) of frequent items is faster for high- than for low-frequency items. If subjects were sensitive to the *speed of their own processing*, then this would be a potential discriminative cue on the recognition test. Although this idea seemed plausible (indeed the idea that subjects are sensitive to "perceptual fluency" [Jacoby & Dallas, 1981] now has wide acceptance), it did not exactly fit the particular results obtained. If more visual information were extracted per unit of time for high-frequency words, in addition to the superiority of test pairs differing in frequency, Wang and Johnson should also have obtained at least a small overall advantage for high-frequency targets, which they did not.

Wang and Johnson (1978) favored instead the idea that the amount or degree of dispersion of activation as a consequence of processing a stimulus is positively related to its frequency of occurrence. More activation should typically occur for high-frequency items because meaningfulness, indicated by, for example, the number of the relationships a word enters into (Noble, 1952; Paivio, Yuille, & Madigan, 1968), increases with frequency of occurrence (Noble, 1963; Paivio et al., 1968). If subjects were sensitive to the level of activation generated by an item, then they could potentially use this as a cue; that is, if they were sensitive to the amount of activation generated by the target item, on the forced-choice test between a high- and low-frequency item they could make a match based on the amount of activation of each of the two test items.

The idea that activation spreads based on meaningful (associative or semantic) relations, has had many proponents (e.g., Collins & Lofus, 1975; Meyer & Schvaneveldt, 1971; Osgood, 1953; Morgan & Underwood, 1950; Underwood, 1965). Some word-processing models further proposed that semantic spread to new items *followed* word recognition or detection (see Becker & Killion, 1977; Schvaneveldt, Meyer, & Becker, 1976).

An alternative considered by Wang and Johnson (1978) was that the threshold that is relevant for word identification (and/or conscious awareness or producing a naming response) may not be the same as the threshold that is relevant for initiating the spread of activation to semantically related

trace systems. The idea that spreading excitation along semantic associations begins prior to final identification of a word was consistent with other findings suggesting the possibility of subliminal semantic effects (e.g., Dixon, 1971; Erdelyi, 1974) or simultaneous activation of multiple meanings of the same physical stimulus (e.g., Conrad, 1974; Warren & Warren, 1976). In short, if subjects were sensitive to (though not necessarily consciously aware of) the overall degree of activation generated by a subthreshold or incompletely identified stimulus, then this information could be used as a cue to the target's meaningfulness or frequency class.

Wang and Johnson (1978) further speculated that, more generally, attention is attracted by changes, in either direction, in ongoing activation level. Thus, attentional selection could occur not only on the basis of physical or semantic characteristics but on the basis of familiarity as well. Thus, we see a friend stand out in a crowd and yet see a stranger stand out among a group of friends.

The reviewers were not impressed by either the theorizing or the data. They wondered if the effect was somehow specific to the set of items used; maybe the items differed in some way other than word frequency. Maybe the obtained pattern was somehow produced by orthographic frequency letter contingencies at the subword level. The manuscript languished in the "to revise" pile. Perhaps today the same manuscript would get a more receptive set of reviewers, given the general acceptance of ideas such as "perceptual fluency" as a basis for judgment (e.g., Jacoby & Dallas, 1981); activation of semantic information prior to word identification (Marcel, 1983; Fowler, Wolford, Slade, & Tassinary, 1981); and the fundamental importance of frequency information across a range of tasks (Hasher & Zacks, 1979, 1984).

Our goal in recounting the story is not to revive the cause of unconscious processing of frequency. Rather, we want to make two points. First, we empathize with those who toil in the messy field of unconscious processing, and believe that it is healthy to cultivate some theoretical ideas, even if all the rocks have not been removed. Second, and more important, substitute "emotion" for "frequency" in the above discussion, and the argument would be similar to that represented in some of the chapters in this volume. The parallel illustrates something fundamental about unconscious processes: people seem able to unconsciously process many aspects of stimuli such as frequency, perceptual qualities, and affective connotation, and we may unconsciously abstract new relations and contingencies as well (Lewicki, 1986; Niedenthal, 1990; Reber, 1976; but see Perruchet, Gallego, & Savy, 1990).

Is all this information activated automatically and inevitably? Perhaps, but fast, "automatic" processing does not necessarily imply context-free processing that is immune to goals. The stimulus set, cues from instructions, and task demands can create an environment in which subjects show remarkable sensitivity to dimensions, recurrences, and regularities built into

a stimulus set by the experimenter. We are inclined to believe that rather than simply reflecting static knowledge structures and inflexible, automatic "modules" or stages of processing, unconscious processes demonstrate some of the same flexibility that conscious processes do: they are sensitive to context, compute information along dimensions that fit current tasks, are opportunistic, and are affected by goals. With this set of assumptions in mind, we will consider some of the findings and ideas in this section of *The Heart's Eye*.

## Emotion and "Front-End" Cognition

The chapters in the first section of this volume explore a variety of fundamental issues: Does mood affect not only what we think, but what we see? Do the emotional connotations of words affect perception and thought even before, and perhaps more strongly than, the semantic aspects of words? Can preferences and/or other evaluative responses to stimuli arise before we consciously identify stimuli or become conscious of our evaluations? Does unconscious affect control the deployment of attention? We briefly review some highlights of the chapters in this section, and consider the issues raised in the context of understanding emotion within a broader cognitive framework.

