Cognitive regulation of emotion:

Application to clinical disorders

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Abstract

This chapter investigates how multilevel models of emotion contribute to our understanding of the cognitive mechanisms that regulate emotion. A theoretical framework, attempting to synthesize different multilevel cognitive models of emotion is presented. This framework distinguishes between different types of processes and structures and shows how emotion and its regulation entail a complex interacting system, including automatic and controlled processes that converge in certain cases and diverge in other cases. The model also demonstrates how all important domains of cognition are recruited by emotion and its regulation: perception, attention, memory, decision making, and consciousness. Then, cognitive processes leading to emotion regulation are considered within that framework. Finally, empirical evidence for such processes is reviewed with a special focus on attention, autobiographical memory, and consciousness.
The cognitive regulation of emotion : Application to clinical disorders

Common sense and folk theories of psychology often pit cognition against emotion. The former would reflect high level processes related to intelligence and voluntary decision making; The latter would be akin to low level processes, such as instincts, operating automatically and beyond one’s volition. In the past, this dichotomy has also been emphasized in scientific psychology and raised a debate that culminated with the controversy between Zajonc (1984), who promoted a strict distinction between cognition and emotion that was summarized in his aphorism “preference needs no inference,” and Lazarus (1984), who defended the notion that no emotion can arise without a cognitive appraisal attributing an emotional meaning to a situation. Since then, most researchers agree that this debate is more an issue of semantic controversy over the definition of cognition than a real theoretical issue (Leventhal & Scherer, 1987). There is now a strong consensus that emotion is elicited, supported, and regulated by a variety of cognitive processes, many of which are implicit and automatic in nature (Öhman, 1999).

Schematically, cognitive processes take place at the input and output levels in emotional phenomena. At the input level, situations, whether external or internal stimuli, are appraised as either emotionally significant or emotionally insignificant. This appraisal process is cognitive in nature and relies on a range of cognitive processes operating at various levels of automaticity, voluntariness, and complexity (Leventhal & Scherer, 1987; Smith & Kirby, 2000). At the output level, emotional states prime or facilitate specific cognitive modes. For instance, Christianson (1992) has shown that negative emotion biases attention toward the focal aspects of the situation that are emotionally relevant. Such focal attention might feed back in continuous appraisal, biasing the evaluation of the situation toward the activated emotion (McNally, 1995). Thus, from a regulation perspective, emotion might be modulated at different stages through cognitive
processes: through appraisal that gives emotional meaning to a situation (Butler and Gross, this volume) and through the cognitive processing mode that is elicited by the emotional state.

In this chapter, we will explore the different cognitive processes that might operate in emotion regulation. We will first present a cognitive model of emotion that will serve as a theoretical framework articulating different cognitive regulation processes. Then, we will turn to specific aspects of the cognitive regulation of emotion, examining successively attentional aspects, memory processes, consciousness, and awareness of emotional experience. We will conclude by integrating these different aspects, examining their clinical implications, and suggesting future directions for research.

Multilevel cognitive models of emotion

Traditionally, cognitive models of emotion have focused on the central question of how emotional meaning is ascribed to a situation. Such research has identified a series of dimensions, such as novelty, valence, goal congruence, or potency, along which a situation is evaluated to yield emotional meaning and which account for the nature of emotional feelings and responses (e.g. Roseman, Antoniou & Jose, 1996; Scherer, 1988). Recently, that approach has been criticized for its excessive “cognitivism” (Scherer, 2001), for being descriptive rather than explicative, and for not integrating the knowledge cognitive sciences have accumulated on basic processes such as attention or memory (Philippot & Schaefer, 2001). Consequently, an alternative to classic cognitive models of emotion, pioneered by Leventhal (1984), has recently gained interest: multilevel modeling of emotion (Philippot & Schaefer, 2001; Power & Dalgleish, 1997; Smith & Kirby, 2000; Teasdale & Barnard, 1993). This approach is based on the premises that emotional information can be processed on at least two distinct levels and that the outputs of
these levels lead to different emotional consequences. The type of emotional memory activated and the type of processes operating are central to multilevel models. These cognitive models are also remarkably consistent with recent neurological evidence, such as that presented by Bechara (this volume). These characteristics suggest that multilevel models are excellent candidates for understanding how emotion is cognitively regulated.

Observing important convergences among the different multilevel models proposed in the literature (Leventhal, 1984; Power & Dalgleish, 1997; Smith & Kirby, 2000; Teasdale & Barnard, 1993), we have recently attempted an integration of these models: the dual memory model of emotion. The development of this model was driven by our ambition to provide a theoretical framework both for our experimental research on the cognitive regulation of emotion (Philippot & Schaefer, 2001) and for our clinical practice with emotional disorders (Philippot, Deplus, Schaefer, Baeyens, & Falise, 2000). In the next sections, we will present this model.

The basic characteristic of the dual memory model architecture is the distinction between the types of memory--the structure--involved in the elicitation and regulation of emotion and the processes operating on these structures. At the structural level, two types of memory systems are postulated, a “schematic” system and a “propositional” system. These two types represent a distinction common to all multilevel models. The schematic system refers to an implicit memory that conveys the immediate emotional meaning of a situation for a given individual. The propositional system pertains to declarative, conceptual knowledge about emotion. The schematic and the propositional system receive their input from different systems--the sensory and the object recognition systems, respectively--and in turn feed into different output systems (e.g., the body response system). The structures postulated in the dual memory model are illustrated in Figure 1. At the process level, different types of processes operating on these
structures are postulated. They differ in terms of automaticity / voluntariness and of consciousness. Before specifying these processes, we will detail the structural level, following the natural flow of information.

The structures involved in the dual memory model

The perceptual system

Raw sensory input from each perceptual modality is automatically integrated and analyzed to extract basic perceptual features. For example, features of shape, movement pattern, and depth are extracted from raw visual input. There are different systems for different sensory modalities. These structures are innate and develop early in ontogeny, and they have an innate output to the body response system. That is, certain patterns of perceptual stimulation, automatically identified at the perceptual system level, automatically trigger specific body responses. For instance, a sudden loud noise, which has the perceptual feature of unanticipated stimulation, automatically triggers a startle response.

