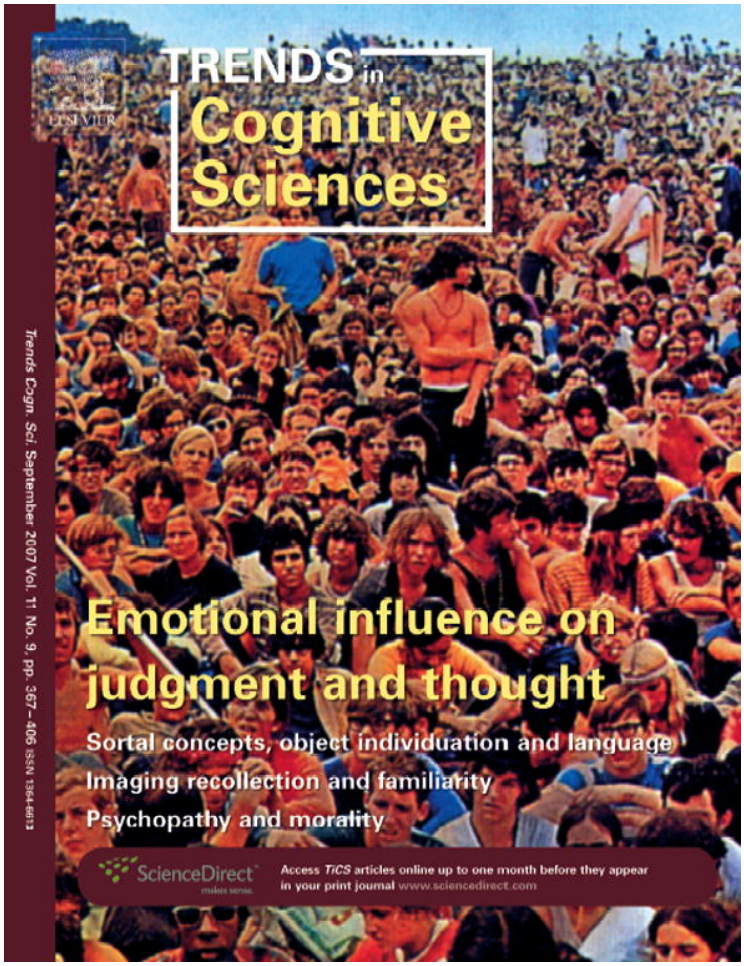

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*Cognitive–emotional interactions*

# How emotions inform judgment and regulate thought

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**Being happy or sad influences the content and style of thought. One explanation is that affect serves as information about the value of whatever comes to mind. Thus, when a person makes evaluative judgments or engages in a task, positive affect can enhance evaluations and empower potential responses. Rather than affect itself, the information conveyed by affect is crucial. Tests of the hypothesis find that affective influences can be made to disappear by changing the source to which the affect is attributed. In tasks, positive affect validates and negative affect invalidates accessible cognitions, leading to relational processing and item-specific processing, respectively. Positive affect is found to promote, and negative affect to inhibit, many textbook phenomena from cognitive psychology.**

## Introduction

Across academic fields, from history and literature to economics and neuroscience, a convergence of opinion has emerged about the importance of understanding emotion (see Glossary) [1]. In this article, we review behavioral research on how affective reactions, including moods and emotions, guide human judgment and cognitive processing [2]. The research shows that people's judgments often reflect their current moods. In happy moods, people judge many things, from consumer products [3] to life satisfaction [4], more positively than when they feel sad.

The affect-as-information hypothesis [5] proposes that affect assigns value to whatever seems to be causing it (Box 1). For example, affect might assign value to objects of judgment or, during cognitive tasks, to one's own thoughts and inclinations. After examining the background to this research, we review studies of affect and judgment, followed by studies of affect and cognitive processing.

