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**Mood Effects on Cognition**

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*Introduction*

Humans are a moody species. Fluctuating positive and negative affective states accompany, underlie, and color everything we think and do, and our thoughts and behaviors are often determined by prior affective reactions. It is all the more surprising that empirical research on how moods influence the way people think, remember, and deal with information is a relatively recent phenomenon. Yet understanding the delicate interplay between feeling and thinking or affect and cognition has been one of the greatest puzzles about human nature since time immemorial. This chapter reviews recent research documenting the multiple roles that moods play in influencing both the *content* and the *process* of cognition.

After a brief introduction reviewing early work and theories exploring the links between mood and cognition, the chapter is divided into two main parts. First, research documenting the way moods influence the *content and valence* of cognition is reviewed, focusing on mood congruence in cognition and behavior. The second part of the chapter presents evidence for the *processing effects* of moods, showing that mood states influence the quality of information processing as well. The chapter concludes with a discussion of the theoretical and applied implications of this work, and future prospects for these lines of inquiry are considered.

We may define moods as “relatively low-intensity, diffuse, subconscious, and enduring affective states that have no salient antecedent cause and therefore little cognitive content” (Forgas, 2006, pp. 6-7). Distinct emotions in contrast are more intense, conscious, and short-lived experiences (e.g., fear, anger, or disgust). Moods tend to have relatively more robust, reliable and enduring cognitive consequences, and the research reported here largely focused on the effects of mild, nonspecific positive and negative moods on thinking and behaviour, although more specific states such as anger have also been studied (e.g., Unkelbach, Forgas & Denson,

2008).

**Historical background.** Since the dawn of Western civilization, a long list of writers and philosophers have explored the role of moods in the way we think, remember, and form judgments. Apart from some early exceptions (e.g., Rapaport, 1942/1961; Razran, 1940), concentrated empirical research on this phenomenon in psychology is but a few decades old, perhaps because the affective nature of human beings has long been considered secondary and inferior to the study of rational thinking (Adolphs & Damasio, 2001; Hilgard, 1980). Neither of the two paradigms that dominated the brief history of our discipline (behaviorism and cognitivism) assigned much importance to the study of affective states or moods. Radical behaviorists considered all mental events such as moods beyond the scope of scientific psychology. The emerging cognitive paradigm in the 1960s was largely directed at the study of cold, affectless mental processes, and initially had little interest in the study of affect and moods. In contrast, research since the 1980's has shown that moods play a central role in how information about the world is represented, and affect determines the cognitive representation of many of our social experiences (Forgas, 1979).

**Early evidence linking mood and cognition.** Although radical behaviorists generally showed little interest in exploring the nature of mood effects, Watson's research with Little Albert may be viewed as an early demonstration of affect congruence in judgments (Watson, 1929; Watson & Rayner, 1920). These studies showed that evaluations of a neutral stimulus, such as a furry rabbit, became more negative after it has been associated with threatening stimuli such as a loud noise. Watson thought that most complex affective reactions are acquired in a similar manner throughout life due to cumulative stimulus associations. In another early mood study, Razran (1940) showed that people evaluated sociopolitical messages more favorably when

in a good rather than in a bad mood, induced either by a free lunch (!) or aversive smells. This work also provides an early demonstration of mood congruence (see also Bousfield, 1950). In another pioneering study, Feshbach and Singer (1957) induced negative affect in subjects through electric shocks and then instructed some of them to suppress their fear. Fearful subjects' evaluations of another person were more negative, and ironically, this effect was even greater when subjects were trying to suppress their fear (Wegner, 1994). Feshbach and Singer (1957) explained this in terms of the psychodynamic mechanism of projection, suggesting that "suppression of fear facilitates the tendency to project fear onto another social object" (p.286). Mood-congruent effects on evaluative judgments were also found by Byrne and Clore (1970; Clore & Byrne, 1974) using a classical conditioning approach. They used pleasant or unpleasant environments (the unconditioned stimuli) to elicit good or bad moods (the unconditioned response), and then assessed evaluations of a person encountered in this environment (the conditioned stimulus; Gouaux, 1971; Gouaux & Summers, 1973; Griffitt, 1970). These early studies paved the way for the emergence of more focused research on mood congruence in thinking and judgments in the 1980s.

#### *Informational effects of moods*

Early studies focused on informational effects, that is, ways that positive and negative moods may influence the *content and valence* of cognition. This research tradition is considered first here. Three main theories accounting for mood congruence are reviewed: (1) *associative network* theories emphasizing memory processes (Bower, 1981; Bower & Forgas, 2000), (2) *affect-as-information* theory relying on inferential processes (Clore, Gasper & Garvin, 2001; Clore & Storbeck, 2006; Schwarz & Clore, 1983), and (3) an integrative *Affect Infusion Model* (AIM; Forgas, 1995; 2002).

**The associative network model.** Bower (1981) assumes that moods are linked to an associative network of memory representations. A mood state may thus automatically prime or activate representations linked to that mood, which in turn are more likely to be used in subsequent constructive cognitive tasks. Several experiments found support for such *affective priming*. For example, happy or sad people were more likely to recall mood-congruent details from their childhood and also remembered more mood-congruent events that occurred in the past few weeks (Bower, 1981). Mood congruence was also observed in how people interpreted ongoing social behaviors (Forgas, Bower & Krantz, 1984) and formed impressions of others (Forgas & Bower, 1987). Further research found that mood congruence is subject to several boundary conditions (see Blaney, 1986; Bower, 1987; Singer & Salovey, 1988). Mood-congruence in memory and judgments is most reliable (a) when moods are intense (Bower & Mayer, 1985) and (b) meaningful (Bower, 1991), (c) when the subsequent task is self-referential (Blaney, 1986), and (d) when open, elaborate thinking (or constructive processing) is used. In particular, tasks requiring constructive processing such as associations, inferences, impression formation, and interpersonal behaviors are most likely to show mood-congruent effects (e.g., Bower & Forgas, 2000; Fiedler, 1991; Mayer, Gaschke, Braverman, & Evans, 1992), because open, elaborate processing amplifies the opportunities for affectively primed incidental memories and information to become incorporated into a newly constructed response. Tasks that require little or no constructive processing, such as recognition or the simple reproduction of existing reactions, are unlikely to show mood congruence (Forgas, 1995; 2002; 2006), because narrow and targeted thinking offers little opportunity for affectively primed information to be incorporated in a response. .

