

# Interaction of Emotion and Cognition in the Processing of Textual Material

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## Article abstract

Cognitive psychology and cognitive science have only recently come to acknowledge that human beings are not “pure” cognitive systems, and that emotions may be more than simply another form of cognition. This paper presents recent theoretical issues on the interaction of cognition with emotion, drawing on findings from evolutionary, neurobiological and cognitive research. These findings indicate that emotions have a fundamental and, often, universal importance for human cognitive functioning. Advanced cognitive processing, such as the processing required for text comprehension and translation, most of the time follows after a first, primary appraisal of the emotional impact of the information on the reader. This type of appraisal is momentary, non-conscious and non-cognitive, and is carried out by some system in the organism that functions with its own distinctive rules, different from those of the cognitive system. Emotional appraisal of the information sets the mode in which the organism (including its cognitive processes) will operate. Evidence suggests that negative emotions can instantly and non-consciously increase processing effort and time and decrease cognitive capacity, while on the other hand, positive emotions generally increase cognitive resources and expand attention and creativity. This implies that both cognitive processing of textual information, as well as its outcome, are influenced not only by the interpreters cognitive skill or by the emotional features of the text per se (the emotional impact that the writer has attempted to generate), but also (and perhaps most importantly) by the subjective emotional significance that the information has for each individual interpreter.

# Interaction of Emotion and Cognition in the Processing of Textual Material

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## RÉSUMÉ

Ce n'est que récemment que la psychologie et la science cognitives se sont rendu compte que les êtres humains ne sont pas des systèmes cognitifs « purs » et que les émotions sont peut-être plus qu'une autre forme de cognition. Dans cet article nous discutons de l'interaction entre la cognition et l'émotion, sur la base de résultats d'études récentes dans les domaines de la psychologie évolutive, de la neurobiologie et de la cognition. Ces résultats montrent que les émotions ont une importance primordiale, souvent universelle, dans le fonctionnement cognitif humain. Le traitement cognitif avancé, tel que celui mis en œuvre dans les cas de la compréhension de texte et de la traduction, a le plus souvent lieu après une première évaluation de l'impact émotionnel du texte sur le lecteur. Ce type d'évaluation est momentané, non conscient et non cognitif. Il est accompli par un système dans l'organisme ayant ses propres règles, différents de ceux du système cognitif. L'évaluation cognitive de l'information établit le mode dans lequel l'organisme (y compris ses processus cognitifs) va opérer. Il existe des données empiriques qui permettent de supposer que les émotions négatives peuvent – instantanément et non consciemment – augmenter l'effort et le temps nécessaires au traitement et diminuer la capacité cognitive. À l'opposé, les émotions positives augmentent généralement les ressources cognitives et élargissent l'attention et la créativité. Cela implique qu'aussi bien le traitement cognitif de l'information textuelle que son résultat sont influencés non seulement par les capacités cognitives de l'interprète ou par les configurations émotionnelles du texte en soi (l'impact émotionnel voulu par l'auteur) mais aussi (et peut-être même plus) par la signification émotionnelle subjective que l'information a pour chaque interprète pris individuellement.

## ABSTRACT

Cognitive psychology and cognitive science have only recently come to acknowledge that human beings are not "pure" cognitive systems, and that emotions may be more than simply another form of cognition. This paper presents recent theoretical issues on the interaction of cognition with emotion, drawing on findings from evolutionary, neurobiological and cognitive research. These findings indicate that emotions have a fundamental and, often, universal importance for human cognitive functioning. Advanced cognitive processing, such as the processing required for text comprehension and translation, most of the time follows after a first, primary appraisal of the emotional impact of the information on the reader. This type of appraisal is momentary, non-conscious and non-cognitive, and is carried out by some system in the organism that functions with its own distinctive rules, different from those of the cognitive system. Emotional appraisal of the information sets the mode in which the organism (including its cognitive processes) will operate. Evidence suggests that negative emotions can instantly and non-consciously increase processing effort and time and decrease cognitive capacity, while on the other hand, positive emotions generally increase cognitive resources and expand attention and creativity. This implies that both cognitive processing of textual information, as well as its outcome, are influenced not only by the interpreters cognitive skill or by the emotional

features of the text per se (the emotional impact that the writer has attempted to generate), but also (and perhaps most importantly) by the subjective emotional significance that the information has for each individual interpreter.