The body response system

Body responses in emotion are organized to support logistically certain types of interactions between the organism and its environment (see the development of this idea in Pauls and in Stemmler, this volume). The concept of action tendency has been proposed by Frijda (1986) to account for this notion. These body responses encompass facial expression, body postures and movements, as well as the whole range of visceral responses (see Stemmler, this volume, for an in-depth analysis of this topic). A set of such prepared body responses is innate,
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and organizes the first emotional responses in ontogeny with the aim of fostering the survival of individuals, their social integration, and their affective and intellectual development. Frijda (1986) has proposed eight innate action tendencies in the human species: approach, inhibition, play, dominance, submission, aggression, rejection, and panic. Each of these action tendencies is supported by a specific body state.

The body response system can be activated directly by outputs from the perceptual system. Early in ontogeny, this automatic and innate connection between perceptual and body response systems constitutes the first manifestations of emotion. For instance, an infant’s perception of loss of support will automatically trigger the panic body response system. Such innate responses can still be observed in adulthood, such as in the example of startle mentioned above. Innate body responses constitute the building blocks of later more elaborate--yet still automatic--responses.

Automatic links between the perceptual and the body response systems correspond to the concept of primary emotion proposed by Damasio (1994; see also Bechara, this volume) and to the concept of sensory-motor level proposed by Leventhal (1984).

The schematic system

The schematic system (or implicational subsystem, following Barnard & Teasdale, 1991; or associative processing, according to Smith & Kirby, 2000) is based on schemata: A schema is an abstract and implicit representation which integrates sensory, perceptual, and semantic information typical of a given category of emotional experiences, on the one hand, and their relation to the activation of specific body response systems, on the other hand. All authors do not agree on the specific nature of schemata: Some see them as associative representations, whereas others view them as analogical or metaphoric representations. Following the germinal work of
Leventhal (1984), we propose that schemata can be conceptualized as the records of the individual’s emotional classical conditioning. When perceptual elements are repeatedly activated at the same time as innate connections between perceptual features and body responses, they become integrated in an abstract representation that encodes high order reoccurrences between the activation of perceptual—and, later in ontogeny, semantic—elements and body responses. For example, touch and odor features of the mother’s breast are perceptual features that automatically trigger an approach body response in the newborn. Repeated associations between experiences of activation of these basic innate features and the approach response, together with new features, such as auditory features of the mother’s voice or the smell of her perfume, will become integrated in a schema.

Several authors endorse the assumption that each schema carries an implicit meaning which can be conceived of as a holistic theme (e.g., the notion of core relational theme proposed by Lazarus, 1991). For example, the theme of "hopelessness / lost" is hypothesized to underlie the schema of "sadness." Some have proposed that the implicit holistic meanings carried by the schemata are best expressed in metaphors or in poetry (Teasdale & Barnard, 1993).

In sum, schemata are built automatically by abstracting communalities in the similar experiences lived by an individual. Direct experience is the only means whereby information can enter into a schema. The schema, as a representation, is not available to consciousness. However, its content can be inferred based upon the changes it induces in feelings and body state.

The object recognition system

Once basic perceptual features have been identified by the perceptual system, they can feed into another cognitive system that allows their identification as an “object.” For instance, a specific visual pattern of lines and of a square surface can be identified as a chair; a pattern of
noise can be recognize as a bird song or as a word. The cognitive ability to identify a stability in perceptual information and to recognize objects develops very early in infancy (Lindsay & Norman, 1977). It allows for the construction of discrete mental representations, the concepts that are the building blocks of the propositional system.

**The propositional system**

The propositional system consists of declarative knowledge about emotion. Representation units of this system are discrete concepts about the different elements of emotional situations. These concepts are linked with one another through specific relationships that obey the laws of semantic propositional logic. In contrast to the schematic system, the meaning stored in the propositional system is thus specific and has a “truth validity” (i.e., a meaning statement can be declared true or false). For instance, the knowledge that A should feel anger against B if B prevents A’s pursuit of an important goal and B acts intentionally, can be declared true, while the statement that A should feel sadness when receiving a pleasant present can be declared false. Knowledge at the propositional level can be activated willfully and consciously. It constitutes the basis for conscious identification of emotion, for verbal communication about emotion, and for willful problem solving and coping in emotional situations. Any source of information that can be translated into propositional networks of concepts can be incorporated in the propositional representational system. Thus, it can be augmented through conversation, readings, and the like. The capacity of this representational system is potentially unlimited.
Processes operating on the schematic and propositional systems

As mentioned in the preceding section, different types of processes can operate on the information contained in the schematic and propositional systems. These processes differ in terms of automaticity / voluntariness, in terms of consciousness, and in terms of the output they produce.

Automatic processes and conscious processes

At the schematic level, processes are automatic and unconscious. The activation of any facet of a schema has the potential to activate the whole representation. An important aspect of these automatic processes is that activation is bi-directional. Indeed, as these representations are associative in nature, information can flow in one direction as well as in the other. For instance, a schema can activate one or more specific body response systems. Conversely, the activation of a response system can trigger a related schema. At the neurological level, this circular activation has been described as an “as if” loop in the brain, in which central body makers can re-activate a “primary” emotion representation (Bechara, this volume; Damasio, 1994). Thus, the activation of a body state can feed back positively in the activation of a schema in two ways: first, centrally, by the direct association between schemata and body response systems, and secondly, peripherally, via the production of actual body responses that feed into the schema via the perceptual system. A large literature has demonstrated that the activation of a specific body state activates the other facets of the corresponding emotion responses, be it via the face (Matsumoto, 1987), the posture (Stepper & Strack, 1993) or respiration (Philippot, Chapelle & Blairy, 2002).

Similarly, while perceptual indices from the perceptual system automatically activate the related schema, the activation of a schema will automatically influence the activity of the perceptual system by lowering the perceptual threshold for indices congruent with the schema.
There is some evidence of this phenomenon in the clinical literature. For instance, trait social anxiety, which can be conceptualized as the chronic activation of a social fear schema, is characterized by a lowered perceptual threshold for threatening face, a very relevant stimulus for the social fear schema (Mogg & Bradley, in press; see the next sections for a further development of this point).

At the propositional level, different types of processes can be activated. Some processes are automatic and unconscious. For instance, some concepts can be activated at an unconscious level and influence subsequent processing of information, as in priming effects. However, information at the propositional level can also be made conscious; propositions—i.e., networks of concepts and their relations—can be sufficiently activated to be transferred into working memory and made conscious. We can thus deliberately activate our knowledge about emotion, identify and label our emotional states, talk about them, and make decisions about how to behave. Indeed, these are the main functions attributed by most multi-level theorists to the conscious processes operating in the propositional system.