**The affect-as-information theory.** This alternative approach seeks to explain mood

congruence by suggesting that "rather than computing a judgment on the basis of recalled features of a target, individuals may ... ask themselves: 'how do I feel about it?' [and] in doing so, they may mistake feelings due to a pre-existing state as a reaction to the target" (Schwarz, 1990, p. 529; see also Schwarz & Clore, 1983; Clore & Storbeck, 2006). Thus, people misattribute a pre-existing mood state as indicative about their reaction to an unrelated target. The model is closely derived from research on misattribution and judgmental heuristics. However, its predictions are often empirically indistinguishable from those derived from earlier conditioning models assuming blind associative learning processes (e.g., Clore & Byrne, 1974). Evidence shows that people mainly rely on their mood as a simple and convenient heuristic cue to infer their evaluative reactions when "the task is of little personal relevance, when little other information is available, when problems are too complex to be solved systematically, and when time or attentional resources are limited" (Fiedler, 2001, p. 175). If the task is of high personal relevance and there are cognitive resources available, then affective priming is the most likely strategy resulting in mood congruence.

For example, mood induced by good or bad weather was found to influence judgments on a variety of unexpected and unfamiliar questions in a telephone interview (Schwarz & Clore, 1983). In another study, Forgas and Moylan (1987) found mood congruence in survey responses of almost 1000 subjects who completed a questionnaire after they had seen funny or sad films at the cinema. As in the study by Schwarz and Clore (1983), respondents presumably had little time, interest, motivation, or capacity to engage in elaborate constructive processing, and so relied on their mood as a simple and convenient heuristic shortcut to infer their reactions. As the informational value of a mood state is not fixed but rather depends on the situational context (Martin, 2000), such mood effects may also be highly context-specific. Furthermore, the affect-

as-information model mostly applies to evaluative judgments, and may have difficulty accounting for mood congruence in attention, learning, and memory. In one sense misattributing mood to an unrelated target is probably the exception rather than the norm in real-life mood effects on cognition.

**The Affect Infusion Model (AIM).** The AIM (Forgas, 1995; 2002) suggests that mood effects on cognition depend on the kind of information processing strategy used, and identifies four processing strategies that vary in terms of (a) their *constructiveness* and (b) the degree of *effort* exerted in seeking a solution. The first, *direct access* strategy involves the simple and direct retrieval of a pre-existing response. This is most likely when the task is highly familiar and there is no reason to engage in more elaborate thinking (e.g., retrieving a friend's mobile number). As this is a low-effort low, constructive processing strategy, affect infusion should not occur. The second, *motivated processing* strategy refers to effortful, yet highly selective and targeted thinking that is dominated by a particular motivational objective (e.g., drafting a message about how to get to your place). This strategy again involves little open, constructive processing and therefore should be impervious to affect infusion and may even produce mood-incongruent effects (Clark & Isen, 1982; Sedikides, 1994). *Heuristic processing* refers to constructive but truncated, low-effort processing, which might be adopted when time and personal resources such as motivation, interest, attention, and working-memory capacity are scarce (e.g., evaluating your friend's new company car). Heuristic processing may result in mood congruence when affect is used as a heuristic cue as predicted by the affect-as-information model (Schwarz & Clore, 1983; see also Clore et al., 2001; Clore & Storbeck, 2006). Finally, *substantive processing* involves both high effort and open, constructive thinking, and is used whenever the task is demanding and there are no ready-made direct access responses or

motivational goals available to guide the response. Substantive processing is most likely to produce affect infusion into cognition as mood may selectively prime or enhance the accessibility of mood-congruent thoughts, memories, and interpretations (Forgas, 1994; 1999a; 1999b).

Further, the AIM identifies a range of contextual variables related to the task, the person, and the situation that jointly determine processing choices (Forgas, 2002; Smith & Petty, 1995), and recognizes that affect itself can influence processing choices (Bless & Fiedler, 2006).

The key prediction of the AIM is the absence of affect infusion when direct access or motivated processing is used, and the presence of affect infusion during heuristic and substantive processing. Affect infusion is most likely in the course of constructive processing that involves the substantial transformation rather than the mere reproduction of existing information. Such processing requires a relatively open information search strategy and a significant degree of generative elaboration of the available stimulus details. Thus, affect "will influence cognitive processes to the extent that the cognitive task involves the active generation of new information as opposed to the passive conservation of information given" (Fiedler, 1990, pp. 2-3). The implications of this model have now been supported in a number of the experiments considered below. In particular, mood congruence in cognition turns out to be *greater* when *more extensive* and *elaborate* processing is required to deal with a more complex, demanding task (Forgas, 2002; Sedikides, 1995).

**Mood congruence in memory and attention.** Several studies found that people are better at retrieving both early and recent autobiographical memories that match their prevailing mood (Bower, 1981; Miranda & Kihlstrom, 2005), and depressed patients preferentially remember aversive experiences and negative information (Direnfeld & Roberts, 2006). Implicit tests of memory provide evidence of mood congruence as well. For example, depressed people



completed more word stems (e.g., *can-*) with negative rather than positive words they had studied earlier (e.g., *cancer* vs. *candy*; Ruiz-Caballero & Gonzalez, 1994), and happy and sad people selectively remembered more positive and negative details about people they had read about (Forgas & Bower, 1987).