**MOTS-CLÉS/KEYWORDS**

emotion, cognition, unconscious processing, text processing

**On the cognitive approach to emotions**

Cognitive psychology and cognitive science have both only recently accepted in theory and research that the human mind is not purely “cognitive” by analogy to a computer system, and that human beings have emotions and feelings which often define cognitive processes. It is beyond the scope of this paper to discuss why these two academic fields have disregarded a human function so self-evident in everyday life. For some scholars (i.e., Still and Costall 1991) this happened as a particular academic field – cognitive psychology – turned to an approach that dominated most research in the area of psychology. Cognitive approaches emerged in the ’60s to replace behaviorist approaches that had been dominant for years. According to Bruner (1990: 2-5), this was “[...] an all-out effort to establish meaning as the central concept of psychology – not stimuli and response, not overtly observable behavior, not biological drives and their transformation, but meaning.” However, as Bruner points, very early on “[...] emphasis began shifting from ‘meaning’ to ‘information,’ from the *construction* of meaning to the *processing* of information.” By adopting ideas from logics, linguistics and computer science, the cognitive approach focused on the way people process information mainly under controlled experimental conditions (e.g., Hunt 1971, 1978, 1980; Sternberg 1980); this led to the development of pure “mathematical” models of mind, well documented by experimental research.

The first book entitled *Cognitive Psychology* was written by Neisser (1967) and its publication has been considered to formally introduce the subject in the academic field of psychology. The first issue of the homonymous academic journal appeared in 1970. One of the basic principles of cognitive psychology in the ’70s was that the human mind could be understood as an information processing system that can be studied in terms of its structure and operations. This same principle was adopted in the ’80s by a then newly emerging academic field, cognitive science.<sup>1</sup>

Until approximately the mid-80’s, cognitive research considered emotions as another type of cognitive information processing, which more or less followed similar rules. And although several different approaches developed within the cognitive paradigm (e.g., Lazarus 1982, 1984; Leventhal 1974; Schachter 1964, 1965), they all converged to a common and unified conception of cognitive processes as playing a central and very significant role for emotions, a role which, at certain times, may be causal. In other words, for traditional cognitive psychology, emotions were one particular form of cognitive processing and were always determined by cognition. At the very core of this conception of emotions was the function of “appraisal,” as a momentary, almost automatic cognitive assessment of a stimulus or of a set of stimuli. Cognitive psychologists viewed appraisal as the necessary and sufficient *cognitive* component of emotion. This approach to emotions, however, has been proven inefficient to explain many emotional phenomena of everyday life. Since the ’80s, several

scholars have questioned the purely cognitive nature that has been attributed to the function of appraisal.<sup>2</sup>

### Beyond the cognitive approach

With a very stimulating article entitled “Feeling and thinking: Preferences need no inferences,” Zajonc (1980, 1984) initiated a debate (which for some scholars still remains open) about which general function, cognition or emotion, takes precedence in the processing of information. As an advance organizer to his view, Zajonc (1980) used the words of a poem by Cummings, which have particular relevance to our argument about the emotional aspects of the process of translation: “since feeling is first / who pays any attention / to the syntax of things / will never wholly kiss you.” Zajonc suggested that many kinds of information are evaluated for their emotional significance in ways that are non-cognitive; instead, it is the outcome of this primary emotional evaluation that defines how the information will then be cognitively processed.

In that article, he published results from a series of experiments based on what was called the “mere exposure effect.” Accordingly, when individuals are presented with a combination of already known and novel stimuli (e.g., Chinese ideograms) for a short period of time, and are subsequently asked to report which ones they like better, they tend to show a preference for the stimuli they already know. This phenomenon led Zajonc to conclude that mere exposure (i.e., familiarity) may be enough for people to develop emotional preferences. This finding in itself would have been perhaps all too obvious if another series of experiments had not shown that the mere exposure effect holds, even when old and new stimuli are presented subliminally; that is, for very few milliseconds, so that subjects feel they did not have enough time to process their recognition. The subliminal mere exposure effect has since been repeated in many different laboratories, and the idea that emotional preferences can be formed by stimuli that have not been previously subjected to conscious and elaborate cognitive processing is now confirmed by extensive experimental research (e.g., Bornstein 1992).

Zajonc argued that emotions are primary and therefore fundamental. They precede the cognitive nature of experience and are much closer to the essence and “internal truth” of things. This, of course, might be commonsense for experienced translators and interpreters who are well aware that the first reading of a particular material is extremely important, in order to get a grasp of the emotional climate and the essence of text. But it was not commonsense for academic cognitive research.