**Reflexive processes**

However, there is another class of processes that operates on both the schematic and the propositional representations and that enables reflexive consciousness of emotional experience. Two types of consciousness, producing different phenomenological experiences and mental phenomena (such as memory experiences), have been proposed: noetic and autonoetic consciousness (Tulving, 1985; Wheeler, Stuss & Tulving, 1997). In a state of noetic awareness, individuals experience the direct consciousness of being aware of things, of knowing them. For example, we can know that once, we have been angry against X, but without being able to remember or to re-evoke the specific experience of it. In the state of autonoetic awareness,
individuals are experiencing a reflexive type of consciousness: They know they are or have been the subjects of a specific experience. We can remember and re-activate the experience of that anger episode against X. These qualities of consciousness apply to past as well as to future or present events. For instance, awaiting an thesis defense, Alex can not only know that he is anxious (noetic awareness) given his jittery state, pounding heart, and apprehensive ruminations, but he can also realize that he is the subject of a specific emotional experience and consciously experience himself as being anxious, or, in other words, feel himself as experiencing anxiety (autonoetic awareness).

The capacity for autonoetic consciousness, and the processes that underlie that capacity, allow for several mental phenomena that might be uniquely human and that would thus characterize human emotions and their regulation. First, autonoetic consciousness allows the mind to travel in time. As demonstrated by Wheeler et al. (1997), this capacity is necessary to remember past specific personal experiences, as well as to envision hypothetical future personal experiences. For instance, brain-damaged patients who have lost the capacity for autonoetic consciousness not only cannot remember past personal experience, but, correlativey, they cannot envision future ones (see Wheeler et al., 1997, for a review of this question). This capacity to travel in time would be uniquely human, as suggested by a recent meta-analysis of the animal literature (William, 2002).

Autonoetic consciousness also allows for the capacity to produce voluntarily and immediately an emotional experience via mental imagery. Clinical evidence supporting this notion has been gathered in our laboratory. In a profoundly amnesiac subject, “A. C.,” we have demonstrated that this absence of autonoetic capacities was associated with the inability to recollect any past personal experience or to envision future personal experience but was also
associated with the inability to produce any emotion via mental imagery (Chapelle, Philippot & Van der Linden, 1996). However, as compared to controls, A. C. evidenced perfectly normal emotional reactions in immediate emotional situations. For instance, when exposed to emotional film clips or slides, his expressive, physiological, and subjective responses were well within the normal range. A. C. had also perfectly preserved his emotional knowledge at the propositional level, holding, for instance, the same expectations than controls about the elicitors and responses that are most typical of given emotions.

These two types of phenomenological experience--on the one hand simply “knowing” that oneself is anxious, and on the other hand, being self-reflexively aware that oneself is experiencing anxiety--require different processing of emotional information. In the present theoretical framework, the state of noetic awareness requires only the conscious activation of propositional information. In contrast, the state of autonoetic awareness implies the strategic combination of both schematic and propositional information. This statement is based on a notion presented by Conway and Pleydell-Pearce (2000), who suggest that voluntary activation of personally and emotionally relevant memories (or predictions about future experiences) implies the combination of two sources of information: one pertaining to “event-specific knowledge” —in the present framework, to a specific propositional network of concepts describing the event in its factual specificity--and the other pertaining to the emotional implications of the event—in the present framework, to a schema. According to Conway and Pleydell-Pearce, human autobiographical memory would have confronted a dilemma in its evolution. On the one hand, the capacity to re-evoke past experiences and their emotional impact yields obvious adaptive advantages (see Bechara, this volume). On the other hand, if each time one re-evoked an emotional memory, the (potentially strong) emotional state that one initially experienced was re-activated, the whole
cognitive system could be disrupted by the emotional arousal and would start to disfunction. Conway and Pleydell-Pearce (2000) have proposed that to protect itself against such catastrophic functioning, human autobiographical memory would have evolved two systems, one containing factual, event-specific knowledge, and the other containing emotional traces. The similarity between these notions and the notions of propositional and schematic systems is striking. Conway and Pleydell-Pearce (2000) have further proposed that the process of building event-specific knowledge has the capacity to inhibit emotional traces.

Along these lines, we propose that the processes leading to a state of autonoetic awareness of emotion need to activate information contained in the propositional networks—because this is the material on which they can operate consciously—and that they also need to access information contained in the schemata because the affective tone of the information is required for autonoetic awareness and because of the many affordances it offers to human cognitive functioning. However, the schema has the propensity to generate positive feedback loops perpetuating and even enhancing its activation, and, consequently, to disrupt high level cognitive processes, as suggested by Conway and Pleydell-Pearce (2000). In the dual memory framework, this disruption could occur in at least three ways: by generating supra-optimal physiological arousal (the Yerkes-Dodson law, 1908), by biasing attention towards perceptual features congruent with the schema, and by automatically activating schema-connected concepts in the propositional network.

To protect themselves against such disruption, autonoetic consciousness processes should have the capacity to regulate the activation of the schema in order to obtain only the schematic information needed, without risking potential disturbances for high level cognitive processes. This implies a strategic, finely-tuned regulation. One possibility is that this regulation operates
on the loops that positively feed into the schema, perhaps by redirecting attention toward elements (perceptual indices or concepts in propositional networks) that are congruent with the strategic aim but not with the schema. These processes might also have an inhibitory effect on the body response system. We have explored some of these different possibilities in a research program that will be described in the following sections.

In sum, many aspects of the capacity of autonoetic consciousness suggest that the processes underlying this capacity are central to the voluntary regulation of emotion. First, autonoetic consciousness relies on the integration of schematic and propositional information. Processes leading to autonoetic awareness thus have the capacity to activate and to regulate both schemata and propositional networks. Specifically, it is postulated that such processes have the capacity to inhibit the over-activation of emotional schemata. Second, autonoetic consciousness allows for the recollection of specific past experiences. This capacity offers to individuals large, detailed, and very particularized data banks of what happened to them in the past and how best to decide their present course of action, given that rich knowledge. Third, autonoetic consciousness yields the possibility of immediate generation of a mental and emotional representation of how one would feel in a future hypothetical situation. This information has been demonstrated to be central for personal decision making in many life situations (Bechara, this volume; Damasio, 1994). Finally, autonoetic consciousness plays a central role in the definition of the self and of how it is regulated. Indeed, the self is constituted from the memory of one’s past experiences and goals and of one’s future goals, all mental constructions for which autonoetic consciousness is central (Conway & Pleydell-Pearce, 2000).