These mood-congruent memory effects occur because of the selective activation of an affect-related associative base, resulting in mood-congruent information receiving greater attention and more extensive processing and encoding (Bower, 1981). That is, people spend longer reading mood-congruent material, integrating it into a richer network of primed associations, and as a result, they are better able to remember such information (see Bower & Forgas, 2000). There is growing evidence for mood congruence at the attention stage: in a recent inattentive blindness study (Becker & Leininger, 2011), mood selectively influenced participants' attentional filter, increasing the chance to notice unexpected faces that carried a mood-congruent emotional expression. Other research demonstrated positive mood lead to attentional bias toward rewarding words (Tamir & Robinson, 2007), and broadened attention to positive images (Wadlinger & Isaacowitz, 2006). Depressed patients also paid greater attention to negative information (Koster, Raedt, Goeleven, Franck & Crombez, 2005), and showed better learning and memory for depressive words (Watkins, Mathews, Williamson & Fuller, 1992) and negative facial expressions (Gilboa-Schechtman, Erhard-Weiss & Jecemien, 2002).

It should be noted that sad people eventually may escape the vicious circle of focusing on and remembering negative information by means of deliberately employing *mood-incongruent* attention and memory. Consistent with the hypothesis of such motivational *mood repair* (Isen, 1985), Josephson, Singer, and Salovey (1996) showed that after initially retrieving negative memories, non-depressed participants in a negative mood deliberately shifted to retrieving

positive memories in order to lift their mood (see also Detweiler-Bedell & Salovey, 2003; Heimpel, Wood, Marshall & Brown, 2002).

**Mood-dependent memory.** Mood has another significant influence on memory by selectively facilitating the retrieval of information that has been learnt in a matching rather than a non-matching mood. Such *mood-dependent memory* may play a role in the memory deficits found in patients with alcoholic blackout, chronic depression, dissociative identity and other psychiatric disorders (Goodwin, 1974; Reus, Weingartner, & Post, 1979; Schacter & Kihlstrom, 1989). However, these effects are rather subtle (Bower & Mayer, 1989; Kihlstrom, 1989; Leight & Ellis, 1981), and there are several moderating factors that influence their occurrence. Constructive tasks such as free recall are more sensitive to mood-dependent memory than are reproductive tasks such as recognition (Bower, 1992; Eich, 1995a; Fiedler, 1991; Kenealy, 1997). The effects are most reliable when people generate their own events to be remembered and their own retrieval cues rather than when they are confronted with fixed materials and predetermined retrieval cues (Beck & McBee, 1995; Eich & Metcalfe, 1989). It seems that the more a person needs to rely on self-constructed information, the more likely that memory for corresponding events will be mood-dependent. Eich, Macaulay, and Ryan (1994) confirmed this, reporting that mood dependence effects were markedly greater when the recalled events were self-generated. Recall was consistently better when encoding mood and retrieval mood were matched rather than different, and this effect pattern was obtained with different mood induction methods (Eich et al., 1994; Eich, 1995b). Similar mood dependence in memory was demonstrated in bipolar patients (Eich, Macaulay & Lam, 1997).

Mood-dependent memory is also enhanced when the intensity, authenticity, or distinctiveness of encoding and retrieval moods is high rather than low (Eich, 1995a; Eich &

Macauley, 2000; Eich & Metcalfe, 1989; Ucros, 1989). Given that individual differences in personality play an important part in mood-congruent memory (Bower & Forgas, 2000; Smith & Petty, 1995), such factors may also moderate mood-dependent memory. Thus, mood-dependent memory is less likely to occur in experiments that employ simple, irrelevant tasks such as list-learning experiments, and when the mood induction is weak and not particularly distinctive to be effective as a retrieval cue. In terms of the Affect Infusion Model (Forgas, 1995; 2002), the higher the level of constructive processing and affect infusion that occurs both at the encoding and at the retrieval stages, the more likely that mood-dependence can be demonstrated.

**Mood congruence in inferences and associations.** The selective priming of mood-consistent materials in memory can have a marked influence on how complex or ambiguous information is interpreted (Bower & Forgas, 2000; Clark & Waddell, 1983). For example, people generated more mood-congruent ideas when daydreaming or free associating to TAT pictures, and happy subjects generated more positive than negative associations to words such as *life* (e.g., *love* and *freedom* vs. *struggle* and *death*) than did sad subjects (Bower, 1981). The selective priming of mood-congruent constructs can also influence social judgments, such as perceptions of faces (Forgas & East, 2008a; Gilboa-Schechtman et al., 2002; Schiffenbauer, 1974), impressions of people (Forgas & Bower, 1987), and self-perceptions (Sedikides, 1995). These associative effects are diminished when the targets to be judged are more simple and clear-cut (e.g., Forgas, 1994; 1995), confirming that open, constructive processing is crucial for mood congruence to occur.

**Mood congruence in judgments.** Consistent with the Affect Infusion Model, several studies have found that the more people need to think in order to compute a judgment, the greater the likelihood that affectively primed ideas will influence the outcome. For example, mood had a

greater influence on judgments about unusual, complex characters that require more constructive and elaborate processing than on judgments of simple, typical targets (Forgas, 1992). Mood also had a greater influence on judgments about unusual, badly matched couples than on typical, well-matched couples (e.g., Forgas, 1993).