Approximately ten years after the publication of Zajonc’s article, a fairly cohesive academic field on emotional research emerged, not only within psychology, but within most of humanities and social sciences. As a newly re-invented field, the study of emotions has now become interdisciplinary, and for that reason it faces the common difficulties of most interdisciplinary fields: problems of terms and definitions. Often, in the literature concepts such as *emotion*, *feeling*, *affect*, *sentiment* and *mood* are used as synonyms. In the English academic literature, the term *emotion* is sometimes used as a singular term by analogy to the term *cognition* – that is, as a general taxonomy of unified processes – and at other times in plural (*emotions*) to denote particular feelings of different nature and of various levels of complexity, such as anger, happiness, guilt, empathy. In addition, the words *affect*, *feeling* and *sentiment* are sometimes treated as synonyms and at other times they denote epistemologically different theoretical

constructs and functions; for example, in traditional psychological experimental research, the *affect* is usually selected for the operational definition of the particular emotion tested, while *feeling* is usually (but not always) chosen to refer to the subjective experience of an emotion. In traditional psychology, emotions have also been closely associated with terms such as drives, motives or arousal, depending on the approach (Davou 2000).

Communication between emotion researchers becomes even more complicated due to the plethora of definitions. Early scholars who attempted to integrate the various definitions that appeared in the literature came across hundreds (e.g., Fridja 1986; Kleinginna and Kleinginna 1981; Strongman 1987), and the discussion of how each term should be most accurately defined still remains open. For our purposes, I find useful the definition adopted by Oatley & Jenkins (1995), which more or less summarizes the currently prevailing trend: Emotions are internal states that (i) produce psychological and physiological effects, (ii) include cognitive evaluations, (iii) have particular muscular and motor expressions, (iv) incorporate a subjective experience of pleasant (positive) or painful (negative) feelings, (v) and can be discharged through neurological and motor functions.

Emotional phenomena can be traced on a spectrum that expands from acute physiological alterations (e.g., an intense emotion such as fear) to personality traits of an emotional nature that are relatively more stable (e.g., irritability). From this emotional spectrum the following taxonomy can be derived:

- (a) an *emotion* refers to an intense mobilization of a very short duration, a “shaking” of the organism as a response to a particular stimulus (person, situation or event), which is generalized and occupies the person as a whole,
- (b) a *feeling* (or emotions) is the colour of all experience; it is always experienced in relation to a particular object of which the person is aware, it may have various levels of intensity, and its duration depends on the length of time that the representation of the object remains active in the mind of the individual,
- (c) *mood* is a more generalized state, that does not necessarily has a particular object (representation), but gives a general emotional colour to life for relatively longer periods of time.

The same emotional state, e.g., fear, can be experienced as emotion or as feeling, depending on its intensity, duration and level of processing of the stimulus (i.e., whether it is acute, intense and experienced before the object that causes it has been represented in the mind, or whether it is longer, less intense and connected to some particular representation). If it is experienced as emotion, fear occupies the whole person and for a few seconds the person either freezes or tends to flee (e.g., in the case of an earthquake). It is interesting to note here that the English word *emotion* derives from the unison medieval Latin word and is based on the Latin prefix *emot* that means *moving away*.<sup>3</sup>

The *emotion* of fear may turn into a *feeling* of fear, as the object that caused it becomes identified and represented in the mind, while at the same time it colours particular decisions and actions directed towards the object. Naturally, the reverse process is possible. Fear as a feeling connected to some particular representation (e.g., as one thinks of the possibility of an earthquake) may be turned to emotion, if the thoughts and actions associated with the fearful event maximize the threat instead of removing it and restoring balance.

### On the interaction of emotion with cognition

In order to examine how emotion and cognition interact at their basic level, we will present some evidence from evolutionary psychology and neurobiology, but we should acknowledge at least to other fields of psychology, social psychology and clinical psychology, that have also provided evidence for this interaction at more complex levels (see e.g., Parkinson (1996), and Silverman and Weinberger, (1985) for social and clinical psychology, respectively).