Theorists commonly assume that people's attitudes and judgments reflect information about the object of judgment. But people's evaluations also reflect information from their own affective reactions. In social situations, for example, the crucial factor in our evaluation of other people is often the feelings that they elicit in us. However, knowing and feeling are tightly linked, and disentangling them requires methods by which affect can be varied independently of belief [6]. Early experiments using emotion-arousing films to induce mood showed that affect could influence attraction to other people over and above cognitions about them [7]. Inductions of mood through film, music and writing tasks have since become standard research methods.

Initial explanations of such mood-congruent judgments focused on the possibility that mood might prime (activate in memory) material that is mood congruent [8,9]. According to this 'priming' hypothesis, moods generate liking or disliking by activating positive or negative beliefs about the object of judgment. Despite abundant research, however, evidence for mood-congruent priming by affect remains controversial [10].

By contrast, the 'affect-as-information' hypothesis [4] proposes that affective cues of mood and emotion influence judgments directly by serving as experiential and bodily information regarding how one feels about the object of judgment. Such experiential information can be more compelling than thoughts about the object of judgment, and can also be reported faster than thoughts [11].

The initial evidence on which this view was based involved a telephone survey of life satisfaction [4]. Calls were made on either warm and sunny or cold and rainy spring days. The results demonstrated that mood affects judgment because rainy days depressed both moods and ratings of life satisfaction. In one crucial condition, however, interviewers first asked respondents about the weather before asking about life satisfaction. By subtly linking people's feelings to the weather in this way, the effects of mood on rating life satisfaction disappeared. The effect of the weather question was not to change people's feelings, but to alter what the feelings seemed to signify.

This experiment has been replicated with several variations. Related studies establishing the generality of

## Glossary

**Affect**: representations of personal value (i.e. the goodness or badness of things). Such representations can be neurological, physiological, experiential, cognitive, expressive and behavioral, among others.
**Affective state**: the co-occurrence of several such reactions constitutes an affective state.
**Emotion**: affective states with objects, reflecting an underlying appraisal of a particular kind of situation. In addition to value information, experiencing a specific emotion informs one that a specific set of appraisal criteria has been met. Different emotions of the same valence can have different effects, which can be predicted on the basis of the underlying appraisal.
**Mood**: diffuse, objectless affective states.

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**Box 1. Theoretical summary**

**Affect as information**

According to the 'affect-as-information' hypothesis, affect provides compelling information about the personal value of whatever is in mind at the time.

*Affect and evaluative judgments*. When making evaluative judgments, people often ask themselves 'how do I feel about it?' [2,5]. In such cases, positive affect signals that the object of judgment is valuable, leading to a positive evaluation, and negative affect signals that it lacks value, leading to a negative evaluation.

*Affect and cognitive processing*. In task situations, affect can be experienced as feedback about the value of one's current thoughts and inclinations [5,33]. A default strategy in many situations is for people to engage in relational processing (relating incoming information to what is already known or believed). Positive affect tends to reinforce this tendency, leading to relational (cognitive, interpretive, category-level and global) processing, whereas negative affect tends to inhibit this tendency, leading to referential (perceptual, item-level and local) processing [5,34,48].

**Other theories**

*Memory priming*. An alternative to the affect-as-information hypothesis is the priming hypothesis, which proposes that mood primes mood-congruent material in memory, which then serves as a basis for judgment [8,9]. There is currently little evidence to indicate that positive mood primes positive material in memory in this way [10]; however, a related hypothesis is that positive mood engages areas responsible for semantic processing.

*Semantic processing*. As suggested above, several theories converge on the general idea that positive mood engages semantic processing. These theories include proposals that positive mood activates substantive processing [49], semantic associations [50] and dopamine release [51]. These proposals are convergent with the affect-as-information characterization of processing in positive moods as relational [34].