Judgments about one's real-life partners showed similar mood congruence (Forgas, 1994). Mood significantly influenced the evaluation of one's partner and relationship conflicts, and paradoxically, these effects were stronger for judgments about complex, difficult conflicts that required more constructive processing, confirming that affect infusion into social judgments depends on the processing strategy recruited by the task at hand. Some personality characteristics, such as trait anxiety, may moderate such mood congruence effects on judgments, as highly anxious people are less likely to process information in an open, constructive manner (Ciarrochi & Forgas, 1999). Affect intensity may be another important trait moderator of mood congruence effects, as people who scored high on measures assessing openness to feelings showed greater mood congruence (Ciarrochi & Forgas, 2000).

Moods also exert an important influence on self-related judgments (Sedikides, 1995). Students in a positive mood were more likely to claim credit for success in a recent exam, and made more internal and stable attributions for their high test scores, but were less willing to assume personal responsibility for failure. Those in a negative mood blamed themselves more for failure and took less credit for success (Forgas, Bower, & Moylan, 1990). These findings were replicated in a study by Detweiler-Bedell and Detweiler-Bedell (2006), who concluded that consistent with the AIM, "constructive processing accompanying most self-judgments is critical in producing mood-congruent perceptions of personal success" (p. 196).

Sedikides (1995) also found support for the AIM, reporting that well-rehearsed "central"

conceptions of the self were processed more automatically and less constructively and thus were less influenced by mood than were “peripheral” self-conceptions that required more substantive processing and showed stronger mood congruence. Individual differences in self-esteem may also influence affect infusion into self-judgments, as mood-congruent effects on self-related memories were stronger for low rather than high self-esteem people (Smith & Petty, 1995), in line with the assumption that the former have a less clearly defined and less stable self-concept (Brown & Mankowski, 1993). Consistent with the AIM, these results show that low self-esteem is linked to the more open and constructive processing of information about the self, increasing the scope for mood-related associations to influence the outcome. Other work suggests that mood congruence may be spontaneously corrected as a result of shifting to the motivated processing strategy, as initially mood-congruent thoughts were spontaneously reversed over time (Sedikides, 1994). Further research by Forgas and Ciarrochi (2002) replicated these results and found that the spontaneous reversal of negative self-judgments was strongest in people with high self-esteem, consistent with the operation of a homeostatic process of mood management.

**Mood-congruent effects on social behaviors.** As planning strategic social behaviors necessarily requires some degree of constructive, open information processing (Heider, 1958), moods may also produce behavioral effects. Positive mood, by priming positive evaluations and inferences, should elicit more optimistic, positive, confident, and cooperative behaviors, whereas negative mood may produce more avoidant, defensive, and unfriendly behaviors. In one experiment, happy or sad mood was induced in people before they engaged in a strategic negotiation task (Forgas, 1998a). Those in a happy mood employed more trusting, optimistic, and cooperative negotiating strategies, and achieved better outcomes, while those in a negative mood were more pessimistic and competitive in their negotiating moves. Other experiments examined

the effects of induced mood on the way people formulate and use verbal requests (Forgas, 1999a). These studies found that due to more optimistic inferences about the receptiveness/willingness of the persons receiving the request, positive mood resulted in more confident and less polite request formulations. In contrast, negative affect triggered a more cautious, polite, and elaborate requesting strategy as a result of rather pessimistic inferences regarding the request's chance of success.

Another unobtrusive field experiment showed that moods also influence how people *respond* to an impromptu request (Forgas, 1998b). Mood was induced by leaving folders containing mood-inducing materials (pictures as well as text) on empty library desks. After occupying the desks and examining the mood induction materials, students received an unexpected polite or impolite request from a confederate asking for paper needed to complete an essay. Results revealed a clear mood-congruent response pattern: negative mood resulted in less compliance and more critical, negative evaluations of the request and requester, whereas positive mood yielded the opposite results. Again, the effects were stronger when the request was formulated in an unusual and impolite way and therefore recruited more substantive processing.

Some strategic interpersonal behaviors, such as *self-disclosure*, are critical for the development and maintenance of intimate relationships, for mental health, and for social adjustment. It seems that by facilitating mood-congruent associations and inferences about a conversational partner, affective states can directly influence people's preferred self-disclosure strategies (Forgas, 2011a). Several recent experiments found that, consistent with the predicted mood congruence effects, those in a positive mood preferred to disclose information that was more intimate, more varied, more abstract, and more positive than was the case for people in a neutral mood. Negative affect had exactly the opposite effect (Figure 1), and this pattern was

even stronger when the conversational partner reciprocated with a high degree of disclosure. Thus, these experiments provide convergent evidence that temporary fluctuations in mood can produce marked changes in the quality, valence, and reciprocity of self-disclosure, suggesting that mood congruence is likely to occur in the context of many other unscripted and unpredictable strategic interpersonal behaviors.

When considered jointly, the evidence shows that transient moods play an important informative function, influencing the content and valence of memory, attention, associations, inferences, judgments, and social behaviors in a predominantly mood-congruent way. However, these effects are dependent on the information processing strategy adopted, with open, constructive processing more likely to be influenced by moods than other kinds of processing strategies (Forgas, 1995; 2002). When such substantive processing is used, affective priming appears to be the most likely mechanism responsible for mood congruence effects (Bower, 1981), while some evaluative judgments made under suboptimal processing conditions may be also become mood congruent as a result of the heuristic affect-as-information mechanism. The overall pattern of results seems consistent with the Affect Infusion Model, suggesting that mood congruence is unlikely when a task can be performed using simple, well-rehearsed direct access or motivated processing, as there is little opportunity for moods to influence cognition. According to the AIM, mood congruence is most likely when individuals engage in substantive, constructive processing.