### Moods and Spreading Activation

Niedenthal, Setterlund, and Jones (NSJ; this volume) suggest that identification of words whose meanings are congruent with a perceiver's current mood requires less sensory evidence than does identification of words that are not mood congruent. This prediction of perceptual facilitation follows from the idea that information is represented in nodes (or codes) within an interconnected associative network and that identification of a stimulus occurs when the activation in a node exceeds a certain threshold (e.g., Morton, 1969). In such a network, preactivation of a conceptual (or word) node would occur via spreading activation from node(s) that represent the mood or aspects of the mood. A preactivated representation would take less external input to reach its threshold of identification (i.e., conscious awareness). NSJ address a fundamental problem for such a view. Given this clear prediction, why has there been so little good evidence that mood affects perception in the way predicted (e.g., Gerrig & Bower, 1982; Clark, Teasdale, Broadbent, & Martin, 1983)?

NSJ suggest that most studies looking for the effects of mood on perception have been insensitive because they have not taken into account the probable organizational structure of the presumed underlying network. In a

structured network, you would not expect activation to spread from a "sad" emotional state equally to any negatively valenced concept, nor from a "happy" emotional state equally to any positively valenced concept. For example, being sad should activate concepts and memories related to *sadness*, but not necessarily concepts and memories related to *fear*. Yet most prior work looked for mood effects on items drawn from a general, valenced (positive or negative) category rather than on items related to the more specific mood that had been invoked. Consistent with this, NSJ then show that the items used in perceptual tasks will determine whether mood effects are found.

NSJ played happy or sad classical music to induce moods (Eich & Metcalfe, 1989) and then had subjects decide whether letter strings were words or nonwords (lexical decision task). The words represented the categories of happy, positive, sad, negative, and neutral and were equated across categories for frequency, length, and immovability (but not, perhaps importantly, for familiarity or interitem associations). Consistent with previous research, the happy and sad subjects did not differ in the time required to make lexical decisions about positively and negatively valenced words that were not specifically related to the induced happy and sad moods. Thus, from these data alone it appears that mood does not affect perception. The intriguing new finding was that happy subjects made lexical decisions about happy words faster than did sad subjects and sad subjects made lexical decisions about sad words faster than did happy subjects. This outcome is clearly consistent with the idea that mood effects in perception and memory may be much more specific than previously assumed.

In another experiment, subjects categorized photographs of faces as male and female as quickly as possible. The faces expressed happiness, sadness, or a neutral emotion. For the male faces only, there was a marginally significant interaction such that sad subjects were slow compared to happy subjects on the happy faces and fast compared to happy subjects on the sad faces. These results were weaker than the lexical decision findings. However, if substantiated with future work, they raise the interesting question of how mood congruence might affect face perception. In a semantic network of concepts represented by words, it is relatively easy to imagine a word becoming preactivated as a consequence of one's mood and hence easier to process. In the case of novel faces that presumably are not already existing nodes in the semantic network, the relevant preactivation that is driven by mood presumably is of component features of various facial expressions or an expression prototype. This feature or prototype preactivation presumably would allow one to process mood-congruent expressive features of new faces more quickly and hence make any identification responses, such as gender, more quickly.

The idea that moods propagate activation through a network in a rela-

tively differentiated or "categorical" way nicely accounts for asymmetrical effects of positive and negative moods reported in the mood and memory literature. Positive emotions more consistently cue emotion-congruent information than do negative emotions (Blaney, 1986; Singer & Salovey, 1988). NSJ suggest that the positive material used in experiments typically more closely matches the induced mood (usually happiness) than does the negative material match the induced mood (usually sadness).

NSJ also discuss the notion that activation spreading from an emotion node such as *sad* may be greater than the activation spreading from a category node such as *furniture* (Gilligan & Bower, 1984). The general idea seems to be that emotional arousal contributes to the spread of excitation, either by producing more activation, longer lasting activation, or activation that spreads further. This provides a potential mechanism for how emotion might disrupt thought processes under certain circumstances. Activation generated from nonemotional concepts (being less strong, briefer, or spreading less far) would not compete effectively with activation generated from emotional concepts. But note, it should be possible to offset such emotional effects with activation generated by ongoing goals or "agendas" (Johnson, 1992; Johnson & Hirst, 1993), which presumably could help keep nonemotional information activated and competitive.

An idea expressed by NSJ that seems problematic to us is that emotion words and emotion knowledge are different than other words and knowledge because they are *felt*, whereas other concepts are not. Consider, for example, ideas like *chair*, *spin*, or *bicycle*, which though not obviously emotional, likely consist of some body knowledge. Conversely, as NSJ point out, activation of words and propositions about emotions do not always activate bodily sensations. Thus, although the somatic aspects of emotion are clearly phenomenally salient and theoretically important, emotional stimuli are unlikely to be unique in their connections with bodily sensations.

