Do feelings have a mind of their own?

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In 1979, Robert B. Zajonc was awarded the Distinguished Scientific Contribution Award by the American Psychological Association, for which occasion he was invited to give a lecture. On such events, honoured scientists often review the awarded research and present a personal view on future developments in the field of interest. Zajonc, however, chose to present a "richly provoking" (Rachman, 1981, p. 279) paper describing his views on the relation between affect and cognition.

At the time Zajonc presented his paper, it was generally accepted that affective reactions depend upon prior cognitive processing. Different existing models of affect and emotion agreed on one thing: Affective reactions can be observed only after considerable information processing has taken place (e.g., Lazarus, Averill, & Optin, 1970; Mandler, 1975). In other words, no affect without cognition. Zajonc' presentation was nothing less than a frontal attack on the cognitive analysis of the affect-cognition relation. He questioned the core of cognitive models by arguing that affective reactions may occur prior to and without the participation of cognitive processing. Whereas cognitive models postulate the primacy of cognition, Zajonc argued for the primacy of affect. Or, as stated in the title of his presentation (that was later published in American Psychologist, Zajonc, 1980): Preferences (affect) need no inferences (cognition).

Zajonc' (1980) paper and the debate that it evoked had a huge impact on emotion research. The fact that in May 2009, this paper was cited more than 2100 times gives some indication of its importance. The true impact of the paper, however, is evidenced by the wealth of studies that it directly or indirectly inspired over the past 30 years. In this chapter, we present a brief overview of debate surrounding Zajonc' paper and the legacy of this debate in emotion research. Our aim is not to re-open the debate but to show how it provided the impetus for an explosion of research on automatic affective processing. In a first part of this chapter, we summarize the arguments that Zajonc and his opponents exchanged. We point out that the debate highlighted a number of important questions about the relation between cognition and emotion, questions that were addressed in subsequent research. In the second part of our chapter, we present a brief overview of this research. Our review of the evidence is not meant to be exhaustive but does aim to provide a useful summary of the main insights that were gained as a result of the research that was inspired by the debate.

Throughout this chapter, we will define the term “affective processing” as the mental act of evaluating the affective properties of a stimulus. Affective reactions are defined as those reactions that are caused by the outcome of affective processing, that is, by the affective properties of stimuli as evaluated by the organism. There is no general agreement on which properties can be regarded as affective or emotional (see Moors, this volume), but they include the properties of valence (good-bad) and arousal (active-passive). The vast majority of the studies on automatic affective processing have, however, focussed on the processing of evaluative stimulus properties (see Eder & Rothermund, in press, for a recent exception). Our use of the term “affect” also does not overlap with the term “attitude” because the latter is typically used to refer only to the evaluative properties of stimuli (e.g., Fazio, 1986). Affective processing can be studied by examining the conditions under which affective reactions occur. The question regarding the relation between affect and cognition thus boils down to the question of whether affective reactions can arise without the involvement of cognitive processes.

An overview of the debate

Preferences need no inferences

The arguments that Zajonc (1980) put forward in support for the *primacy of affect* hypothesis can be grouped into four categories (see Eder, Hommel, & De Houwer, 2007, for a related analysis). A first group of arguments draws upon how we, as humans, experience affective reactions at a *phenomenological level*. In daily life, we seem to have little control over our feelings. Affective reactions often arise involuntary and once present, they cannot easily be dismissed on logical grounds. Even if we know that the experienced affective reaction is inappropriate, we often cannot stop it. It is also hard to persuade someone into believing that (s)he likes something if that person actually dislikes it. People may doubt their beliefs, but they will never doubt their feelings. To summarize, affective reactions seem to defy reason and logic.

In a second section, Zajonc (1980) discusses some *behavioural data* which, he claims, support the primacy of affect hypothesis. He mainly draws upon his own work on the mere exposure effect. In mere exposure research, it has been shown that the liking of a stimulus will increase if the stimulus is repeatedly presented (Zajonc, 1968; see Bornstein, 1989, for a review). Importantly, participants will show increased liking of a repeatedly presented stimulus even if they do not recognize the stimulus as being previously presented. The strongest evidence for this claim comes from studies in which stimuli were presented only briefly. It was observed that the liking of presented stimuli increased even though participants could not consciously recognize the stimuli that were presented (e.g., Kunst-Wilson & Zajonc, 1980; Bornstein & D'Agostino, 1992). This suggests that liking does not depend upon cognitive processes such as conscious recognition.