#### *Mood Effects on Processing Strategies*

The evidence surveyed so far clearly shows that mood states can have a significant *informational* influence on the content and valence of cognition, producing mood-congruent effects on memory, attention, associations, judgments and social behaviors. In addition to

influencing cognitive content, that is, *what* people think, moods may also influence the process of cognition, that is, *how* people think. This section will review evidence for the information processing consequences of moods.

Since the 1980s, a growing number of studies suggest that people experiencing a positive mood rely on a more superficial and less effortful information processing strategy. Those in a good mood were consistently found to reach decisions more quickly, used less information, avoided systematic and demanding thinking, and, ironically, appeared more confident about their decisions. In contrast, negative mood apparently triggered a more effortful, systematic, analytic and vigilant processing style (Clark & Isen, 1982; Isen, 1984; 1987; Schwarz, 1990).

Nevertheless, more recent studies show that positive mood sometimes produces distinct processing advantages. For instance, happy people tend to adopt a more creative, open, and inclusive thinking style, use broader cognitive categories, show greater mental flexibility, and perform better on secondary tasks (Bless & Fiedler, 2006; Fiedler, 2001; Isen & Daubman, 1984; Hertel & Fiedler, 1994). How can we explain these processing differences?

Initially, explanations emphasized the *motivational* consequences of good and bad moods. According to the *mood maintenance/mood repair* hypothesis, those in a positive mood may be motivated to maintain this rewarding state by avoiding effortful activity such as elaborate information processing. In contrast, a negative mood should motivate people to engage in more vigilant, effortful information processing as an adaptive strategy to relieve their aversive state (Clark & Isen, 1982; Isen, 1984, 1987). More recently, several studies also showed that the cognitive consequences of affective states may depend on whether the mood state is high or low in approach motivational intensity. For example, low approach positive affect seems to broaden cognitive categorization and attention, but high approach positive affect tends to narrow



cognitive categorization (Gable & Harmon-Jones, 2008; Price & Harmon-Jones, 2010).

An alternative *cognitive tuning* account (Schwarz, 1990) argues that positive and negative moods have a fundamental signaling/tuning function, informing the person whether a relaxed, effort-minimizing (positive mood) or a vigilant, effortful (negative mood) processing style is required. Both these models rely on a functionalist/evolutionary view of moods as fulfilling adaptive functions (Forgas, Haselton & von Hippel, 2008). Yet another theory focuses on the impact of moods on *information processing capacity*, suggesting that mood states may influence processing style because they take up scarce processing capacity. Curiously, both positive mood (Isen, 1984) and negative mood (Ellis & Ashbrook, 1988) are hypothesized to reduce processing capacity. However, as positive and negative mood clearly promote qualitatively different processing styles, it is unlikely that the conflicting capacity reduction explanations put forward by Isen (1984) and Ellis and Ashbrook (1988) can both be correct.

**The assimilation/accommodation model.** The various explanations all assume that moods influence processing style by altering the degree of motivation, vigilance, and effort exerted. However, this view has been challenged by some experiments demonstrating that positive mood does not necessarily impair processing effort, as performance on simultaneously presented secondary tasks was not impaired (e.g., Fiedler, 2001; Hertel & Fiedler, 1994). An alternative theory, Bless and Fiedler's (2006) assimilation/accommodation model suggests that the fundamental, evolutionary significance of moods is not to regulate processing effort, but rather to trigger equally effortful but qualitatively different *processing styles*. The model identifies "... two complementary adaptive functions, *assimilation* and *accommodation* (cf. Piaget, 1954). Assimilation means to impose internalized structures onto the external world, whereas accommodation means to modify internal structures in accordance with external constraints.

With respect to affective influences the role of positive mood is to facilitate assimilation, whereas the role of negative mood is to strengthen accommodation functions” (Bless & Fiedler, 2006; p. 66).

Several lines of evidence now support the assimilative/accommodative processing dichotomy. For example, those in a positive mood used broader, more assimilative cognitive categories (Isen, 1984), sorted stimuli into fewer and more inclusive groups (Isen & Daubman, 1984), and classified behavioral descriptions into fewer and more inclusive types (Bless, Hamilton, & Mackie, 1992). Positive affect also recruited more assimilative and abstract representations in language choices, as happy people produced more abstract event descriptions than sad participants (Beukeboom, 2003), and were more likely to retrieve a generic rather than specific representation of a persuasive message (Bless, Mackie & Schwarz, 1992). Similar mood-induced effects on processing style were found with non-verbal tasks. For example, happy mood resulted in greater focus on the global rather than the local features of geometric patterns (Gasper & Clore, 2002; Sinclair, 1988).

What is the reason for these mood-induced differences in processing style? Bless and Fiedler (2006) suggest that moods perform an adaptive function essentially preparing us to respond to different environmental challenges. Positive mood indicates that the situation is safe and familiar, and that existing knowledge can be relied upon. In contrast, negative mood functions like a mild alarm signal, indicating that the situation is novel and unfamiliar, and that the careful monitoring of new, external information is required. There is supporting evidence suggesting that positive affect increases, and negative affect decreases, the tendency to rely on internal knowledge rather than external information in cognitive tasks, resulting in a selective memory bias for self-generated information (Bless, Bohner, Schwarz & Strack, 1992; Fiedler,

Nickel, Asbeck & Pagel, 2003).

The theory thus predicts that *both* positive and negative mood can produce processing advantages albeit in response to different situations requiring different processing styles. Given the almost exclusive emphasis on the benefits of positive affect in our culture, this is an important message with some intriguing real-life implications. Numerous studies now suggest that negative mood can produce definite processing advantages in situations when the careful and detailed monitoring of new, external information is required, as we shall see below.