A related key idea developed by NSJ is that emotional knowledge exists on at least three basic levels: in a lexicon, as conceptual knowledge, and in somatic representations. However, probably most knowledge includes such levels of information. The main value of emphasizing various "levels" of representation is not to qualitatively distinguish emotion from other categories of experience, but to emphasize the point that not all aspects of emotional knowledge are activated in any particular situation. As NSJ suggest, activation at a given level might sometimes occur with and sometimes without activation at other levels. It seems to us, moreover, in accounting for why activation might sometimes stay within one level and sometimes spread to others, we again enter the domains of context, goals, and control.

Finally, NSJ depict categorical organization at every level of representation (e.g., somatic, conceptual, lexical), implying that interconnections between levels are also organized primarily categorically. But categorical orga-

nization may not exist at all levels. Moods may be partially created and maintained because of the activation of certain nonsomatic (e.g., conceptual) representations. Thus, it is possible that the categorical structure of emotional representation resides primarily at conceptual and lexical levels, while representations are less categorical and perhaps only loosely valenced at the somatic level. In order to test the idea that *somatic* representations are themselves categorically organized, one would want to induce moods categorically (e.g., distinguishing between anger and sadness) in ways that do not rely on conceptual and lexical information—a task that seems nearly impossible. For example, sad music probably evokes conceptual associations with sadness as well as instigating somatic affect consistent with a sad mood.

## Chronic Evaluation

Pratto (this volume) develops the hypothesis that we chronically *evaluate* stimuli without awareness, and suggests that negative stimuli, especially, attract attention. She advances the argument that chronic evaluation and predisposition toward evolutionarily important stimuli result in a process called "automatic vigilance." As supporting evidence for chronic evaluation, she notes that subjects may show preferences for previously exposed stimuli over new stimuli, even though subjects had not consciously evaluated the stimuli during the preexposure phase (e.g., Seamon, Brody, & Kauff, 1983).

However, as Pratto notes, the fact that these Phase 2 judgments are affected by exposure to the stimuli in Phase 1 does not necessarily mean subjects automatically evaluated the stimuli in Phase 1. One possibility is that subjects have picked up some information in Phase 1 that may be used in making preference judgments in Phase 2 (see also Klinger & Greenwald, this volume). In other tasks, the same information might be used to make nonevaluative judgments when no other basis for decision is readily available (such as lightness or darkness judgments, see Mandler, Nakamura, & Van Zandt, 1987).

Another type of evidence discussed by Pratto is a study by Bargh, Litt, Pratto, and Spielman (1989). Subjects were given brief presentations of personality trait adjectives (e.g., *gentle*). Subjects received semantic probes (choose the word most like the one presented from a pair such as *kind* or *intelligent*) and evaluative probes (was the word *good* or *bad*?). Above-chance performance on the evaluative questions occurred at briefer stimulus presentations compared to the semantic questions. Because people were accurate at the evaluation judgment at such short exposure durations, Pratto suggests that evaluation may occur more readily than the rest of meaning apprehension; that is, people evaluate stimuli preconsciously when a stimulus is presented even though they have no intention to do so.

Similarly, in a study by Fazio, Sanbonmatsu, Powell, and Kardes (1986), subjects were required to evaluate trait adjectives by responding *good* or *bad*. Each item was primed by valenced items such as *priest, pizza,* or *toothache.* Subjects evaluated the adjectives more quickly when the prime (e.g., *pizza*) and the target (e.g., *intelligent*) had the same valence than when the valences of the prime and target were inconsistent. Similar effects were reported by Bargh, Chaiken, Govender, and Pratto (1992). Pratto concludes that attitudes automatically become activated on exposure to the prime stimuli—the facilitation/inhibition presumably reflects this automatic, ongoing evaluation. But, as Pratto notes, the general task context might contribute to such effects. The subject's ongoing and primary task is to evaluate target stimuli; if the responses of "good" and "bad" are highly activated throughout the task, it seems likely they would be applied to the primes as well as the targets in this context. A response to the prime that fits the response appropriate for the target should produce faster times than mismatched responses (i.e., there may be response or motor priming). This does not imply, however, that evaluative responses would be major components of the responses to such items in a nonevaluative context.

More directly to the point that subjects may make evaluative responses when not directed to do so are the Pratto and John (1991) studies. Subjects named the color of the print of personality trait words (e.g., *honest*). Subjects took longer to respond to negative than to positive trait words and remembered the negative words better on a recall test. Furthermore, in a subsequent experiment described by Pratto, subjects took longer on the negative items even when warned (incorrectly) that they might take longer on the positive words. These findings are consistent with the idea that valenced information is activated when not directly relevant to the task, and even when it might interfere with the primary task.

Pratto describes a related experiment in which subjects named print colors of negative (*mutilating, violence*), positive (*kissing, baby*), and neutral (*administer, doorstep*) verbs and nouns. In this case, response times to negative and positive items did not differ and both were slower than to neutral items. However, when items having to do with "romance, violent sex, or babies" were replaced with other items, the negatives again were slower than the positives. (Items were controlled for frequency and word length.) Pratto concludes that negative stimuli and reproductively relevant positive stimuli are particularly "attention grabbing." In short, "simple evaluation as good or bad appears to occur automatically in every sense of the word: effortlessly, uncontrollable, outside of awareness. Yet it signals consciousness by guiding attention to valenced information."

Pratto also makes the interesting suggestion that although evaluation may be chronic, it is not particularly "fine grained" or discriminating. The average response times to name colors of negative traits was longer than the

average response times to name colors of positive traits, but the degree of negativity or positivity did not matter.