A third group of arguments is based on *neurological evidence*. Zajonc (1980) points to studies which suggest that affective reactions depend more upon activity in the right hemisphere whereas cognitive reactions are mediated by the left hemisphere. This supports the hypothesis that affect and cognition rely upon separate systems. In order to show that an independent affective system is not neuroanatomically implausible, Zajonc proposes the locus coeruleus as the subcortical structure that might be involved in such a system.

Finally, Zajonc (1980) presents *evolutionary arguments* to support his position. First, he argues that both phylogenetically and ontogentically, affect precedes language and thinking. Affective reactions can be observed in phylogentically lower organisms, but also in infants of more complex species (such as humans) despite severe limitations in (or absence of) cognitive capabilities. Second, he points out that the limbic system, which underlies affective reactions in lower organisms, developed long before the cortex, which underlies cognitive capabilities. It is hard to imagine that upon development of the cortex, the limbic affective system lost its autonomy in the sense that all affective expressions would necessarily be cognitively (i.e., cortically) mediated. Third, from an evolutionary point of view, it would be counter-adaptive to make all affective reactions dependent upon cognitive analysis. Often the adaptive value of affective reactions depends upon the speed with which they occur. For instance, when an animal is confronted with a predator, it has no time to engage in elaborate cognitive processing. It needs to react as quickly as possible. In such cases, a fast, pre-cognitive affective reaction is adaptive.

Based on these four groups of arguments, Zajonc postulates the existence of an independent affective system that requires only minimal sensory input in order to be activated. This system will always generate an affective reaction immediately following sensory input and before other cognitive activities such s recognition or discrimination can occur. However, it is possible that cognitive processing will influence affective reactions. Often, cognitive processing will override the initial affective reactions. Nevertheless, automatic affective reactions will always precede cognitive reactions. To summarize, affect is primary.

Feelings need inferences

Seldom has a theoretical paper aroused so many direct responses as Zajonc (1980). As was mentioned earlier, this can be attributed mainly to the fact that his views were diametrically opposed to generally accepted beliefs. Another reason is that, as Zajonc (1980, p. 171) elegantly admitted, his conclusions were "stronger than can be justified by the logic or weight of the evidence" that was present at the time. As such, Zajonc' paper was an easy target.

Some commentaries focussed on one or more of Zajonc' arguments and questioned either their empirical basis or underlying logic (e.g., Birnbaum, 1981; Hassan & Ward, 1991; Mellers, 1981; O'Malley, 1981). Instead of evaluating each single counter-argument, we will discuss only the most common and fundamental criticism. Many commentators (Baars, 1981; Greenberg & Safran, 1984; Kleinginna & Kleinginna, 1985; Lazarus, 1981, 1982, 1984; Merckelbach & Jansen, 1986; Parrot & Sabini, 1989; Plutchik, 1985; Tsal, 1985; Watts, 1983) correctly pointed out that Zajonc did not distinguish between conscious, controlled cognition and automatic cognition. At the time of Zajonc' presentation, evidence was accumulating on the existence of such automatic cognitive processes. These processes were characterized as involuntary, effortless, rapid, rigid, uncontrollable and unconscious (e.g., Posner & Snyder, 1975; Shiffrin & Schneider, 1977). Many of Zajonc' (1980) arguments relate to cognition in the sense of conscious, controlled cognition. For instance, Zajonc argues that affect often seems to contradict reason and logic. However, reason and logic refer to conscious cognitive activities. The seemingly irrational nature of affect therefore only suggests that affect may be independent of conscious cognition. It says nothing about the possible involvement of automatic cognition in the generation of affect. If we experience affect as involuntary, effortless, and inescapable, this might well be because affect depends upon automatic cognitive processes that are in nature involuntary, effortless, and inescapable. Also the behavioural data that Zajonc (1980) mentioned, as well as the neurological and evolutionary arguments, at best allow for the conclusion that affective reactions can occur independently of controlled cognition. Hence, most commentators reaffirm their believe in the primacy of cognition.