**Memory performance.** One key area where the processing consequences of good or bad moods have been explored is memory performance. If negative mood indeed recruits a more accommodative, externally focused processing style, then it should result in improved memory for incidentally encountered information. In one experiment happy or sad subjects read a variety of essays advocating alternative positions on public policy issues. Later, their cued recall memory of the essays was assessed (Forgas, 1998, Exp. 3). Results showed that those in a negative mood remembered the details of the essays significantly better than those in a happy mood, consistent with negative mood promoting more externally focused, accommodative thinking.

This effect was further explored in a recent field experiment, when happy or sad shoppers (on sunny or rainy days, respectively) saw a variety of small objects displayed on the check-out counter of a local news agency (Forgas, Goldenberg & Unkelbach, 2009). After leaving the store, they were asked to recall and recognize the objects they had seen on the check-out counter. It turned out that mood, induced by the weather, had a significant effect. Those in a negative mood (on rainy days) had significantly better memory for what they had seen in the shop than did happy people (on sunny days), confirming that mood states have a subtle but reliable memory effect, and negative mood actually improves memory for incidentally encountered information (Figure

2).

A series of further experiments explored mood effects on eye-witness memory, predicting that, due to promoting more assimilative thinking (Isen, 1987), positive affect should increase, and negative affect should decrease, the tendency of eye-witnesses to incorporate false details into their memories (Forgas, Vargas & Laham, 2005). In one study (Forgas et al., 2005, Exp. 1), participants viewed pictures of a car crash (negative event) and a wedding party (positive event). One hour later, they received a mood induction (recalling happy or sad events from their past) and answered questions about the initially viewed scenes that either contained or did not contain misleading, false information. After a further 45-minute interval the accuracy of their eye-witness memory for the two scenes was tested. As predicted, positive mood increased, and negative mood decreased the amount of false, misleading information incorporated (assimilated) into their eye-witness memories. In contrast, negative mood almost completely eliminated this “misinformation effect”, as confirmed by a signal detection analysis.

In a second, more realistic experiment students witnessed a staged 5-minute aggressive encounter between a lecturer and a female intruder (Forgas et al., 2005, Exp. 2). One week later, while in a happy or sad mood, they received a questionnaire that either did or did not contain planted, misleading information. After a further interval, their eye-witness memory was assessed. Those in a happy mood when exposed to misleading information were more likely to assimilate false details into their memory. In contrast, negative mood eliminated this source of error in eye-witness memory, consistent with negative mood recruiting more accommodative processing and thus improving subject’s the ability to discriminate between correct and misleading details (Figure 3).

In a further experiment, participants saw videotapes showing (a) a robbery and (b) a

wedding scene. After a 45-minute interval they received an audio-visual mood induction and completed a short questionnaire that either contained or did not contain misleading information about the events. Additionally, some were instructed to “disregard and control their affective states.” Exposure to misleading information reduced eye-witness accuracy most when people were in a happy rather than a sad mood. However, direct instructions to control one’s affect proved ineffective to reduce this mood effect.

Conceptually similar results were reported by Storbeck and Clore (2005), who found that “individuals in a negative mood were significantly less likely to show false memory effects than those in positive moods” (p. 785). These authors explain their findings in terms of the affect-as-information mechanism. These experiments offer convergent evidence that negative moods recruit more accommodative thinking and therefore can improve memory performance by means of reducing susceptibility to misleading information. Paradoxically, happy mood *reduced* eye-witness accuracy yet *increased* subjective confidence, suggesting that judges were unaware of the processing consequences of their mood states.

**Mood effects on judgmental accuracy.** Is it possible that mood states, through their influence on processing style, may also improve or impair the accuracy of our social judgments? For example, can good or bad mood influence the common tendency for people to form evaluative judgments based on their first impressions? One recent experiment examined mood effects on this ‘primacy effect’, which occurs because people pay disproportionate attention to early rather than later information when forming impressions (Forgas, in press). After an autobiographical mood induction (recalling happy or sad past events), participants formed impressions about a character (Jim) described either in an introvert–extrovert or an extrovert–introvert sequence. As primacy effects occur because of the assimilative processing of later

information, the subsequent impression formation judgments revealed that positive mood significantly increased the primacy effect by recruiting more top-down, assimilative processing. In contrast, negative mood, by recruiting a stimulus-based, accommodative processing style, almost eliminated the primacy effect.

Many common judgmental errors in everyday life occur because people are imperfect and often inattentive information processors. For example, the *fundamental attribution error* (FAE) or *correspondence bias* refers to the pervasive tendency by people to infer intentionality and internal causation and underestimate the impact of situational constraints and forces when making judgments about the behavior of others (Gilbert & Malone, 1995). This error occurs because people focus on central and salient information, that is, the actor, whereas they ignore equally relevant but less salient information about external influences on the actor (Gilbert & Malone, 1995). As negative mood promotes vigilant, detail-oriented processing, it should reduce the incidence of the FAE by directing greater attention to external influences on actors.

This prediction was tested in one experiment (Forgas, 1998c) where happy or sad subjects read an essay and made attributions about its writer advocating a popular or unpopular position (for or against nuclear testing). The writer's position was described as either assigned (implies external causation) or freely chosen (implies internal causation). Results showed that happy persons were more likely and sad people were less likely than controls to commit the FAE by incorrectly inferring an internally caused attitude based on a coerced essay.

Such mood-induced differences in judgmental accuracy do occur in real life. In a field study (Forgas, 1998c) happy or sad participants (after watching happy or sad movies) read essays and made attributions about writers advocating popular positions (pro recycling) or unpopular positions (contra recycling). Again, positive affect increased and negative affect decreased the

tendency to mistakenly infer internally caused attitudes based on coerced essays. In a further study, recall of the essays was additionally assessed as an index of processing style (Forgas, 1998c, Exp. 3). Negative mood again reduced and positive mood increased the incidence of the FAE. Recall memory data confirmed that those in a negative mood remembered more details, indicating enhanced accommodative processing. Furthermore, a mediation analysis showed that this mood-induced difference in processing style significantly mediated the observed mood effects on the incidence of the FAE. We should note, however, that negative mood only improves judgmental accuracy when relevant stimulus information is actually available. Ambady and Gray (2002) found that in the absence of diagnostic details, “sadness impairs [judgmental] accuracy precisely by promoting a more deliberative information processing style” (p. 947).