This rather gross differentiation between negative and positive items in color naming is in contrast to the more categorical mood effects reported by NJS in the lexical decision task. It would be interesting to see if mood-induced subjects would show categorical interference effects in the color-naming task. Such an outcome would suggest that moods can structure spreading activation when reading is incidental to a task (color naming) as well as when it is central to a task (lexical decision). Another possibility is that the word processing that goes on in color naming taps into earlier phases of word processing than does lexical decision. And, as discussed in the next section, there may be even less differentiated affective responses that operate in even earlier stages of word processing. Using a task requiring the perceptual identification of briefly presented words, Kitayama and Howard (this volume) suggest that affective responses discriminate emotional from nonemotional stimuli, but do not differentiate positive from negative stimuli.

Before moving on to consider the Kitayama and Howard chapter, we make one additional comment. Although the results of Pratto and John's (1991) color naming studies present a provocative pattern, they are not entirely persuasive with respect to Pratto's two main points: (1) that evaluation is chronic, regardless of intentions and task demands; and (2) that negative stimuli especially attract attention. The interpretive problem arises, we think, from the possibility of context effects in the color-naming task. As has been noted about semantic priming, estimates of priming vary, depending on the proportion of items of a particular type included in the test list (e.g., Neely, Keefe, & Ross, 1989; Tweedy, Lapinski, & Schvaneveldt, 1977). So, estimates of interference in the color-naming task might be affected by the proportion or items of a particular type. More important, perhaps, the interitem associations among the words would be expected to affect the extent to which word reading interferes with color naming. If there is semantic priming among items, this would increase activation on particular items, making the reading response easier and consequently increasing the word's potential for competition with color naming. Neither the "expectancy" created by many words of the same type nor the impact of interitem semantic relations on activation level need be "conscious." Furthermore, in the studies described by Pratto, there may be more or stronger interitem relations among the negative (and among a subset of the positive) items than among neutral items. In short, semantic or associative relations among words could increase their activation levels, creating interference in color naming. Such an effect would be expected even when the items are not emotionally loaded. Controlling for word length and frequency among item sets does not control for familiarity and interitem associative relations. The results would

more strongly imply chronic evaluation and an advantage for negative items if obtained with only a few unrelated negative and positive target items embedded in many neutral items.

### Affect and the Amplification of Attention

Kitayama and Howard (K&H, this volume) assume semantic activation similar to that discussed by NSJ. They also are interested in the attention-grabbing aspects of emotion, as is Pratto. Their notion is that preconscious activation of a *perceptual* code is sufficient to elicit some emotion associated with the code and that this preconscious affect amplifies the attentional processing directed in the region of the perceptual code. According to K&H, whether this "amplified" attention results in enhancement or impairment of conscious perception depends on whether it falls on a relatively isolated target stimulus candidate (producing enhancement), or on a larger set of items including activated competitors (producing impairment).

These ideas were investigated in a study in which trials consisted of a target word flashed at 33 msec, followed by a choice between a pair of words consisting of the target and a distractor with the same valence (Kitayama, 1992). Accuracy of identification did not differ for negative and positive items. Furthermore, whether accuracy was higher or lower for the emotional than for the neutral items depended on word length. For short words, identification of emotional items was worse, and for long words, identification of emotional items was slightly better. K&H suggest this pattern arises because there are fewer likely alternatives for the long than for the short words and thus affect is more likely to amplify the attention given to the correct item relative to its potential competitors in the case of short words. The idea that attention is amplified, however, does not seem to add much to what might follow from a simple notion of spreading activation. If, compared to long words, short words give rise to more alternatives that are more densely connected to other words, any increase in activation would spread more among short words, causing more potential interference.

The particularly interesting idea here is that affect is connected to *perceptual* codes. Thus, a presumably at-one-time neutral perceptual stimulus configuration, such as SEX, comes (presumably through contiguity and other mechanisms) to be affectively charged: emotion is not only attached to the meaning of the message but to the perceptual aspects of the messenger. Because it seems unlikely that affect is connected to individual letter features, the code to which affect is connected must be fairly well developed. But once we start assuming that affect is attached to a high-level perceptual code via learning, it seems to us that we are already in the realm of meaning. The configuration SEX* (the * indicates "important" or "significant" but does not give any evidence of valence) seems to us to constitute a primitive

semantics. The fact that activation occurs prior to identification does not necessarily imply it is presemantic (after all, semantic processing occurs prior to identification, Marcel, 1983). Thus, a more general question raised by thinking about Kitayama and Howard's findings is: In what sense are functionally important cues not semantic, especially those that have acquired their functional importance through learning? A related issue is whether the activation of emotional significance occurring prior to conscious identification is valenced or unvalenced. Although K&H describe amplification as an undifferentiated response to emotional stimuli, it is possible that processing of emotional significance is categorical in nature. Codes indicating either positive or negative significance might both trigger attentional processes with the same effect.