Evolutionary psychology views emotional phenomena from the point of view of Darwinian Theory, as phenomena of particular significance for survival; their basic function is communication and adaptation. For example, fear stimulates self-defence activities and protects the organism from dangers of the outside physical and social world. Anger is necessary for territorial protection and for setting boundaries to intruders of one's private space (it is useful here to think of space also in its metaphorical, symbolic form, i.e., not only physical, but also psychological, social and cultural). The communicational function of emotions is self-evident. Simply stating that one is angry is not enough to keep the intruder away, if the latter does not trace any apparent indications of readiness for attack. At least six emotions (i.e., fear, sorrow, anger, happiness, surprise and disgust) are considered primary and are universally recognized irrespectively of cultural differences (e.g., Ekman 1992). Emotions and feelings – as we defined them above – “ring a bell” about the survival value each stimulus or piece of information has for the individual that perceives it. Evidence on how this bell is “activated” comes from the neurobiological and neuropsychological.

Studying the emotions, LeDoux (1998) has produced evidence that cognitive and emotional functions are of a different nature and appear to derive from two independent systems, which, however, continuously interact. LeDoux distinguishes emotional from cognitive processing of information and introduces the concept of “emotional unconscious” to describe the processing of information that has emotional significance and takes place without the person's awareness. Every stimulus perceived by the individual is almost immediately (within 200 milliseconds) interpreted for its positive or negative valence. Within this fraction of time, the brain is predisposed to function in particular ways, although the information that has generated the predisposition is not conscious – the individual is not yet aware of what has caused this particular positive or negative feeling (Libet 1996; LeDoux 1998).

The emotional content of the information is processed in different areas of the brain (e.g., the amygdala) than those which are responsible for the processing of cognitive contents (e.g., hippocampus or frontal lobes) (Izard 1992; LeDoux 1995; Sarter *et al.* 1996). This fact, further confirms that there must be two different systems, the emotional and the cognitive, with different structure and principles of organization, which, however, interact and cooperate.

The emotional content of the information includes cues with evolutionary more primitive structure, which do not carry elaborated information material, but have an adaptive value and, therefore, the power to: (i) set the brain in a specific mode of functioning in terms of how it organizes information, (ii) prepare biological mechanisms for a series of activities (e.g., fight or flight), (iii) focus attention on particular aspects of the environment, (iv) and regulate utilization of the organism's resources (Oatley and Johnson-Laird 1987, 1995). For example, anxiety sets the brain to function

in a distinctive mode according to which most informational cues are interpreted primarily as threatening to the organism.

Generally, negative emotions and feelings stimulate a rigid and limited focus of cognitive resources into coping with one (real or imaginary) problem, and cause persistence to cognitive choices that have nevertheless been proven ineffective (Fredrickson 1998; Fredrickson and Branigan 2005; Isen 2002). On the other hand, even a momentary experience of positive emotions, such as joy, interest, pride, love or satisfaction can be beneficial for structuring and improving available cognitive resources, as well as for broadening and enhancing attention, creativity, problem solving ability and acquisition of new cognitive schemata (Fredrickson and Branigan 2001).

Most experimental evidence on the interaction of emotion with cognition comes from experiments using subliminal priming, a modification of the mere exposure technique. Two stimuli are presented successively for different amounts of time. The first stimulus (prime) is flashed subliminally for milliseconds, so that although the subject has the impression that something was shown, s/he does not have the time to process it adequately so as to register it in memory and recall it later. The stimulus that follows (target) is presented supraliminally, that is long enough to allow processing at a conscious level. The research question investigated is whether the first stimulus produced any particular predisposition, which may influence perception and interpretation of the subsequent stimulus. When the prime has a relatively neutral emotional valence, this technique is called *semantic priming*, while when there is some (positive or negative) emotional valence the technique is called *emotional priming*. These experiments have provided strong evidence that even the mere presence of some stimulus (a word, a person, an odor or a sound) is sufficient to produce emotional predispositions, without any prior cognitive processing and out of the individual's awareness. These predispositions can influence not only the emotional and cognitive processes that follow, but also more stable attributes of the individual such as self-esteem. In Zajonc's laboratory it was found that a group of psychology graduate students rated their own research ideas worse if, before making the judgment they were subliminally exposed to a scowling photo of Zajonc, who had a reputation of being a tough evaluator.<sup>4</sup>

Bornstein (1992) created a complicated experimental design, which he applied with the help of two accomplices (A and B) who were unknown to the individuals who participated in the study. The first group of participants was exposed subliminally to the picture of A, while the second group was similarly exposed to the picture of B. Then, each participant was asked to take part in a discussion with A and B, where the three of them had to read poetry and decide on the gender of a poet who was kept unknown. Since the pictures of either A or B were shown subliminally, participants were not aware that they had seen either of the two accomplices. According to the directions of the experimenter, at a certain point during the discussion A and B started to argue on the gender of the writer, and they had to continue arguing until the subject would intervene to solve their debate. The important finding in this experiment was that participants systematically tended to take the side of either A or B, depending on whose picture they were initially exposed to; that is, they tended to agree with the person who was non-consciously familiar to them.