The regulation of emotion in the dual memory model.
From the present perspective, the core of emotional activation rests in the schema. This cognitive structure provides the organism with wholly-prepared, immediate response modes to challenging situations in the environment. This capacity yields important adaptive capacities (See Stemmler, this volume). However, this fast, powerful, and automatic response system, as a result of these very characteristics, also has the potential to prevent or disrupt slower, more cognitively elaborated responses. This becomes problematic when such thoughtful responses provide a better alternative than automatic ones, or when conflicts arise between the two response modes. From the present perspective, the question of emotion regulation becomes a question of modulating the activation of the schema. This question can be divided into two more specific sub-questions: How can the schema be inhibited when more thoughtful types of response would better serve the individual’s adaptation and/or well-being, and how can the self-perpetuating activation of the schema via the many feedback loops be controlled?

In the framework of the dual memory model, schema activation can be regulated by three means: the regulation of peripheral feedback, the re-direction of attention, and the elaboration of emotional information. We will examine each of these means in the following sections.

**The regulation of the peripheral feedback**

There is ample empirical evidence that modulating one’s body state alters one’s emotional state. In the emotion literature, the facial feedback effect—the fact that altering one’s facial expression produces the corresponding emotional state—has received much attention. A wealth of studies has documented that manipulating facial expression influences feeling state (Laird, 1984; Manstead, 1988; Matsumoto, 1987; McIntosh, 1996). The impact of facial muscle manipulation has been extended to studies of physiological changes, such as heart rate or skin temperature (Hess, Kappas, McHugo, Lanzetta & Kleck, 1992; Kappas, 1989; Levenson, 1992;
Levenson, Carstensen, Friesen, and Ekman, 1991; Levenson, Ekman & Friesen, 1990). Further, Stepper and Strack (1993) have documented that manipulating posture also has an impact on subjective feeling states and influences subsequent judgment of valenced material, extending previous findings from Duclos, Laird, Schneider, Sexter, Stern, and VanLighten (1989) showing that posture affects mood. Finally, studies from our laboratory have demonstrated that manipulating breathing patterns has a strong impact on feeling state (Philippot et al., 2002) and that this effect can occur outside of awareness of the process (Philippot & Dellavalle, 1998).

At the clinical level, controlled breathing and muscle relaxation are known to be powerful means to alleviate intense negative emotions such as anxiety or anger. For instance, it has been demonstrated that hyperventilation (i.e., breathing faster than required by an organism’s needs), which can be associated with tense situations, plays a pivotal function in rapid and automatic onset of extreme fears in certain anxious conditions, such as panic attack (Beck & Scott, 1988; Huey & West, 1983). Feedback loops among the activation of a fear schema, the production of bodily sensations, and their positive feedback on the schema have been documented in clinical samples (Ehlers, Margraf, & Roth, 1988; Kenardy, Oei, & Evans, 1990). In these conditions, breathing retraining is a central component of the therapeutic intervention (Barlow, 2002). Similarly, after the pioneering works of Jacobson (1957) and Wolpe (1961), muscle relaxation is a key component of the regulation of emotional arousal in psychotherapeutic intervention.

In sum, there is ample evidence that altering body state induced by the activation of an emotional schema has an impact on the course of emotion. As this chapter is focused on the cognitive regulation of emotion, we won’t develop this point further and refer the reader to Pauls’s chapter in this volume.
The re-direction of attention

As presented in the preceding sections, once activated, a schema lowers the perceptual threshold for elements that are congruent with it. Thus, perceptual elements, as well as conceptual ones, linked to a schema will be primed by the activation of the schema. This results in pre-conscious and automatic attentive biases for perceptual and conceptual elements that are congruent with the schema. Positive feedback loops are thus created, reinforcing the activation of the schema. For instance, when afraid, we would more readily perceive frightening stimuli than neutral or positive ones. The clinical literature has documented such attentive biases for words (concepts) and for images, such as expressive faces. This literature will be reviewed in a subsequent section.

These perceptual priming and attentive biases are postulated to be instantiated automatically. Thus, there is the possibility that these automatic processes might be over-ridden by a willful attentional focus on elements that are incongruent with the schema. This rationale constitutes one of the bases of cognitive therapy. Indeed, the main principle of this approach is to identify the irrational thinking underlying dysfunctional attitudes, feelings, and behaviors and to help the individual to engage in more rational thinking (Beck, Rush, Shaw, & Emery, 1979). Irrational thinking is most often supported by biased attention to negative elements that reinforce it (Beck & Clark, 1997). Therefore, one important therapeutic approach involves training people to redirect their attention toward elements that are incongruent with their negative interpretation in order to develop a more balanced and objective view of the situation.

The dual memory model also postulates that schema activation might be maintained by positive feedback loops between the schema and elements of the propositional system that are automatically associated with the schema. Indeed, specific conceptual representations in the
propositional system might be recurrently activated during the arousal of a schema. For example, individuals suffering from panic disorder might repeatedly interpret their panics as heart attacks. Thus, the concepts of “heart,” “heart attack,” “cardiologist,” and the like are systematically activated during the arousal of their panic schema. These re-occurrences generate an association between the panic schema and these concepts. Eventually, simply activating the concept of heart, as when seeing the drawing of a heart on a Valentine card, will automatically trigger the panic schema. The latter will in turn activate its related concepts, including “heart.” A positive and automatic feedback is thereby created, maintaining and even enhancing the activation of the schema. Such a phenomenon has also been described in depression, in which depressive thinking maintains the activation of a depressogenic schema (Nolen-Hoeksema, 1996), a notion labeled “cognitive interlock” (Teasdale & Barnard, 1993).

The positive feedback loop between a schema and propositional elements is supposed to result from automatic processes: specifically, the activation of associations originating in the repetitive contingent activation of the schema and these propositional elements. Yet, as presented in a preceding section, propositional elements can be strategically activated and inhibited by willful processes that are directed by an intention and not by a schema. This opens the possibility of modulating the feedback loops between schema and propositional elements, either by inhibiting these propositional elements or by activating elements that are incongruent.