Another central consideration raised by K&H is that different aspects of events (e.g., voice quality and verbal content of a spoken message) may carry different affective messages, and the potential for one to interfere with the identification of the affective message of the other depends on the relative ease with which the affective information of each can be extracted. K&H describe a study by Kitayama, Taylor, Brown, and Currier (1992) in which subjects were less accurate and slower to identify the negative semantic content of sentences (e.g., *The house was badly damaged last month*) when the sentences were spoken in a positive tone than when they were spoken in a neutral or negative tone. These kind of "mixed-message" situations are one of life's greater social challenges and constitute a rich domain for research. For example, a subtler (but still conflicting) voice tone might produce less interference, or, given the same voice tone, the degree of interference when tone and message conflict should be related to the semantic complexity of the message or to individual differences in comprehension ability. (We may be particularly likely to give such mixed messages to students who are doing poorly by adopting an especially encouraging voice tone when the feedback is "bad." Those students who are going to find it hardest to comprehend the semantic content of the message are perhaps going to be most influenced, and potentially misled, by the upbeat tone.)

## What Gives Rise to Preferences?

Klinger and Greenwald (K&G, this volume) report several experiments by Klinger (1991) patterned after Kunst-Wilson and Zajonc (1980). Klinger presented subjects with five brief (16.7 msec each) exposures to irregular attractive or unattractive (based on other subjects' ratings) octagons in phase one and then in phase two paired these preexposed stimuli with new octagons. Subjects were asked to choose the old item from each pair or to pick the one they liked better. When no mask was used in the preexposure phase (so subjects could clearly see the stimuli) both recognition and preference for

old items was above chance. When a mask was used, recognition was at chance, and prior exposure increased preferences for attractive items but decreased it for unattractive items.

A similar pattern was found with attractive or unattractive names drawn from the telephone book. In phase one, subjects judged the number of syllables in each name and in phase two, subjects rated how much they liked items from a list of old and new names that were matched for attractiveness. Subjects preferred the exposed names. In another condition, Klinger attempted to reduce explicit memory for the preexposed items by introducing a distracting task between phase one and phase two. In this case, subjects preferred the preexposed attractive names, but the preexposed unattractive names were slightly less preferred than the new names.

K&G use these results to argue against the notion that exposure increases preference. Their explanation of why liking judgments are mediated by stimulus attractiveness begins with the commonly accepted idea that exposure generates perceptual records that when activated again can give rise to a feeling of familiarity (e.g., Mandler, 1980; Jacoby & Dallas, 1981). K&G note that feelings of familiarity may be attributed to various sources, depending on task demands. They then propose that source attributions account for the mediating effect of attractiveness in the preexposure/preference paradigm. This last step in the logic is unclear to us. How exactly are source attributions operating (and being mediated by attractiveness) when subjects make liking judgments about polygons and names? (Although we, too, see source monitoring as a fundamental cognitive function [e.g., Johnson, 1988; Johnson, Hashtroudi, & Lindsay, 1993], this is a case where it does not seem central.)[1]

Most previous findings regarding brief preexposure and preference can be explained by assuming that in the absence of any particular preference subjects use differential familiarity responses to choose stimuli in a situation in which they find it difficult to discriminate among stimuli on any other basis. What is especially noteworthy about the results described by K&G is that here preexposure appears to play a role in subjects' computations of attractiveness (as indexed by other subjects' ratings). It is as if preexposure

[1]Klinger and Greenwald in fact discuss some other findings that are not directed specifically at affect, but are quite instructive about source monitoring. K&G found the "false fame" effect (Jacoby, Kelley, Brown, & Jasechko, 1989) as a consequence of preexposure of nonfamous names only for previously exposed attractive names, not for previously exposed unattractive names. In another judgment condition, subjects judged that preexposed attractive (but not unattractive) names belonged to a famous senator, and in yet another condition that preexposed unattractive (but not attractive) names belonged to a famous criminal. These studies nicely highlight the fact that the familiarity of stimuli is interpreted in light of task demands, prior beliefs, and so forth to determine the attributions made in a particular situation. Because source attributions are clearly involved in these latter cases, K&G suggest that source attributions must then be involved in the case of liking judgments. However, this connection is not clear to us.

facilitates extracting aspects of a stimulus that affect attractiveness ratings, making the attractiveness of a preexposed attractive stimulus slightly more available than that of its matched distractor and making the unattractiveness of a preexposed unattractive stimulus slightly more available than that of its matched distractor. That is, preexposure may make aspects of the stimulus that are actually relevant to the liking judgment pop out—preexposure may sensitize subjects to aspects of the stimulus that may later be used in a more deliberate way to make attractiveness ratings. This is quite interesting. The fact that the effects of the attractiveness variable wash out when preexposed stimuli are better remembered (not masked originally, or not subject to manipulations to cause forgetting) suggests that feature pop-out effects are subtle and/or fragile and likely not to be noticed or acted upon when stronger, more salient old/new recognition responses occur.

In short, we agree with K&G that there is no evidence that affect was computed unconsciously in the preexposure phase for incompletely processed (unconscious) stimuli, but they have an intriguing demonstration that the information picked up during such preexposures can influence judgments of affect. Furthermore, their results cannot easily be interpreted as an instance of subjects saying to themselves that they do not know which they prefer so they will simply choose on the basis of familiarity. Here, preexposure seems to affect actual evaluative judgments by influencing availability of aspects of the stimulus relevant to evaluative judgments.