After an extended review of related research, Bornstein arrives at the conclusion that the mere exposure effect is stronger when stimuli are presented for milliseconds

than when they are available to the individual for more elaborate processing. In other words, moods and feelings tend to be influenced more by information that the individual is unaware of processing; apparently, conscious processing allows for re-assessments and modifications of the initial impact of the information.

This finding is of particular significance for the science of translation; it implies that repeated elaboration of the material may perhaps lead to a linguistically or semantically more accurate outcome, at the expense, however, of the emotional validity of the original text. The more the translator engages in cognitive elaboration of the material the higher might be the risk to re-evaluate and, therefore, depart from the initial emotional impact. A second implication of the above findings is that there may be several cues in the material under translation which may have significant personal implications for the translator, and which could act as subliminal stimuli that generate particular emotional predispositions that affect cognitive processing, as well as the final outcome of the translated text. It may be the general emotional climate (Parkinson 1996) of the particular situation (be it a text for translation or live discourse or speech), or it may be the personality of the source (the writer or the speaker) which may have unconscious emotional implications for the translator, and the power to influence mood and emotions. In the area of learning, for example, Boekaerts (1993) has shown that when negative emotions create a pessimistic perceptual attitude they divert the individual's attention to aspects irrelevant to the task, which activate intrusive thoughts that give priority to a concern for well-being rather than for performing the cognitive task.

What is of further importance is that apart from the emotional valence of the material, the meaning *per se* may be non-consciously active in the mind of the translator, affecting further cognitive processing in non-conscious ways. A study by Fowler *et al.* (1981) indicated that the meaning of subliminal stimuli was available to the observer even when the stimuli themselves were not detectable. In this experiment words (e.g., "cook") were flashed on a screen so rapidly that observers were not aware of what was presented. However, when this was followed by the presentation of two recognizable words (e.g., "bake" and "view"), and the observers were instructed to make a forced choice about which word was most similar to the one subliminally presented, their choices were significantly better than chance.

Results on subliminal semantic priming provide further evidence that material of which the individual is not aware can influence ongoing perceptual judgment (Balota 1983), but also the mood with which the person approaches subsequent events. To further test the effect on mood, a stimulus with some emotional valence (e.g., the picture of a smiling or frowning face) is flashed for 1/200 second (5 milliseconds) and is immediately followed by another, neutral ("masking") stimulus that is presented supraliminally. The role of the masking stimulus is to prevent further non-conscious processing and recording of the initial stimulus. Then a third "target" stimulus is presented also supraliminally (e.g., a Chinese ideogram) and observers are asked whether they like it or not. Murphy and Zajonc (1993) found that liking of the target stimulus depended on the initial stimulus that was subliminally presented. The emotional significance attributed to the "target" stimulus (in this case the ideogram) depended on the emotional significance of the initial stimulus (in this case, on whether the face in the picture was smiling or frowning).



Hermans *et al.* (1998) showed that the emotional semantic priming effect holds for other senses as well. They paired pleasant and unpleasant odours with words of positive and negative emotional content and found that the emotional significance of the target word (i.e., whether it is positive or negative) is recognized in significantly less time when it corresponds to the emotional content of the preceding odour. That is, a non-conscious pleasant smell prepares the individual to recognize more quickly a word with pleasant connotations (e.g., “kiss”) than with unpleasant connotations (e.g., “murder”).

Further evidence indicates that particular emotions, attitudes and intentions may be provoked non-consciously and influence the individual’s interpretation of social circumstances. Bargh (1990) studied the non-conscious effect of stereotypes. In a brilliantly designed study, participants were told that they were to take part in a linguistic examination and that their task was to create sentences from a particular set of cards. One group of participants had words related to old age (e.g., wrinkles, elderly), while the second group had chance words, related to a variety of issues. When each participant finished and left the room, experimenters measured the amount of time s/he needed to reach the end of the corridor. And though the sentences produced about old age did not particularly refer to physical conditions, those participants who worked with these words needed significantly more time to arrive at the end of the corridor; their pace had been slowed, simply because they had occupied their thought with words related to old age. In another experiment, subjects were asked to make sentences with words that referred to either assertiveness or politeness. Then, when each subject finished, s/he was asked to find the research supervisor who was outside the room, involved in a set up discussion with an accomplice. Bargh measured the amount of time that the subject waited before interrupting the experimenter and found that those who participated in the experimental condition of “assertiveness” waited significantly less time than the participants in the condition of “politeness.”