This process, however, might not be as straightforward as it first appears. Indeed, schema activation and feedback operate automatically, relying upon fast processes requiring few cognitive resources but having a great impact in terms of attentional focus, concept priming, and physiological arousal. In contrast, the voluntary processes that might modulate the feedback loop between schema and propositional elements are slower, require more cognitive resources (as they...
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involve much inhibition), and are likely to be disrupted by the high level of physiological arousal generated by the schema. For instance, awaiting a difficult exam, a student painfully experiences the activation of his/her anxiety schema and of the arousal state it generates. Ideas and images of failure are likely to intrude automatically into his/her consciousness and to nourish his/her anxiety (via the positive feedback loop between schema and propositional elements). The student might attempt to distract him/herself from these negative thoughts, for instance, by trying to focus on reviewing class material or by chatting with other students. However, he/she might not be very successful in this strategy, as ideas and images primed by the anxiety schema are likely to intrude regularly into his/her consciousness. For instance, reviewing material might make him/her more conscious of the difficulty of the class and of the possibility of failure, thereby reactivating schema feedback. Similarly, conversation with friends is likely to address the exam and their fears.

In sum, several feedback loops in which the direction of attention toward schema-associated elements at the perceptual or at the propositional levels are likely to maintain schematic activation and the resulting emotional arousal.

The elaboration of emotional information

An alternative to the re-direction of attention toward elements that are not associated with the schema would be to focus willfully on anxiogenic images and thoughts. The student waiting anxiously for his/her exam would try to specify what is really at stake in the situation and what are the objective dangers. Indeed, according to cognitive therapists such a willful and confrontational approach (as opposed to avoidance) of anxiogenic thinking is likely to disrupt irrational thinking that maintains the activation of the anxious schema and to help the individual to focus on all aspects of the situation, rather than focusing only on the negative aspects (Clark,
1999). From a different perspective, and based on neurological evidence, we have proposed that such willful elaboration of emotional information using executive processing has a functional inhibitory action on automatic processes that activate the schema and its feedback loops (Schaefer & Philippot, 2002).

According to these considerations, it appears that applying willful cognitive strategies to prevent schema feedback is not a simple endeavor and that we know little about how these processes might operate. The hypotheses mentioned in this paragraph will be further developed and linked to research findings in a subsequent section.

Conclusion

From the perspective of the dual memory model, the regulation of emotion is mostly a question of modulation of the schema in order to facilitate the individual’s adaptation and meet his/her needs. This regulation can be achieved indirectly by acting upon the feedback loops that maintain and enhance schema activation. These feedback loops may be peripheral, as in the modulation of body state generated by the schema. They can also be central, as when they pertain to attention redirection or controlled elaboration of emotional information. In conclusion, the dual memory model provides a useful theoretical framework for the exploration of the many cognitive processes regulating emotion. Yet, these speculations require an empirical validation. The concluding section of this chapter will present empirical evidence pertaining to these issues.

Empirical evidence regarding cognitive regulation of emotion

Many areas of research, in clinical, social, and cognitive psychology as well as in neuropsychology are pertinent to the regulation hypotheses developed in the preceding section. The most directly relevant areas concern attentional processes in emotion, more specifically
attentional biases in emotional state, on the one hand, and the elaboration of emotional information (e.g., remembering past emotional experiences or imagining future emotional consequences of a hypothetical situation), on the other hand. We will review these research domains in the following paragraphs with a particular focus on the work conducted in our laboratory.

Attention biases

In the preceding section, we developed the notion that schema activation automatically lowers the perceptual threshold for perceptual elements associated with the schema. We suggested that this process should result in an attentional bias for schema-relevant stimuli. Indeed, a wealth of studies has evidenced an attentional bias in the processing of threatening stimuli by anxious individuals. Such biases have been documented for different anxiety disorders such as generalized anxiety disorder (Bradley, Mogg, White, Groom & de Bono, 1999; MacLeod, Mathews & Tata, 1986; Mogg, Mathews & Eysenck, 1992; Mogg, Mathews & Weinman, 1989), panic disorder (Ehlers, Margraf, Davies & Roth, 1988; Mc Nally, Rieman & Kim, 1990; Mc Nally, Riemann, Louro, Lukach & Kim, 1992), spider phobia (Watts, Mc Kenna, Sharrock & Trezise, 1986; Lavy, van den Hout & Arntz, 1993) and social phobia (Amir, Foa & Coles, 1999, Gilboa-Schechtman, Foa & Amir, 1999; Mattia, Heimberg & Hope, 1993).

However, the nature of these attentional biases are the object of a controversy. Indeed, some predict that anxious individuals focus on schema-congruent information, thereby sustaining its activation (Beck, Emery & Greenberg, 1985). For instance, socially-anxious individuals would more quickly perceive that a conversation partner is frowning than would non-anxious individuals. The overactive schema would also increase the likelihood that ambiguous information would be interpreted as threatening. For instance, a neutral face might be perceived
as hostile by a socially-anxious individual. However, some researchers predict that anxious individuals will avoid any information linked to the schema. For instance, actively avoiding social stimuli, (e.g., faces) constitutes a form of cognitive escape from anxiety-provoking situations for social phobics (e.g. avoiding looking at others’ faces makes conversation less likely; Clark & Wells, 1995).

We have proposed that, in actuality, both focusing and avoidance processes would be present, but at a different times. According to this view, anxious individuals would show an initial hypervigilance for threat-relevant stimuli. This hypervigilance would be the consequence of automatic processes, and it could be observed without conscious perception of threat-relevant information (Mogg & Bradley, 1999). However, at further and less automatic stages of information processing, people would actively turn away from threatening information to escape the discomfort associated with it. Thus, this model postulates a dynamic shift of attention allocation from initial threat hypervigilance to later threat avoidance. For instance, while speaking to other people, socially anxious individuals would have their attention automatically attracted to frowns more readily than would non-anxious individuals. Because of this perception bias, socially anxious individuals are likely to automatically over-activate a state of social anxiety. However, as soon as a frown was detected, they would turn their attention away from it--and, more generally, from others’ faces--to avoid the threatening stimulus and the discomfort associated with it. Unfortunately, in doing so, they are likely to maintain their anxiety: Not only are they likely to behave socially inappropriately, but they will also be unable to determine whether the frowns were a sign of actual social threat or, for instance, simply a sign of perplexity.