*Motivation and attention*. The phenomena that the affect-as-information hypothesis explains in terms of positive and negative affect are explained by some investigators [35] in terms of the approach–avoidance motivation that is often attendant to positive–negative affect. In addition, some investigators characterize the outcomes that the affect-as-information hypothesis describes as 'relational versus item-specific processing' in terms of 'broad versus narrow attention' [52]. These issues raise questions for further research, in addition to those listed in Box 3.

such effects over different emotions and situations include experiments on the influence of feelings of distress, disgust and sadness on various different judgments.

## Affect and judgment

### *Attributions regulate affective influences*

The affect-as-information hypothesis proposes that affective influences on judgment depend on the affect being experienced as a reaction to the object of judgment. An interesting test has come from a mock trial in which jurors' attributions for their feelings were varied.

Accountancy students served as jurors and rendered decisions about the culpability of an accounting firm in a corporate bankruptcy case [12]. Different versions of the trial transcript were presented with varying amounts of detail about the distressing consequences of the bankruptcy. The more distressed the jurors felt about the harmful consequences of the bankruptcy, the more they judged the accounting firm liable. Some jurors, however, had been asked before the trial began to rate their anxiety about being a juror. Those jurors were significantly less likely to reach verdicts that went against the firm because their distress seemed to be about having to render a decision rather than about the effects of the bankruptcy.

Again, we see that whether or not affect influences judgment depends on implicit attributions about its cause. Without a salient cause, affect tends to be promiscuous, attaching itself to whatever is available, which is why moods can influence even irrelevant judgments.

### *Specific emotions have specific effects*

The affect-as-information hypothesis applies to affect from specific emotions in addition to moods. Because different emotions convey different information about the ways in which events are positive or negative [13], however, emotions of similar valence can have different effects.

Such effects have been demonstrated in an online study conducted immediately after the terrorist attacks of 11 September 2001 with a sample of 1000 Americans [14]. Respondents were induced to focus on either angering or fear-inducing aspects of the events. Angry (but not fearful) respondents subsequently favored policies of retaliation, whereas fearful (but not angry) respondents made higher risk estimates for both risks of terrorist attacks and completely unrelated risks.

Another set of studies has examined the impact of disgust on judgments of morality (S.Schnall *et al.*, unpublished). In one, disgust was induced by having participants work at a dirty, sticky desk in a filthy, trash-filled room. Results showed that the room increased disgust among individuals who habitually focused on their bodily reactions, and this disgust led them to judge morally ambiguous actions as immoral. This effect was not observed for individuals made to feel sad.

In these examples, instead of the broad brush effects of general moods, specific emotions had more targeted influences.

### *Emotions can make mountains out of molehills*

The studies described so far involve judgment tasks with no right or wrong answers. Other studies have examined judgments of physical reality (C.Riener, PhD thesis, University of Virginia, 2007). In these experiments, sad music heard while standing at the bottom of a steep hill led participants to overestimate the incline of the hill. The overestimations were similar to those made by participants wearing a heavy backpack [15].

This tendency to make mountains out of molehills has also been shown for participants experiencing mild fear from standing at the top of the hill on a skateboard. They overestimated the incline significantly more that others standing on a stable platform of the same height (J. Stefanucci, PhD thesis, University of Virginia, 2006).

### *Conclusions about affective influence on judgment*

In summary, we have reviewed studies indicating that affective feelings influence judgments of life satisfaction, culpability, risk, morality and physical space. Although the principles have been applied to affective feelings, they apply equally well to non-affective feelings (Box 2).

Most of the affective phenomena reviewed here depend on some kind of misattribution of affect, which suggests that affect is an unwanted source of bias. The message,

**Box 2. Affect-as-information principles apply to non-affective feelings**

The basic principles of the affect-as-information hypothesis also apply to similar non-affective phenomena. Familiarity, certainty, confusion, amazement and sleepiness all have characteristic feeling or experiential aspects. But they are not affective feelings, because they are not primarily about goodness or badness. Much literature focuses on feelings of 'ease or difficulty in remembering something'. The experience of ease or difficulty of retrieving a memory is often more important in judgment and decision-making than the memory itself [53].