**Mood effects on skepticism and the detection of deception.** Most of our knowledge about the world is based on second-hand information we receive from others. Many messages, such as most interpersonal communications, are by their very nature ambiguous and not open to objective validation. Other claims (such as “urban myths”) can potentially be evaluated against objective evidence, although such testing is usually not practicable. One of the most important cognitive tasks people face in everyday life is to decide whether to trust and accept, or distrust and reject social information. Rejecting valid information (excessive skepticism) is just as dangerous as accepting invalid information (gullibility). What determines whether the information we come across in everyday life is judged true or false?

There is some recent evidence that by recruiting assimilative or accommodative processing, mood states may significantly influence skepticism and gullibility (Forgas & East, 2008a; 2008b). For example, one study asked happy or sad participants to judge the probable truth of a number of urban legends and rumours (Forgas, 2011c). Positive mood promoted greater

gullibility for novel and unfamiliar claims, whereas negative mood promoted skepticism, which is consistent with the more externally focused, attentive, and detail-oriented accommodative thinking style. In another experiment, participants' recognition memory was tested two weeks after initial exposure to true and false statements taken from a trivia game. Only sad participants were able to correctly distinguish between the true and false claims they had seen previously. In contrast, happy participants tended to rate all previously seen and thus familiar statements as true (in essence, a fluency effect). This pattern suggests that happy mood produced reliance on the "what is familiar is true" heuristic, whereas negative mood conferred a clear cognitive advantage improving judges' ability to accurately remember the truth or untruth of the statements.

Unlike many 'urban myths', interpersonal communications are often intrinsically ambiguous and have no objective truth value (Heider, 1958). Accepting or rejecting such messages is particularly problematic, yet critically important for effective social interaction. It turns out that mood effects on processing style may also influence people's tendency to accept or reject interpersonal communications as genuine. People in a negative mood were significantly less likely and those in a positive mood were more likely to accept various facial expressions communicating feelings as authentic (Forgas & East, 2008a).

Taking this line of reasoning one step further, does mood, through its effect on processing styles, influence people's ability to detect deception? In one study, happy or sad participants watched videotaped interrogations of suspects accused of theft who were either guilty or not guilty of this offence (Forgas & East, 2008b). Surprisingly, those in a positive mood were more gullible, as they accepted more denials as true. In contrast, sad mood resulted in more guilty judgements, and actually improved the participants' ability to correctly identify targets as deceptive (guilty) or honest, consistent with a more accommodative processing style. These



experiments offer convergent evidence that negative mood increases skepticism, and may significantly improve people's ability to accurately detect deception.

**Mood effects on stereotyping.** Assimilative processing in happy mood should promote, and accommodative processing in negative mood should reduce the use of pre-existing knowledge structures, such as stereotypes. In several studies, Bodenhausen (1993; Bodenhausen, Kramer & Süsser, 1994) found that happy participants relied more on ethnic stereotypes when evaluating a student accused of misconduct, whereas negative mood reduced this tendency. Generally speaking, sad individuals tend to pay greater attention to specific, individuating information when forming impressions of other people (Bless, Schwarz & Wieland, 1996).

Similar effects were demonstrated in a recent experiment where happy or sad subjects had to form impressions about the quality and other aspects of a brief philosophical essay allegedly written by a middle-aged male academic (stereotypical author) or by a young, alternative-looking female writer (atypical author). Results showed that happy mood increased the judges' tendency to be influenced by irrelevant stereotypical information about the age and gender of the author. In contrast, negative mood eliminated this effect (Forgas, 2011b). Again, this pattern is entirely consistent with the predicted assimilative vs. accommodative processing style recruited by good or bad moods, respectively.

Could mood-induced differences in processing style also influence reliance on stereotypes in actual social behaviors? We tested this prediction by asking happy or sad people to generate rapid responses to targets that appeared or did not appear to be Muslims, using the "shooter's bias" paradigm to assess subliminal aggressive tendencies (Correll, Park, Judd & Wittenbrink, 2002). In this task, people are instructed to rapidly shoot at targets only when they carry a gun. Prior work with this paradigm showed that US citizens display a strong implicit bias to shoot

more at Black rather than White targets (Corell et al., 2002; Correll et al., 2007).

We expected a “turban effect”, that is, Muslim targets may elicit a similar bias. We used morphing software to create targets who did, or did not appear Muslim (wearing or not wearing a turban or the hijab) and who either held a gun, or held a similar object (e.g., a coffee mug). Participants indeed shot more at Muslims rather than non-Muslims, but the most intriguing finding was that negative mood actually *reduced* this selective response tendency fueled by negative stereotypes (Unkelbach, Forgas & Denson, 2008). Positive mood in turn increased the shooter’s bias against Muslims, consistent with a more top-down, heuristic assimilative processing style (Bless & Fiedler, 2006; Forgas, 2007). Thus, mood effects on information processing styles may extend to influencing actual aggressive behaviors based on stereotypes as well.

**Mood effects on interpersonal strategies.** Effective interpersonal behavior may be improved by processing external information in a more attentive and accommodative fashion. For instance, moods may optimize the way people process, produce, and respond to persuasive messages. In a number of studies, participants in sad moods showed greater attentiveness to message quality, and were more persuaded by strong rather than weak arguments. In contrast, those in a happy mood were not influenced by message quality, and were equally persuaded by strong and weak arguments (e.g., Bless et al., 1990; Bless et al., 1992; Bohner, Crow, Erb & Schwarz, 1992; Sinclair, Mark & Clore, 1994; Wegener & Petty, 1997).