## *General Issues*

All of these chapters explore the idea that emotion is a fundamental part of our transaction with the environment. They suggest that emotion may control our attention, even determine the product of earliest perceptual processing. Furthermore, the impact of emotion may be automatic, beyond control. By way of summary, we will consider three questions central to this characterization of cognition and emotion.

***What is the nature of the earliest emotional responses generated by stimuli?*** Three possibilities are suggested by these chapters: the earliest states of information processing may produce only an unvalenced affective significance (Kitayama & Howard); or, early responses may include valenced affective significance (Pratto); or, early responses may reflect a more categorically differentiated significance (Niedenthal, Setterlund, & Jones). Perhaps one could decide among these possibilities if they were contrasted using the same stimuli in the same paradigm (word identification, color naming, lexical decision, etc.).

Another possibility is that each research program could be tapped into

different stages of preidentification processing, perhaps because of processing characteristics of the different tasks used (e.g., color naming of a word string may be affected by earlier stages of word processing than is a lexical decision about it). We might adopt such a serial processing model in which, for any particular stimulus, information specifying emotional significance is generated before information specifying positive or negative valence, which in turn arises before information specifying the categorical nature (e.g., sadness or fear) of the valenced response. Although sequenced, all phases are completed before stimulus identification.

An alternative possibility is that the pattern of activation generated by a stimulus and the time course of the development of the activation are not fixed, but depend on the task environment, the subject's goals, and so forth (an "opportunistic" model). Like the serial model, the opportunistic model assumes that different patterns of activation probably yield information that is differentially useful for different tasks. The difference is that in the opportunistic model, whether this information is likely to affect task performance —or to be quickly processed for that matter—depends on factors in addition to the strength of the preexperimental bond between perceptual features of the stimulus and various semantic and somatic aspects of emotional experience. Thus, whether valenced information is available early may depend on such factors as how many other strongly valenced stimuli have been recently processed (thus having an opportunity to spread activation to the target in question), the subject's activated agendas (e.g., whether there is a current goal or an active set to evaluate), and whether there are other strong, competing cues in the stimulus or goal environment that inhibit or functionally offset activation-yielding affective information.

***How should we characterize the relation between emotion and perception?*** One possibility is that emotion operates *on* perception. In this view, perception is separate from emotion; emotion serves to energize otherwise activated pathways (K&H), preactivate representations (NJS), or draw attention to particular stimuli (Pratto).

An alternative idea is that emotion does not so much act on perception, rather emotion, like semantics, is an integral part of phenomenal perception; that is, emotion, like meaning, is part of what constitutes perception. In fact, in this view, emotion is part of semantics (e.g., Osgood, Suci, & Tannenbaum, 1957), hence the issue of whether emotion precedes semantics would not make much sense. It would still be interesting if, say, under some particular set of degraded stimulus conditions, valence information was available before, say, taxonomic category information. However, statements about the relative potency of emotion and other semantic relations would have to be based on procedures that fairly equated the potential within sets of items for interitem priming, the perceived goal relevance of the valence and cate-

gorical information, and so forth. Unfortunately, if interitem priming itself is context dependent, trying to equate "emotion" and "semantic" sets of items may be an ultimately impossible task. Consequently, rather than contrast the potency of emotion and semantics in a presumed static associative structure, research questions might be rephrased to emphasize the dynamic interactive quality of cognition. For example, we might ask not whether emotion precedes semantics (or stimulus identification, etc.) but instead attempt to characterize the conditions favoring or not favoring the computation of emotion. With this orientation in mind, failures to find "automatic" encoding of affect (e.g., in the second half of the trials in the Kitayama and Ferguson [1992] study described by K&H) are interesting as well.

***What is the functional importance of "front-end" emotion in perception and thought?*** When emotion does play an early role in processing stimuli, what are the consequences of such affective responses? Consider the case of meaning: even if all meanings of a stimulus are activated simultaneously independent of context, within milliseconds one meaning typically comes to dominate comprehension of the message. Activated information that is not relevant to ongoing schemas seems quite fragile, at least by some measures. The message as comprehended at the idea level is likely to determine what is available for voluntary recall, what further information is sought out, and what inferences seem reasonable and justified. Under some circumstances, the "discarded" meanings seem to play relatively little functional role. When is activated but unattended affective information equally fragile? If I am fleetingly (unconsciously) negatively valenced by something you say, but generally delighted by your message (which fits my own view nicely), under what circumstances does that moment of unconscious negative valence have functional consequences and under what circumstances does it not? In other words, when are we at the mercy of unchecked, perceptually driven, and associative activation and when are we not?

## Concluding Remarks

We have focused on aspects of these chapters relevant to clarifying the role of affect in perceptual processing. In addressing issues such as whether affect precedes semantic analysis (or vice versa), we should keep in mind that in dividing significance into categories such as affective and semantic, we have useful categories for conceptualizing the types of information encoded and remembered (e.g., Johnson et al., 1993), but affect and semantics may not arise in fixed temporal order, in a linear information processing stream. The computations involved in both affect and semantics are likely to be influenced by structure within the stimulus array and by goals and mo-

tives active at the time. Emotion does not have to be computed "first" to be automatic, or to be independent of goals or context in order to be judged central for our understanding of cognition. Feelings are critical to defining motives and agendas; they signal the potential importance of events, they activate related knowledge, they determine what we ruminate about. Their functional role in perception and thought must be enormous, whether we think of them as "first" or "later," or "immersed" in the cognitive stream. In fact, their profound functional importance may arise not because they come first, but because they act iteratively.