On the primacy of affect

In a number of papers, Zajonc (1981, 1984, 2000; Zajonc, Pietromonaco, & Bargh, 1982; Zajonc & Markus, 1984, 1985) responded to these objections. Most importantly, Zajonc clarifies his definition of cognition:

My definition of cognition (Zajonc, 1980, p. 154) required some form of transformation of a present or past sensory input. "Pure" sensory input, untransformed according to a more or less fixed code, is not cognition. ... Cognition need not be deliberate, rational or conscious, but it must involve some minimum "mental work". This "mental work" may consist of operations on sensory input that transform that input into a form that may become subjectively available, or it may consist of the activation of items from memory. (Zajonc, 1984, p. 118).

The definition makes clear that Zajonc does distinguish between controlled cognition and automatic cognition. He adopts a broad mentalist definition (see Moors, 2007) that equates cognition to the (controlled or automatic) transformation of sensory input through the generation, activation, or transformation of internal representations. Because cognition is defined as a "nonsensory process that transforms sensory input and produces or recruits representations, ... the question of cognitive participation in affect is reduced to the presence of representational processes" (Zajonc & Markus, 1982, p. 127).

Importantly, Zajonc (1984; Zajonc & Markus, 1982, 1985) reaffirms his belief that affect can be primary to both controlled and automatic cognition. He does explicitly acknowledge that cognitive processes may always be involved in deliberate and intentional affective reactions such as evaluative judgements (Zajonc et al., 1982). Therefore, when Zajonc claims that affect can be primary to cognition, he actually means that automatic affective reactions can occur without the involvement of cognitive processes.

In order to substantiate the primacy of (automatic) affect, Zajonc (1984) repeats some of the arguments that were put forward in his original publication (Zajonc, 1980), this time with more emphasis on phylo- and ontogenetic and neuroanatomical evidence. He also presents additional behavioural data for the primacy of affect. Zajonc acknowledges that opponents may again argue that the affective phenomena he discusses involve some form of hidden automatic cognition. He intelligently responds that if these and all other automatic affective reactions are based on hidden cognition, the involvement of such cognition should be demonstrated rather than assumed. It does not suffice to reject affective phenomena that reveal no clear involvement of cognition as evidence for the primacy of affect, solely based on the argument that some hidden cognition must be involved. Arguments can only be rejected if it can be demonstrated that cognition is involved or if it can be shown what representations need to be activated (Zajonc, 1984; Zajonc & Markus, 1985). He urges cognitive researchers to demonstrate how cognition is involved in the generation of "true" affect: "It is a critical question for cognitive theory and for theories of emotions to determine just what is the minimal information process that is required for emotion." (Zajonc, 1984, p. 122).

The legacy of the debate

After Zajonc' response to the comments on his original paper, the debate was evaluated in a number of subsequent papers (e.g., Kleinginna & Kleinginna, 1985; Leventhal

& Scherer, 1987; Merckelbach & Jansen, 1986; Plutchik, 1985). It was noted that the debate had stranded on definitional issues, and that depending upon how the terms "cognition" and "affect" are interpreted, one could either defend the primacy of affect or the primacy of cognition based on the same body of evidence (Kleinginna & Kleinginna, 1985; Leventhal & Scherer, 1987). Nevertheless, Zajonc’ (1980) work played an important role in renewing the interest in affective behavior (Kitayama & Howard, 1994; Niedenthal & Halberstadt, 1995). As such, Zajonc has achieved one of the main goals that motivated him to write his 1980 paper, namely "to appeal for a more concentrated study of affective phenomena that have been ignored for decades" (Zajonc, 1984, p. 117).

His work not only gave impetus but also direction to this new interest in affective behaviour by highlighting two research questions. Most importantly, Zajonc' (1980) analysis stimulated cognitive researchers to recognize the importance of automatic affective processing, that is, affective processing that is not mediated by controlled cognitive processes. Many influential cognitive theories of affect and emotion that have been published since then acknowledge the important role played by automatic affective processing (e.g., Bargh & Chartrand, 1999; Fazio, 1986; Gawronski & Bodenhausen, 2006; Öhman, 1987; Sherer, 1993; Williams, Watts, MacLeod, & Mathews, 1988). Inspired by these theories and new conceptualisations of the term “automaticity” (e.g., Bargh, 1992; Moors & De Houwer, 2006), researchers started to examine the properties of automatic affective processing, the variables that moderate the presence and outcome of this type of processing, the different effects that automatic affective processing can have, and the (cognitive) processes on which automatic affective processing might be based. Finally, some researchers also addressed Zajonc’ claim that, at least in some cases, automatic affective reactions can occur independently of automatic cognitive processes. In the remainder of this chapter, we will present a brief overview of the research on automatic affective processing in which these issues were addressed.