In a recent study [54], for example, participants recalled details of the Oklahoma City bombing and then indicated when they thought it occurred and how personally important it was. They were instructed to recall either two or ten details of the bombing to create experiences of ease and difficulty of retrieval. The intriguing finding was that recalling more details (ten rather than two) made the bombing seem both more distant in time and less personally important, because distant and unimportant events are harder to recall. In addition, just as with affective feelings, changing participants' attributions for these feelings of retrieval – by making salient the true cause of the ease or difficulty – eliminated their effects. Thus, the influence of these non-affective feelings on judgments also reflected their informational value.

however, does not lie in the method used in these studies. Affect is, in fact, crucial for good judgment. Studies show that individuals with neurological damage involving deficits in affect show marked distortions of judgment and decision-making [16,17].

## Affect and cognitive processing

In addition to influencing judgment and decision-making, affect influences how people process information. Such influences have been observed across a range of tasks, including problem-solving [18], stereotyping [19] and persuasion [20]. Despite the variety of cognitive tasks involved, the influences of affect are relatively consistent. Table 1 lists some of the cognitive phenomena that have shown affective influences.

In this section, we describe several experiments showing that when people are made happy they engage in global, category-level, relational processing, whereas when they are sad they engage in local, item-level, stimulus-specific processing. Such affective influences are evident in the repetition of a classic experiment (Figure 1). A related experiment examining global–local focus is described here.

### *Affect regulates global–local focus*

People have a surprising ability to zoom in and out mentally, focusing on either the big picture or the details. But some people favor a focus on the forest, whereas others favor the trees. For example, habitually anxious individuals are quick to focus on local stimulus features, especially when currently feeling anxious [21].

To examine further the impact of momentary mood, participants in one experiment wrote about either a happy or a sad event in their lives or about a typical day [22]. They then responded to a global–local perception task [23]. The task involves pictures in which a triangle might be made of squares or a square might be made of triangles. Respondents select which of two comparison pictures (e.g. squares made of squares or triangles made of triangles) is most similar to the original. Participants in sad moods adopted a more local focus than those in happy moods (Figure 2). Although some studies have also found a difference between happy and neutral moods [24], in these data both happy and neutral groups showed the normative tendency toward a global focus [22].

Consistent with affect-as-information principles, drawing participants' attention to the true cause of their feelings [25] eliminated the impact of mood on global–local perception. This finding suggests that the affect-as-information processes that govern judgment also guide efforts on cognitive tasks.

### *Emotions modulate stereotyping*

A different kind of global–local perception concerns whether people see others as members of groups or as individuals. Social psychologists have sought to determine

**Table 1. A sample of the cognitive phenomena influenced by affect[a]**

| Cognitive phenomenon | Influence | Refs |
|---|---|---|
| Semantic priming | Participants in positive moods are more likely than those in negative moods to activate semantically related concepts (e.g. doctor–nurse) from memory | [59] |
| Global superiority effect | The general tendency to process incoming information in a global manner is empowered by positive mood and inhibited by negative mood | [21,22,24,25] |
| Heuristic processing | People in positive moods are more likely than those in negative moods to use judgment heuristics. In a persuasion context, for example, participants in positive moods are equally persuaded by strong and weak appeals, whereas those in negative moods are persuaded more by strong appeals. | [2,20] |
| False memories | When presented with a list of words (e.g. bed, rest) that implies a non-presented critical lure (e.g. sleep), participants in positive moods are more likely than those in negative moods to recall incorrectly having seen the critical lure (show false memories). | [44] |
| Schema-guided memory | When presented with a situation that activates a schema (e.g. eating out at a restaurant), people in positive moods are more likely than those in negative moods to use the schema to fill in the blanks when recalling details of the situation (e.g. ordering dessert) | [40] |
| Retrieval-induced forgetting | Retrieval-induced forgetting occurs when rehearsal of a subset of previously observed material inhibits memory for non-rehearsed material; research indicates that this tendency is empowered by positive moods and inhibited by negative moods | [46,47] |
| Stereotyping | Participants in positive moods tend to rely more on stereotypes to guide their thinking about members of various social groups than do those in negative moods, who tend to rely on individuating information | [26–29] |