We tested this hypothesis in an experiment using the dot prime paradigm (Mogg, Philippot & Bradley, 2002). Social phobics and matched controls were exposed to pairs of facial
expressions presented on a computer monitor. Each pair comprised a neutral face with either a friendly or threatening face. After facial stimulus offset, a single probe, consisting of an arrow pointing either up or down, was presented in the location of one of the faces. Participants were asked to press as quickly and as accurately as possible the key corresponding to the arrow (up or down). The rationale is that participants’ reaction time is faster if they are looking at the face location on which the probe appears. It can thus be deduced from reaction times, whether participants were looking at the neutral or at the emotional face. Further, to observe if the focus of attention changed over time, the stimulus duration was manipulated (either 500 ms or 1250 ms). It was predicted, and observed, that social phobics initially focus their attention on the threatening face, but that this attentional bias rapidly disappears. In contrast, non-phobics showed the opposite pattern. Although no initial bias for threatening faces was observed, further in the process, non-phobics strategically focused their attention on the threatening face. Similar results, using a different paradigm (homograph paradigm) were reported by Amir, Foa & Coles (1999). They fit nicely our prediction of an automatic lowering of perceptual threshold resulting from schema activation, followed by a protective voluntary attempt to redirect attention away from the threatening stimulus.

However, an important alternative hypothesis has been proposed in the literature: The attentional bias could be determined by an evaluative bias. For instance, Mogg and Bradley (1998) propose a cognitive-motivational view relying on two different systems: the Valence Evaluation System that assesses the stimulus threat value and the Goal Engagement System that orients allocation of attention as a function of the output of the former system. If a stimulus in the environment is evaluated as threatening, the Goal Engagement System interrupts ongoing activities and orients attention toward the threat. This model postulates that anxious individuals
over-evaluate the threat value of environmental stimuli. This notion is widely accepted by clinicians (e.g. Beck, Emery & Greenberg, 1985) but, curiously, has been submitted to very little empirical investigation.

In a study by Merkelbach, Van Hout, Van den Hout & Mersch (1989), social phobics and controls had to evaluate angry, neutral, and joyful faces with respect to their pleasantness. Contrary to the cognitive-motivational model’s prediction, no differences were observed between the two populations. We recently replicated this intriguing result (Douilliez & Philippot, 2002): Socially-anxious and control participants were asked to evaluate the threatening value of fearful, joyful, and neutral faces. In addition, we extended the study with other types of stimuli: words and pictures, of which we manipulated valence (positive, negative, and neutral) and social relevance (socially relevant and not socially relevant). Our rationale was that faces are potent innate stimuli (Öhman & Soares, 1993), and, as such, the processing of faces should not be influenced by social anxiety. In contrast, words and scenes depicted in the pictures require an interpretation and can therefore be affected by experience, including social anxiety.

As predicted, replicating Merkelbach et al. (1989), no differences between anxious individuals and controls were observed for the evaluation of faces. In contrast, anxious individuals evaluated negative pictures and words as more threatening, compared to evaluations by normal controls. Thus, the notion that attentive biases in anxiety are necessarily supported by an evaluative bias cannot be sustained.

In conclusion, initial attentive biases toward threatening stimuli in anxiety disorders are supported by a wealth of empirical studies. We propose that these biases are generated by an enhanced activation of the anxiogenic schema. Attentive biases maintain schema activation and prevent people from voluntarily processing threatening information in depth. This process is
likely to constitute one mechanism underlying the maintenance of emotion disorders (Clark, 1999). Further research must specify attentive bias with respect to valence and relevance for individual’s preoccupations, and thereby test the existence of explicit and implicit evaluative biases and examine the relationship between these two types of biases.

Elaboration of emotional information and regulation of emotional experience

The way people think about their emotions (or, in other words, how they elaborate emotion information), is very likely to influence their ability to regulate emotional experience. Recent research suggests that one important dimension in this respect is the level of specificity at which emotional information is processed. Indeed, clinical evidence indicates that processing emotional information at an over-general level is associated with problems in emotion regulation. For instance, Williams (1996; Williams, Stiles, & Shapiro, 1999) has shown that depression and possibly PTSD are associated with an over-general retrieval mode for memories of personal emotional experiences, whatever the emotional tone of the memory. Depressed individuals have difficulties accessing specific personal memories, that is, discrete personal episodes with a precise and circumscribed location in time and space (e.g., “I was afraid last Saturday afternoon when I was attacked by a big dog while I was jogging on Pleasant Street’’). Rather, they report over-general memories, that is, personal episodes that are extended in time or repetitive, with no precise location in space or time (e.g., “I am afraid when I am attacked by dogs while I am jogging’’). The development of a specific retrieval mode for autobiographical memory is associated with a lower risk for relapse into depression and effective relapse prevention treatments (Williams, Teasdale, Segal & Souslby, 2000).
This specificity deficit for personal memories has also been recently observed in schizophrenia (Riutort, Cuervo, Danion, Peretti & Salamé, 2002), a result replicated in our laboratory for emotional memories (Neumann, Philippot & Danion, in preparation). In this latter study, schizophrenic patients and controls completed two tasks. In the first task, participants were shown a series of neutral, positive or negative pictures from the International Affect Picture System (IAPS) (Lang, Bradley, & Cuthbert, 1999). The next day, they were exposed to the same pictures, mixed with new “distractor” pictures. Participants were asked to identify which pictures had been shown the day before. They could give a “remember” answer—meaning that they specifically remembered having seen that picture and that their recall was accompanied by autonoetic awareness—or a “know” answer, indicating that they knew the picture was in the previous set but had no specific memory of it, reflecting a recall marked by noetic awareness. In this episodic memory recall test, schizophrenic patients reported more “know” answers than “remember” ones, while control participants displayed the opposite pattern. This deficit had already been established by Danion and collaborators for non-emotional material (Danion, Rizzo, & Bruant, 1999). In a second task, participants were asked to recall and describe personal memories of emotional experiences. Their descriptions were coded for specificity according to Williams’ (1996) criteria. The second day, they were presented with personal memories and distractors and asked to recall which memories they reported the first day. Schizophrenic patients’ memories for personal emotional experiences were more general than controls’ memories. In addition, over-general memories produced more “know” answers during the second recall by schizophrenic patients than by controls. This pattern of results suggests that both deficits—the autonoetic consciousness one and the memory specificity one—might be related to a
unique functional deficit in reflexive processes that are necessary both for the reconstruction of specific memories and for autonoetic consciousness.