In short, we do not have to settle the issue of which information is "first" or which is more affected by context or agendas to get the main message. As clearly illustrated by the work reported in these chapters, affective connotations of stimuli, like other aspects of meaning (e.g., Marcel, 1983; Treisman, 1960), can be activated without intention or awareness and provide a perhaps underestimated influence on perception, thought, and action. Moreover, taken together, the studies described in these papers are quite consistent with the view that perceptual cues can give rise to affect in the absence of reflection (e.g., Johnson & Multhaup, 1992). At the same time, it becomes increasingly clear that the human cognitive system is capable of responding and/or learning to respond along many different dimensions (e.g., graphemic, phonemic, frequency, semantic, affective) extremely rapidly. This incredible flexibility of rapid "front-end" computations along many dimensions and categories, and not a special capacity for any single one (e.g., frequency/novelty or affective significance), may be the real evolutionary story here.

## Acknowledgment

Preparation of this paper was supported by NIA Grants AG09744 and AG09253.

## References

Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. *Journal of Personality and Social Psychology, 62*, 893–912.

Bargh, J. A., Litt, J. E., Pratto, F., & Spielman, L. A. (1989). On the preconscious evaluation of social stimuli. In A. F. Bennet & K. M. McConkey (eds.), *International congress of psychology XXIV. Cognition in individual and social contexts (Vol. 3*, pp. 357–370). Amsterdam: Elsevier/North Holland.

Becker, C. A., & Killion, T. H. (1977). Interaction of visual and cognitive effects in word recognition. *Journal of Experimental Psychology: Human Perception and Performance, 3*, 389–401.

Blaney, P. H. (1986). Affect and memory: A review. *Psychological Bulletin, 99*, 229–246.

Brand, J. (1971). Classification without identification in visual search. *Quarterly Journal of Experimental Psychology, 23*, 178–186.

Broadbent, D. E. (1967). Word-frequency effect and response bias. *Psychological Review, 74*, 1–15.

Brown, C. & Rubenstein, H. (1961). Test of response bias explanation of word-frequency effect. *Science*, 133, 280–281.

Clark, D. M., Teasdale, J. D., Broadbent, D. E., & Martin, M. (1983). Effect of mood on lexical decisions. *Bulletin of the Psychonomic Society*, 21(3), 175–178.

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, 82, 407–428.

Conrad, C. (1974). Context effects in sentence comprehension: A study of the subjective lexicon. *Memory and Cognition*, 2, 130–138.

Dixon, N. F. (1971). *Subliminal perception: The nature of a controversy*. London: McGraw-Hill.

Eich, E., & Metcalfe, J. (1989). Mood dependent memory for internal versus external events. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 443–455.

Erdelyi, M. H. (1974). A new look at the new look: Perceptual defense and vigilance. *Psychological Review*, 81, 1–25.

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, 50, 229–238.

Fowler, C. A., Wolford, G., Slade, R., & Tassinary, L. (1981). Lexical access with and without awareness. *Journal of Experimental Psychology: General*, 110, 341–362.

Gerrig, R. J., & Bower, G. H. (1982). Emotional influences on word recognition. *Bulletin of the Psychonomic Society*, 19(4), 197–200.

Gilligan, S. G., & Bower, G. H. (1984). Cognitive consequences of emotional arousal. In C. E. Izard, J. Kagan, & R. B. Zajonc (eds.), *Emotions, cognition, and behavior* (pp. 547–588). Cambridge: Cambridge University Press.

Greenwald, A. G., Klinger, M. R., & Liu, T. J. (1989). Unconscious processing of dichoptically masked words. *Memory & Cognition*, 17, 35–47.

Hasher, L., & Chromiak, W. (1977). The processing of frequency information: An automatic mechanism? *Journal of Verbal Learning and Verbal Behavior*, 16, 173–184.

Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General*, 108, 356–388.

Hasher, L., & Zacks, R. T. (1984). Automatic processing of fundamental information: The case of frequency of occurrence. *American Psychologist*, 39(12), 1372–1388.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General*, 110, 306–340.

Jacoby, L. L., Kelley, C., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology*, 56, 326–338.

Johnson, M. K. (1977). What is being counted none the less? In I. M. Birnbaum & E. S. Parker (eds.), *Alcohol and human memory* (pp. 43–57). Hillsdale, NJ: Erlbaum.

Johnson, M. K. (1988). Discriminating the origin of information. In T. F. Oltmanns & B. A. Maher (eds.), *Delusional beliefs* (pp. 34–65). New York: Wiley.

Johnson, M. K. (1992). MEM: Mechanisms of recollection. *Journal of Cognitive Neuroscience*, 4, 268–280.

Johnson, M. K., & Hirst, W. (1993). MEM: Memory subsystems as processes. In A. F. Collins, S. E. Gathercole, M. A. Conway, & P. E. Morris (eds.), *Theories of memory* (pp. 241–286). Hove (UK): Erlbaum.