[a]Many of the hallmark findings of cognitive psychology seem to be moderated by affect. In general, this research indicates that positive affect leads to relational (cognitive, interpretive, category-level and global) processing, whereas negative affect leads to referential (perceptual, item-level and local) processing [5,34,48].


**Figure 1**. Examples of serial reproductions of a drawing from memory showing that the schema of a face guides the construction of memory. In 1932, Frederick Bartlett [58] showed students a drawing of an African shield, and asked them to draw it from memory. He gave their drawings to others, asking them to reproduce the drawings from memory; these drawings were then reproduced from memory by a third group, and so on. The drawing bore the title '*Portrait d'homme*', and reproductions of it gradually began to look more like a portrait of a man and less like an African shield, as shown above. The schema of a face suggested by the title guided people's memories, illustrating Bartlett's theory of constructive memory. This classic experiment has been recently repeated with the addition of mood [22]. Blind ratings of the drawings that resulted showed that those reproduced by individuals in happy moods were more face-like than those reproduced in sad moods. Positive affect thus seems to promote the use of accessible schemas, whereas negative affect inhibits their use, leading to more local, stimulus-bound processing. Reprinted with permission from Ref. [58].

when people use stereotypes in social perception [26]. Contrary to most people's intuitions, happy moods promote group stereotyping, whereas sad moods promote a focus on individuals [27,28]. One relevant study involved a mock trial in which a Latino student was accused of a stereotype-consistent offense. The results showed that individuals in happy moods were more likely than those in sad moods to have their verdicts influenced by the stereotype [29].

In this experiment, the stereotyping seems to reflect a general cognitive style rather than prejudice as such. Indeed, similar findings come from marketing and political science studies showing that happy moods promote reliance on brand names as opposed to product attributes among consumers [30], and a reliance on political party as opposed to candidate positions among voters [31].

In addition, a surprising result in the mock jury study [29] was that angry jurors responded like happy jurors, rather than like sad ones. This finding is consistent with affect-as-information logic, which always asks about the information inherent in affective states. Despite being a negative emotion, anger carries positive information about one's own position. When angry, one believes oneself to be correct, which should increase confidence in one's own cognitions. Thus, anger would be expected to show the same processing effects as happiness [5].

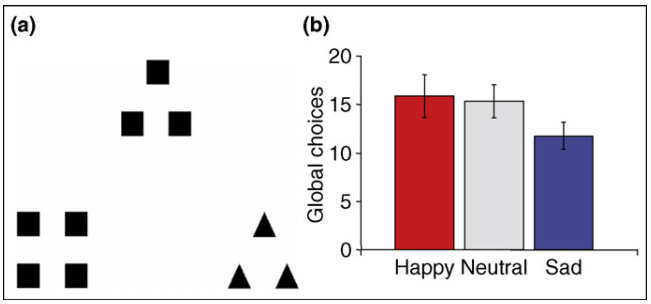


**Figure 2**. Global–local perception experiment. **(a)** Respondents indicate, in each of 24 trials, the comparison picture (bottom) with which the target picture (top) goes. In this instance, if participants base their similarity judgment on global features, they would say that the comparison picture with the overall shape of a triangle is more similar to the target picture. If they base their similarity judgments on local features, they would choose the comparison picture in which the component elements are squares. Sample trial taken from Ref. [23]. **(b)** Results show a more global focus for happy and neutral than for sad mood groups. Data taken from Ref. [22].