Another line of research also suggests a relation between generality in emotional information processing and deficits in emotional regulation. Studying mental rumination in anxiety, Borkovec (Borkovec & Hinz, 1990; Borkovec, Ray, & Stöber, 1998) has shown that such recurrent thinking patterns were characterized by their over-generality: In a state of anxious apprehension, people tend to think of possible threats in an unspecific, abstract way.

Williams and his collaborators (1999) explain the phenomenon of over-general memory as a protective mechanism from acute emotions associated with specific memories. Similarly, Borkovec (Borkovec, Ray, & Stöber, 1998) has proposed that the lack of specificity in mental rumination results from an avoidance of specific threatening information. By remaining at a general—and therefore more abstract—level of information, individuals attempt to avoid the reactivation of acute and painful emotions felt in specific personal experiences.

This interpretation is based on the notion that specifying emotional information would make this information more vivid and would increase associated feelings. However, according to multilevel models of emotion and to the dual memory model in particular, the opposite prediction could be formulated: Voluntarily focusing on emotional information and willfully elaborating it as specifically as possible should decrease schematic activation and, as a consequence, the intensity of emotional arousal and feelings. Indeed, willfully elaborating emotional information necessarily implies executive processing. As presented in the first section of this chapter, the activation of such processes strategically orients attention toward elements that may not be related to the schema (interruption of feedback loops to the schema). Further, and most importantly, executive processes might entail the inhibition of schematic activation. This latter notion is
congruent with the proposal of Conway and Pleydell-Pearce (2000) that elaborating specific personal information implies the inhibition of intense autonoetic feeling states that would otherwise disrupt elaborated cognitive processing. This notion is also in accordance with the clinical observation that, in exposure therapy, people can learn to regulate anxiety only if they focus their attention on the emotional information that they usually avoid and if they attempt to attend to it as specifically as possible (Foa & McNally, 1996).

Thus, understanding why people with emotional disorders tend to process emotional material at an over-general level—and how this characteristic might play a role in the etiology of their emotional disregulation—necessitates addressing several key questions. First, do people hold a naïve theory that focusing on personal emotional cognition increases emotional intensity? Second, does over-general processing of emotional information induce more intense emotional states than does specific processing? Third, does voluntarily specifying painful emotional material decrease or increase discomfort? Our underlying hypothesis was that people indeed believe that focusing on emotion will increase its intensity (Question 1). Therefore, when confronted with painful spontaneous thoughts—either about a personal memory or about predictions related to possible future negative situations—people would not invest any effort in elaborating them; rather, they would attempt to avoid them, resulting in the over-generality bias we have observed. However, in actuality, over-general processing would favor schema activation (Question 2). If this is indeed the case, constraining people to focus on painful personal cognitions and to elaborate them should result in a decrease in painful feelings (Question 3). We recently investigated these hypotheses in our laboratory.

In the first experiment (Philippot, Burgos, Verhasselt, & Baeyens, 2002), participants were asked to imagine themselves thinking as specifically as possible about a past personal
positive experience and about a negative one. They then had to predict how their emotional intensity would evolve over time during this task. Outpatients suffering from anxiety disorders were compared to healthy matched controls. Results showed that both groups of participants hold a naïve theory that thinking specifically about an emotional experience intensifies the emotional feelings during the first minutes and maintains this intensity thereafter at a high level. This general pattern is observed for positive as well as for negative emotions. Interestingly, control participants anticipated less intense feelings when thinking about a negative as compared to a positive experience. This suggests a “protective” inhibition of negative emotion. In comparison, anxious patients anticipated a higher emotional intensity for negative events, suggesting that they did not believe they could modulate the aversive arousal resulting from the processing of negative personal experience. It is therefore likely that anxious individuals avoid the specification of negative emotional information more than non-anxious individuals do.

Is people’s naïve theory correct? In other words, does specifying emotional information increase emotional feelings? To answer this question, we conducted several series of experiments, using different methods, in which we examined how emotional intensity was influenced by the induction of an over-general versus specific mode of processing emotional information. In the first series of experiments, we used Williams’ (1996) distinction between over-general and specific autobiographical memories to prime an over-general or a specific mode of processing autobiographical information. In a first experimental session, participants were invited to report personal memories related to particular emotions. In the second experimental session, before undergoing an emotion induction procedure, participants were primed with two of these memories. According to the experimental condition, participants were primed for 60 sec. with either over-general or specific memories. In a control condition, participants spent 60 sec.
finding synonyms and antonyms of common neutral words. In the first study, emotion induction consisted of reliving a recent negative experience through a mental imagery procedure (Vrana, Cuthbert & Lang, 1986). Results showed that participants clearly reported more intense emotion when primed with over-general memories than when primed with specific memories or when they completed the control task. The second study replicated these results with a different method of emotion induction (exposing participants to film excerpts) and different types of emotion: joy, anger, fear and sadness. All emotion conditions displayed the same pattern of results, although it was statistically significant only for joy and anger. Overall, the results of these two studies suggest that people’s naïve theory is incorrect. In contrast, these results support the prediction of the dual memory model: Priming a general mode of processing emotional information resulted in more intense emotions during subsequent emotional situations than did priming a specific mode of processing.

One could object that emotional memories were primed at a specific or a general level before emotion induction. Participants were not explicitly instructed to process information at a general or a specific level during emotion induction. This procedure was chosen to ensure perfectly similar and comparable emotion induction conditions and to avoid biases due to different instructions during emotion induction. However, this conservative choice produces the limitation that one does not know whether the effect observed is due to the priming procedure itself or to the mode of information processing that has been primed and applied during the subsequent emotion induction procedure. To overcome this limitation, another study was designed (Schaefer, Collette, Philippot et al., 2002). In that study, participants were trained to generate emotional mental imagery (Vrana et al., 1986). In addition, during imagery trials, participants had to repeat sentences reflecting a particular way of appraising the scenario and to
imagine that these sentences were their own thoughts occurring during the situation being imagined. The over-general or specific mode of processing was manipulated using one of two sets of sentences. For the over-general mode, metaphoric sentences reflecting a holistic way of appraising the situation were used (e.g. "Everything collapses around me"). For the specific mode, explicit, analytical questions about specific emotional elements of the scenario were used ("Is this situation important for me?"). This procedure was used with scenarios of joy, anger, tenderness, sadness, and a neutral state. Heart rate and brain activity (recorded via a Siemens CTI 951 R 16/31 PET scanner) were recorded during baseline and imagery trials. Participants reported the intensity of their feeling state after each trial. The results of this study clearly show that for all emotions, participants reported more intense feelings for the over-general condition than for the specific one. These subjective reports were corroborated by heart rate differences. Finally, brain activity clearly differentiated the two modes of processing: Specifically, the over-general mode of processing was associated with increased activity in the ventromedial prefrontal cortex, whereas the specific mode was associated with activation of the dorsolateral prefrontal cortex. These results were replicated in another study that did not use brain activity recording (Schaefer & Philippot, 2002).