A brief review of research on automatic affective processing

Properties of automatic affective processing

At the time that Zajonc (1980, 1984) drew attention to the importance of automatic affective processing, the dominant view was that there are two sets of mutually exclusive cognitive processes, one being non-automatic or controlled processes and the other being automatic processes. According to this view, which is known as the all-or-none view of automaticity, all non-automatic processes have the same features (e.g., unconscious, intentional, controlled, effortful, and slow) whereas all automatic processes have the opposite features (e.g., unconscious, unintentional, uncontrolled, effortless, and fast). It has become clear, however, that this all-or-none view is incorrect. Studies have demonstrated that most processes possess features typical of non-automatic processes but also features typical of automatic processes. Evidence from Stroop studies, for instance, suggests that the processing of word meaning is automatic in that it does not depend on intention, resources, or time, but at the same time occurs only when attention is directed toward the word (see Logan, 1985, 1989, for a review). An important implication of this conclusion is that one cannot simply characterize a process as automatic or non-automatic. Rather, it is necessary to always specify the sense in which a process is automatic, that is, to specify which automaticity features it possesses and which automaticity features it does not posses. Research has shown that affective processing can possess several features of automaticity. Much of this evidence comes from studies on affective priming (Fazio, Sanbonmatsu, Powell, & Kardess, 1986; Hermans, De Houwer, & Eelen, 1994). In a typical study on affective priming, a prime word is presented briefly before a target word appears. Participants are asked to evaluate the target word, that is, to determine whether the word refers to something good or something bad. Results typically show that participants respond more quickly when the target and the prime share the same valence (e.g., HAPPY – SUNSHINE; congruent trials) than when they differ in valence (e.g., HAPPY – CANCER; incongruent trials). This paradigm has often been used to study affective processing because the presence of an affective priming effect (e.g., faster responses on congruent than on incongruent trials) allows one to infer that the valence of the prime has been processed. This is because the congruence between the valence of the prime and the valence of the target can have an effect only if the valence of the prime has been processed. Hence, if one observes an affective priming effect under certain conditions, one can conclude that affective processing (of the prime) can take place under those conditions. We will now provide a brief overview of the conditions under which affective priming (and thus affective processing) can place.

Can affective processing be unconscious? Evidence suggests that affective processing can be unconscious in at least two respects. First, several studies have revealed affective priming effects even when the primes were presented subliminally, that is, when participants were not aware of the presentations of the primes (e.g., Abrams, Klinger, & Greenwald, 2002; Draine & Greenwald, 1998; Hermans, Spruyt, De Houwer, & Eelen, 2003; Klauer, Eder, Greenwald, & Abrams, 2007). Second, novel stimuli whose affective properties were created in the laboratory can lead to affective priming effects even when participants are not aware of how they acquired their liking for the stimuli (e.g., Olson & Fazio, 2002). Hence, people can affectively process stimuli even when they are unaware of the stimuli that they process and even when they do not consciously know why they like or dislike the stimuli.

Can affective processing be efficient? Hermans, Crombez, and Eelen (2000) asked participants to perform an affective priming task while simultaneously reciting a series of digits. They found that the magnitude of the affective priming effect was unaffected by the degree of mental load imposed by the secondary task, which suggests that affective processing is relatively independent of available processing resources and thus efficient (see Klauer and Teige-Mocigemba, 2007, for more recent evidence).

Can affective processing be fast? There is ample evidence showing affective priming effects even when there is little time to process the primes. For instance, Klauer, Rossnagel, and Musch (1997; also see Hermans, De Houwer, & Eelen, 2001) found affective priming effects when the onset of the prime occurred 100 ms before or simultaneously with the onset of the target. Affective priming has been observed even when the onset of the prime occurs after the onset of the target (e.g., Fockenberg, Koole, & Semin, 2006). Such results indicate that the affective properties of the primes can be processed within a few hundred milliseconds after the presentation of the prime.