### *Positive affect promotes dominant responses*

The stereotyping research illustrates the 'affective processing principle' [5], which proposes that positive affect promotes, whereas negative affect inhibits, the use of accessible cognitions and responses. A crucial test of the principle comes from recent research (J.R.H. *et al.*, unpublished data) on 'chronic egalitarians', for whom egalitarian rather than stereotyped responses are habitually the most accessible. As proposed, positive affect empowered and sad mood blocked the most accessible response. Happy mood increased egalitarian rather than stereotypic responses, and sad moods inhibited such egalitarian impulses, which increased stereotyping for these individuals.

A further example of how sad mood acts as a stop sign for dominant responses comes from a behavioral economics experiment in which respondents placed a value on a small gift [32]. In neutral moods, they showed the 'endowment effect' – that is, being willing to pay more to keep things than to buy them initially. But consistent with affect-as-information logic, sad moods completely reversed the effect.

These results again suggest that sad and happy affect signal the value of current response inclinations [5,33]. They also show that accurate predictions require knowledge of what inclinations are dominant in particular situations.

### *Affect regulates relational versus item-specific processing*

In problem-solving situations, if people engage in relational processing (i.e. relating aspects of the problem to what they know), then positive affect should confer value on that approach, resulting in a relationship between positive affect and relational processing. Conversely, negative affect should make relational processing seem problematic, resulting in more item-specific processing [34].

Note that normally, rather than induced mood states, the source of affect would be finding oneself making progress on a task or encountering difficulty. This 'affective feedback' would then regulate attention [24,35,36] and elicit 'cognitive tuning' [2] to meet task demands.

As this hypothesis suggests, whether relational or item-specific thinking is superior should depend on the

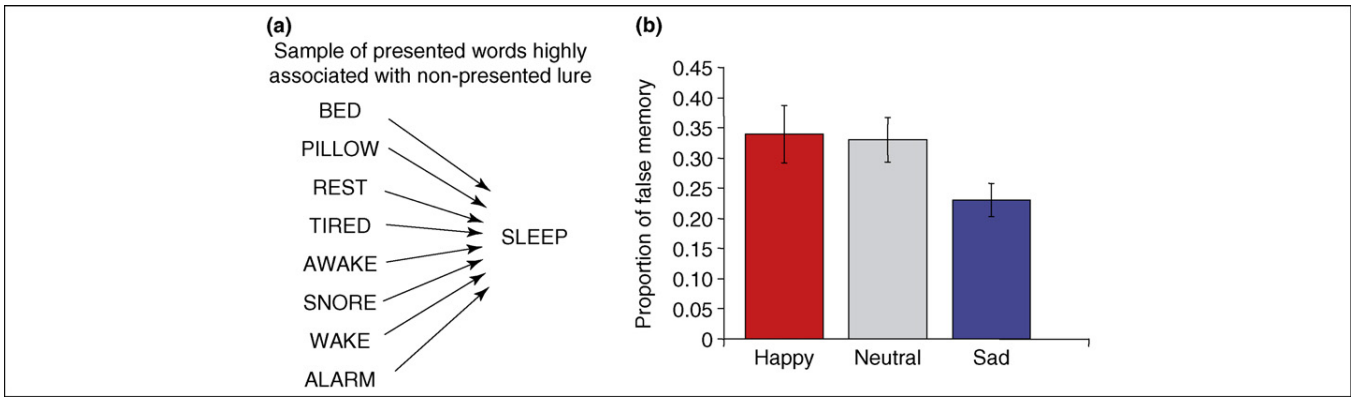


**Figure 3**. False memory experiment. Thirty-six word lists, each comprising words highly associated with a non-presented lure, are presented. Relational processing of happy and control groups results in the false recall of many lures, whereas item-specific processing in sad moods was more accurate. Figure based on Ref. [44].

task. Thus, sad moods lead to superior spatial memory [37], whereas happy moods foster creative responses [38]. But positive moods also lead to errors when solving syllogisms [39] or engaging in schema-guided memory [40].