Johnson, M. K., & Multhaup, K. S. (1992). Emotion and MEM. In S.-A. Christianson (ed.), *The handbook of emotion and memory: Research and theory* (pp. 33–66). Hillsdale, NJ: Erlbaum.

Johnson, M. K., & Sherman, S. J. (1990). Constructing and reconstructing the past and the future in the present. In E. T. Higgins & R. M. Sorrentino (eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 482–526). New York: Guilford Press.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, 114, 3–28.

Jonides, J., & Gleitman, H. (1972). A conceptual category effect in visual search: O as letter or as digit. *Perception and Psychophysics*, 12, 457–460.

Kitayama, S. (1992). Affect and perception: Some implications of the amplification model. Unpublished manuscript, University of Oregon.

Kitayama, S., & Ferguson, C. M. (1992). Emotional voice quality and emotional verbal content in speech perception: An exploration with a Stroop task. Unpublished manuscript. University or Oregon.

Kitayama, S., Taylor, T., Brown, T., & Currier, J. (1992). The biasing effects of emotional voice tone in sentence comprehension. Unpublished manuscript. University of Oregon.

Klinger, M. R. (1991). Conscious and unconscious processing in the mere exposure effect. Unpublished doctoral dissertation. University of Washington.

Kunst-Wilson, W. R., & Zajonc, R. B. (1980). Affective discrimination of stimuli that cannot be recognized. *Science*, 207, 557–558.

Lewicki, P. (1986). Processing information about covariations that cannot be articulated. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12, 135–146.

Mandler, G. (1980). Recognizing: The judgment of previous occurrence. *Psychological Review*, 87, 252–271.

Mandler, G., Nakamura, Y., & Van Zandt, B. J. S. (1987). Nonspecific effects of exposure on stimuli that cannot be recognized. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13, 646–648.

Marcel, A. J. (1983). Conscious and unconscious perception: Experiments on visual masking and word recognition. *Cognitive Psychology*, 15, 197–237.

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology*, 90, 227–234.

Morgan, R. L., & Underwood, B. J. (1950). Proactive inhibition as a function of response similarity. *Journal of Experimental Psychology*, 40, 592–603.

Morton, J. (1969). Interaction of information in word recognition. *Psychological Review*, 76, 165–178.

Neely, J. H., Keefe, D. E., & Ross, K. L. (1989). Semantic priming in the lexical decision task: Roles of prospective prime-generated expectancies and retrospective semantic matching. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 1003–1019.

Niedenthal, P. M. (1990). Implicit perception of affective information. *Journal of Experimental Social Psychology*, 26, 505–527.

Noble, C. E. (1952). An analysis of meaning. *Psychological Review*, 59, 421–430.

Noble, C. E. (1963). Meaningfulness and familiarity. In C. N. Cofer & B. S. Musgrave (eds.), *Verbal behavior and learning: Problems and processes* (pp. 76–157). New York: McGraw-Hill.

Osgood, C. E. (1953). *Method and theory in experimental psychology*. New York: Oxford University Press.

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning*. Urbana: University of Illinois Press.

Paivio, A., Yuille, J. C., & Madigan, S. A. (1968). Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of Experimental Psychology Monograph Supplement*, 76, No. 1, Part 2.

Perruchet, P, Gallego, J. & Savy, I. (1990). A critical reappraisal of the evidence for unconscious abstraction of deterministic rules in complex experimental situations. *Cognitive Psychology*, 22, 493–516.

Postman, L., Bruner, J. S., & McGinnies, E. (1948). Personal values as selective factors in perception. *Journal of Abnormal and Social Psychology*, 43, 142–154.

Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality and Social Psychology*, 61, 380–391.

Reber, A. S. (1976). Implicit learning of synthetic languages: The role of instructional set. *Journal of Experimental Psychology: Human Learning and Memory*, 2, 88–94.

Schvaneveldt, R. W., Meyer, D. E., & Becker, C. A. (1976). Lexical ambiguity, semantic context, and

visual word recognition. *Journal of Experimental Psychology: Human Perception and Performance*, 2, 243–256.

Seamon, J. G., Brody, N., & Kauff, D. M. (1983). Affective discrimination of stimuli that are not recognized: Effects of shadowing, masking, and cerebral laterality. *Journal of Experimental Psychology: Human Learning, Memory, and Cognition*, 9, 544–555.

Singer, J. A., & Salovey, P. (1988). Mood and memory: Evaluating the network theory of affect. *Clinical Psychology Review*, 8, 211–251.

Treisman, A. M. (1960). Contextual cues in selective listening. *Quarterly Journal of Experimental Psychology*, 12, 242–248.

Tweedy, J. R., Lapinski, R. H., & Schvaneveldt, R. W. (1977). Semantic-context effects on word recognition: Influence of varying the proportion of items presented in an appropriate context. *Memory and Cognition*, 5, 84–89.

Underwood, B. J. (1965). False recognition produced by implicit verbal responses. *Journal of Experimental Psychology*, 70, 122–129.

Wang, A. Y., & Johnson, M. K. (1978). Frequency information prior to identification in word recognition. Unpublished manuscript.

Warren, R. E., & Warren, N. T. (1976). Dual semantic encoding of homographs and homophones embedded in context. *Memory & Cognition*, 4, 586–592.