Overall, these results support our counter-intuitive hypothesis: Processing emotional information at a general level results in more intense emotional feelings and arousal than does elaborating it at a specific level. This has been demonstrated using procedures that prime one processing mode or the other before emotion induction as well as in a procedure that constrains it during emotion induction. However, in none of the experimental situations reported until now were the participants attempting to rein in a negative emotional state. Rather, they were either trying to produce an emotional state (during mental imagery trials) or, at best, trying not to
regulate their emotion (when exposed to film excerpts). As most emotional disorders are characterized by a failure to keep negative emotions in check, one may wonder how well our results generalize to clinically relevant situations.

To address this question, we conducted another study (Philippot, Burgos, Verhasselt & Baeyens, 2002) in which participants (students) were placed in a state of anxious apprehension: They were expecting to have to give an oral presentation and to be evaluated based on their presentation. Before the presentation was to take place, participants were told that they would have to perform a mental training task to help them diminish their anxiety. According to the condition to which they were assigned, participants performed one of three tasks: a specific thinking task, a general thinking task, and a control task. In all three tasks, participants listened to a 10-minute audiotape that asked them questions to which they were instructed to answer mentally. In the specific thinking task, participants had to answer a series of questions requiring them to specify in progressively greater and greater detail their worries about the speech. In the general thinking task, participants likewise had to answer a series of questions about their worries, but this time the questions addressed general impressions and meanings evoked by the situation. The control task was actually a distraction task: Participants had to find antonyms of a series of non-emotional words. Participants reported the intensity of their anxiety before and after the manipulation. Results showed that anxiety and fear diminished very significantly in the specific thinking condition ($F(9, 50) = 5.90, p < .000, \eta^2 = .52$), whereas these feelings tended to increase in the general thinking condition and to remain stable in the control condition. These results suggest that the conclusions of the preceding studies can be applied to the regulation of negative emotions in clinically significant situations.
In sum, the empirical evidence gathered in our laboratory support our counter-intuitive hypothesis. Voluntarily focusing on and specifying personal emotional information induces less emotional arousal than does thinking about the same information at a general level. However, people believe just the opposite. Thus, in an attempt to protect themselves from acute painful feelings, they are likely to think at a very general level about their negative emotional experiences. Negative mental ruminations perfectly illustrate this tendency. Unfortunately, such over-general processing of emotional information favors the activation of the corresponding emotional schema or, at the least, such over-general processing does not counter-act the schema. The negative emotional schema is thereby likely to become chronically activated. For instance, anxiously ruminating about a future exam will maintain the activation of the anxiety schema. On the other hand, specifying emotional information will produce at least two positive outcomes. First, our results demonstrate that such voluntary specific elaboration will inhibit the activation of the schema. Second, accessing specific, concrete, and differentiated information about an emotional situation provides the necessary basis for strategic problem solving that can facilitate discovery of more functional ways to deal with the situation. Coming back to our anxious student example, attempting to specify what is actually feared--and what exactly constitutes the anxiety reaction--should diminish the activation of the anxiety schema and, hence, the anxiety arousal and feelings. In addition, knowing what is feared and what constitutes his/her immediate reaction will help the student find more appropriate ways to deal with his/her anxious apprehension of the exam.

Conclusions and future directions
In this chapter, we have investigated how multilevel models of emotion contribute to our understanding of the cognitive mechanisms that regulate emotion. A dimension that is central to the cognitive perspective, but that is often over-looked in the emotion tradition, is the distinction between automatic and controlled processes. We have shown that emotion and its regulation entail a complex interacting system that includes automatic and controlled processes that converge in certain cases and diverge in other cases. These processes vary with respect to consciousness and intent. We have also attempted to demonstrate that all important domains of cognition are recruited by emotion and its regulation: perception, attention, memory, decision making, and consciousness. The dual memory model we propose is an attempt to synthesize previous multilevel models of emotion and to provide a theoretical framework for emotion, articulating the different emotion-relevant domains of cognition and their different types of processes.

As we have seen, the dual memory model generates many testable hypotheses, some of which are counter-intuitive, such as the notion that specifying emotional information lowers emotional intensity. Many of these hypotheses await further investigation. For instance, the notion that executive processes have an inhibitory effect on emotional arousal needs to be tested against the hypothesis of Gross (Butler & Gross, this volume; see also Kring, this volume) that reappraisal has a major influence on emotional arousal. Indeed, in our experiments (e.g. Philippot et al. 2002), when participants had to specify and make explicit their apprehension, their anxiety was reduced. It could be that the process of specification induced a reappraisal of the situation, although our instructions were designed to prevent this possibility. Still, a direct test, weighing the effects of specification of anxious apprehension with reappraisal of the situation against those of specification of apprehension without reappraisal, is needed.
Finally, the clinical implications of the model are similarly numerous. Indeed, it suggests new types of interventions for disorders of emotion regulation. These new types of interventions include the redirection of attention, the specification of sensitive autobiographical memories and/or of catastrophizing predictions, and the enhancement of autonoetic awareness of present experience. It is interesting to observe that new forms of treatments specifically target these facets. For instance, Segal, Williams, and Teasdale (2002) have recently validated a new approach to preventing depression relapse that is primarily based on attention redirection and the development of autonoetic awareness of present experience. Similarly, Schauer, Roth and Elbert (2002) have proposed a short treatment for trauma victims that is based on the specification of autobiographical memories.

Clearly, cognitive regulation of emotion opens a vast field where fundamental research and clinical applications potentially cross-pollinate each other. We hope that the present chapter will bring its modest contribution to that thrilling scientific adventure.
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Notes

1 As commonly accepted in the literature, consciousness refers to capacities and processes, while awareness refers to a state resulting from the activation of these capacities and processes (Wheeler, et al., 1997).
Figure Captions

Figure 1.

Architecture of the Dual Memory Model of Emotion