A final set of experiments employed tasks known to involve relational processing to determine whether or not relational versus item-specific processing characterizes affective influences on processing.

### *Sad moods decrease false memories and forgetting*

Even when motivated to be accurate, people can generate false memories, a fact of practical importance in legal testimony. To induce false memories, participants in one experiment studied lists of words associated with other words that would never be presented, called 'critical lures' [41]. For example, words such as bed, pillow, rest, awake and blanket all activate the word 'sleep', which might then be falsely recalled.

Such false memories are assumed to reflect relational or gist processing [42,43]. According to the affect-as-information hypothesis, positive mood should promote and negative mood should inhibit such relational processing, making false-memory studies ideal for hypothesis testing. As predicted, individuals in happy moods do show high numbers of false memories – a tendency that is significantly reduced in sad moods [44,45] (Figure 3). As often occurs, happy and neutral participants perform similarly, because even neutral participants usually report positive resting moods.

Research on forgetting paints a similar picture. Eyewitnesses who are repeatedly interrogated about some aspect of an event tend to forget other aspects [46]. Again, positive moods have been found to sustain such deficits, whereas negative moods eliminate them [47]. This curious tendency for remembering one thing to induce forgetting of others is thought to be promoted by relational processing and to be inhibited by item-specific processing. The mood moderation of such forgetting suggests that relational versus item-specific processing is indeed one way in which affect influences cognitive processing.

## Concluding remarks

Affect and emotion are pervasive influences on human judgment and thought. We have summarized evidence relevant to one hypothesis about the psychological processes involved. We initially discussed experiments finding influences of moods and emotions on various kinds of judgment. We then described experiments finding such influences on cognitive processing. Questions for future research are listed in Box 3. The affect-as-information hypothesis explains both judgment and processing effects by assuming that affect serves as a compelling form of information about value. In the case of judgment, value might be assigned to the object of judgment; in the case of processing, by contrast, value might be assigned to the person's own cognitions and inclinations. Experiments consistently show that positive affective information promotes and negative affective information inhibits the cognitive responses that are accessible or dominant in a particular situation.

The tasks commonly used in cognitive psychological research involve relational processing – that is, relating incoming information to what is already known. Our

**Box 3. Questions for future research**

- How do affective influences on processing interact with culture? Research frequently finds increased negative affect in East Asian as compared with Western societies [55]; however, other research also shows a predominance of an holistic cognitive style in the East, which is thought to typify positive rather than negative affect [56]. Is the relationship between affect and cognitive processing discussed in this article common to all cultures, does positive affect trigger culturally normative styles, or does some other pattern hold?
- What are the respective roles of conscious and unconscious affect? Conscious feelings provide information about implicit attitudes, preferences and decisions. They are important for planning and self knowledge. However, the connections defining attitude are formed presumably not in consciousness but implicitly between neural representations of attended objects and neurochemical reactions to them [57]. What, then, are the functions of conscious and unconscious affect in this process? Are judgments more dependent on conscious affect, and processing decisions more dependent on unconscious affect?
- How do the hedonic and informational roles of affect combine and conflict? In performance situations, affect serves as feedback about progress towards goals (affect as information); however, sometimes maximizing positive affect is itself the goal (affect as goal). Many publications have examined each of these roles of affect in isolation, but in what kinds of situations is each active? In some situations, informational and hedonic goals coincide (e.g. as experienced in the pleasure of mastery), but in many they might not. When do they function jointly? And when they conflict, what factors dictate which one will prevail?

review shows that many of the textbook phenomena of cognitive psychology occur when people feel happy, but do not occur or occur only in a reduced form when people feel even slightly sad. Because these are the kinds of phenomena on which the cognitive revolution was based, the results suggest – somewhat ironically – that the cognitive revolution had an emotional trigger.

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