Non-conscious processing of words of negative emotional valence can create anxiety. In vigorously controlled experimental conditions, Kemp-Wheeler and Hill (1987) showed that when unpleasant words are flashed subliminally, participants develop anxiety symptoms which are expressed with an increase in perspiration and muscular tone (varying from tension to tremor, according to individual parameters). The symptoms were absent or at a statistically significant lower level in participants who were exposed to words with neutral emotional valence. The effect of non-conscious processing has also been examined with clinical populations by researchers with a psychodynamic orientation (e.g., Silverman 1976; Silverman and Weinberger 1985). This set of studies showed that subliminal acoustic stimulation with messages of emotional significance may produce changes in pathology, behaviour and cognitive processes as for example problem solving.

## Conclusion

Emotional processing of the information is fundamental in every aspect of human functioning, but it appears to follow principles different from those of cognitive processing. The picture that emerges is of an emotional system, independent but interacting with the cognitive system, an idea that was first introduced in a very stimulating paper written by Norman (1981). Both systems are at the service of the organism’s

well-being and survival. The emotional system carries out a first, extremely brief but highly significant assessment of the potential impact of the information for the perceiver, which determines in various ways the cognitive processes which follow.

For our purposes, here, all this implies that both cognitive processing of textual information, as well as its outcome, are influenced not only by the interpreters' cognitive skill or by the emotional features of the text per se (the emotional impact that the writer has attempted to generate), but also (and perhaps most importantly) by the subjective emotional significance that the information has for each individual interpreter.

What we presented so far shows the power of the information, both in long-term memory and in working memory, to generate emotions, feelings and moods that flood the person and give colour to thoughts, either enhancing or inhibiting the person's cognitive capacity in ways that remain to be investigated. The emotional valence of the information may influence the cognitive process at every level of processing.

At the level of input, we may expect that positive valence will expand the person's perceptual abilities in an attempt to "take in" more positive stimulation; a crucial research question, here, is whether there is a "threshold" of positive emotion above which the person cannot absorb or handle any more stimulation. Similarly, negative valence at the level of input may predispose the perceiver to "contract" or "close" input channels, in order to exclude negative information, and the question may relate to the relative "threshold" of negative input.

At the level of working memory, several research questions could be formulated. For example, how does the emotional valence of the material affect working memory capacity or processing time? Questions relating to the effect of the emotional valence of information retrieved from long-term memory – in order to be used for the elaboration of the material under current processing – may be more complex; each particular person makes use of his or her personal cognitive schemata and experience which have a highly subjective emotional value. The same material may create quite different emotional and cognitive associations for different people depending on their history and experience. This is perhaps one of the reasons why each translator of a particular piece of literature practically creates a distinct narration of the same original text, often quite different from what its creator had intended. In fact, creativity may be just that: the different emotional significance that stimulates different thoughts to different persons.

#### NOTES

1. The Cognitive Science Association was established in 1980, from scholars of different academic fields with a common interest in the study of cognition. Cognitive science attempted to relate findings from three major research areas, i.e., cognitive psychology, artificial intelligence and neuroscience, all of which study the mind and mental processes, focusing however on different levels of integration of the phenomena. Psychology is interested in the macro-phenomena of experience while neuroscience focuses to the corresponding micro-phenomena in the central nervous system. The field of artificial intelligence is more abstract in that instead of describing processes, it offers interpretative paradigms of how phenomena emerge as results of a processing activity that is independent of the material substratum (hardware) that accomplishes it (Marangos 1996).
2. For a brief presentation of cognitive theories of emotion and for a discussion on the issue of appraisal see Davou (in press).
3. The Random House College Dictionary, Revised Edition, Random House, New York, 1975, από όπου προέρχονται και οι υπόλοιπες αναφορές στην ετυμολογική ερμηνεία των αγγλικών εννοιών που εμφανίζονται εδώ.

4. This information was derived from an extended article devoted to Zajonc's work. It presents a summary of his most important findings and theoretical points, as well as extended interviews with Zajonc and his colleagues, and was published in the *Journal of the American Psychological Association* (*Monitor*, September 1998, pp. 12-13). Zajonc's ideas developed after four decades of research on emotions and subliminal perception.

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