Further, mood states may also influence the *production* of persuasive messages. In one experiment, participants received an audio-visual mood induction and were then asked to produce effective persuasive arguments for or against (a) an increase in student fees, and (b) Aboriginal land rights (Forgas, 2007). As expected, results showed that participants in a sad

mood produced higher quality, more effective persuasive arguments on both issues than did happy participants. A mediation analysis revealed that it was mood-induced variations in argument concreteness that mediated the observed differences in argument quality, consistent with the prediction that negative mood should recruit a more externally oriented, concrete and accommodative processing style (Bless, 2001; Bless & Fiedler, 2006; Fiedler, 2001; Forgas, 2002). Similar effects were found when happy and sad people produced persuasive arguments for a “partner” to volunteer for a boring experiment using e-mail exchanges (Forgas, 2007). Once again, negative affect produced a processing benefit, resulting in more concrete and more effective persuasive messages (Figure 4).

Induced moods may also influence the degree of *selfishness* versus *fairness* people display when allocating resources amongst themselves and others in strategic games, such as the dictator game (Tan & Forgas, 2010). Positive mood, by increasing internally focused, assimilative processing resulted in more selfish allocations, and this effect was even greater when the other person was a stranger rather than an in-group member (Figure 5). Negative mood, in contrast, focusing greater attention on external information such as the norm of fairness, resulted in significantly more generous and fair allocations to both in-group members and strangers.

#### *Summary and Conclusions*

Understanding the relationship between feeling and thinking, affect and cognition has been one of the more enduring puzzles about human nature. From Plato to Pascal and Kant, a long line of Western philosophers have tried to analyse the ways that affect can influence our thinking, memory, judgments and behaviors. Despite a number of promising early studies, psychologists were relatively late to apply empirical methods to study mood effects on cognition. This chapter reviewed the current status of this important research area, and suggested that the effects of mood

on cognition can be classified into two major kinds of influences: *informational effects* impacting on the content and valence of thinking usually resulting in mood congruence, and mood effects on *processing strategies*, influencing how people deal with information.

**Practical Implications.** Contemporary culture places an almost exclusive emphasis on the beneficial effects of positive mood, and the achievement of positive affect seems to be the objective of most applied psychological interventions. In contrast with this view, the results reviewed here highlight the potentially adaptive and beneficial processing consequences of both positive and negative moods, demonstrating that positive affect is not universally desirable. For instance, people in a negative mood are less prone to judgmental errors (Forgas, 1998c), are more resistant to eye-witness distortions (Forgas et al., 2005), are less likely to rely on stereotypes (Unkelbach et al., 2008), and are better at producing high-quality, effective persuasive messages (Forgas, 2007). Given the consistency of findings across a number of different domains, tasks and affect inductions, these effects appear reliable. Further, they are broadly consistent with the notion that over evolutionary time, affective states came to operate as adaptive, functional triggers to elicit information processing patterns that are appropriate in a given situation. In a broader sense, the results presented here suggest that the persistent contemporary cultural emphasis on positivity and happiness may be misplaced, given growing evidence for the important, adaptive benefits of both positive and negative mood states.

It is important to note that the processing advantages of negative affect reported here apply only to mild, temporary negative moods, and do not generalize to more intense and enduring negative affective states such as depression, as depression does not necessarily produce more accommodative thinking. In a recent review article on the cognitive manifestation of depression, Gotlib and Joormann (2010) concluded that “depression is characterized by increased elaboration

of negative information, by difficulties disengaging from negative material, and by deficits in cognitive control when processing negative information” (p. 285). According to this view, the cognitive dysfunction inherent in depression can rather be described as of prolonged, gridlocked mood-congruent information processing, rather than better accommodation to situational requirements. We should also note that according to recent evidence, the cognitive consequences of affective states may also depend on whether the affective state is low or high in approach motivation. In several studies, low approach positive affect was found to broaden cognitive categorization and attention, but high approach positive affect had the opposite effect, narrowing categorization (Gable & Harmon-Jones, 2008; Price & Harmon-Jones, 2010).

In conclusion, there is now strong evidence showing that mood states have a powerful, yet often subconscious influence on *what* people think (content effects) as well as *how* people think (processing effects). As we have seen, research shows that these effects are often subtle and subject to a variety of boundary conditions and contextual influences. A better understanding of the complex interplay between mood and cognition remains one of the most important tasks for psychology as a science. A great deal has been achieved in the last few decades applying empirical methods to exploring this issue, but in a sense, the enterprise has barely begun. Hopefully this chapter, and the collection of papers in this volume in general, will stimulate further research exploring the fascinating relationship between mood and cognition.

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Figure Captions

Figure 1. The effects of positive, neutral, and negative mood on the intimacy, variety, abstractness, and valence of self-disclosing messages.

Figure 2. Mean number of target items seen in a shop recalled as a function of the mood (happy vs. sad) induced by the weather.

Figure 3. The interaction between mood and the presence or absence of misleading information on eye-witness memory: Positive mood increased and negative mood decreased the tendency to incorporate false, misleading details into eye-witness reports (false alarms).

Figure 4. Mood effects on the quality and concreteness of the persuasive messages produced: Negative affect increased the degree of concreteness of the arguments produced, and arguments produced in negative mood were also rated as more persuasive.

Figure 5. Mood effects on the degree of selfishness vs. fairness on allocations made to ingroup members versus strangers: Positive mood recruited more assimilative, internally focused processing resulting in greater selfishness, and negative mood produced greater attention to fairness norm and fairer allocations.