Can affective processing be goal-independent? A first question in this context is whether affective processing of a particular stimulus can occur in an involuntary manner, that is, in the absence of the goal to affectively process that stimulus. The fact that affective priming can be found when participants are unaware of the prime stimulus already provides evidence for involuntary affective processing because awareness of the stimulus does seem to be a prerequisite for having a conscious goal to process that stimulus affectively. A second line of studies examined whether affective processing of a particular stimulus can occur in the absence of a goal to affectively process any stimulus in the environment. The results of these studies support the conclusion that affective processing can indeed be goal-independent in this way. Most importantly, affective priming effects have been found in tasks that do not require the participants to adopt the goal to evaluate stimuli (e.g., task that require to read or name the target, to determine the lexical status or semantic category of the target, or to compare the prime and target with regard to a non-affective feature such as color; see Bargh, Chaiken, Raymond, & Hymes, 1996; Klauer & Musch, 2002; Spruyt, Hermans, De Houwer, & Eelen, 2002; but see Klauer & Musch, 2001). Note, however, that this evidence is not entirely conclusive because there never was a direct test of whether participants (implicitly) adopted the goal to evaluate stimuli. Even when participants are not asked to evaluate stimuli, or even when the affective dimension is not mentioned by the experimenter, the mere presence of affectively valenced stimuli might be sufficient to induce an affective processing goal. What is certain is that affective priming effects are stronger when participants have the goal to evaluate stimuli than when they have the goal to process non-affective features of the stimuli (e.g., Spruyt, De Houwer, & Hermans, 2009; Spruyt, De Houwer, Hermans, & Eelen, 2007).

Conclusions. Affective priming studies have confirmed that affective processing does have many of the features of automatic processes. It can occur even when participants (1) are unaware of the stimulus that is processed affectively, (2) are unaware of why they like or dislike the stimulus, (3) are engaged in other effortful tasks and thus have little mental resources available for the affective processing of the stimulus, (4) have little time to process the stimulus affectively, (5) do not have the conscious goal to processes the stimulus affectively, or (6) do not have the conscious goal to evaluate other stimuli. Recent evidence suggests, however, that affective processing is not completely unconditional. For instance, the presence of a goal to process non-affective features of a stimulus seems to reduce the probability of affective processing (e.g., Spruyt et al., 2009).

What determines the presence of automatic affective processing?

Now that we know more about the *way* in which affective processing can be automatic, we can examine *when* affective processing is automatic. This can be done by studying variables that moderate the presence of automatic affective reactions. We will distinguish two sets of moderators: Properties of the stimuli that evoke the automatic affective reactions and properties of the individual who shows the automatic affective reactions.

Properties of the stimuli. Fazio (1986) put forward the hypothesis that automatic affective reactions will be evoked only when the affective properties of the evoking stimulus are highly accessible. As a measure of accessibility, participants were asked to determine as quickly as possible whether a stimulus (e.g., a word or a picture) referred to something good (e.g., the word HAPPY) or something bad (e.g., the word CANCER). Stimuli that were evaluated quickly were said to have highly accessible affective properties. Fazio et al. (1986) found affective priming effects (and thus evidence for automatic affective processing) only when the affective properties of the primes were highly accessible. Moreover, manipulations of accessibility (e.g., training participants to access the affective properties of certain stimuli) influenced also the strength of the automatic affective reactions as captured by the affective priming effect. Nevertheless, there is still some debate about the impact of accessibility on automatic affective processing. Most importantly, Bargh, Chaiken, Govender, and Pratto (1992; also see Bargh et al., 1996) failed to replicate the finding that affective priming was moderated by the accessibility of affective information. Moreover, the results of several studies suggest that the affective properties of recently learned stimuli can evoke automatic affective reactions even though the affective properties of these stimuli are probably difficult to access (e.g., De Houwer, Hermans, & Eelen, 1998; Hermans, Baeyens, & Eelen, 2003).

Properties of the individual. Hermans et al. (2001) found that affective priming effects were stronger for participants who scored high on the “need to evaluate” scale than for those who had a low score on this scale. This suggests that individuals who are chronically engaged in consciously evaluating objects and situations, also show stronger automatic affective reactions. Hermans et al. argued that this relation might be mediated by the accessibility of affective information. Because accessibility depends on how often the affective properties of stimuli have been evaluated in the past, accessibility will on average be higher for individuals with a high need for evaluation, that is, individuals who constantly evaluate the affective properties of objects and situations in the environment.

A second line of studies that is relevant in this context concerns the impact of alexithymia on affective priming. Alexithymia refers to a lack in the capacity to identify and describe emotions. Vermeulen, Luminet, and Corneille (2006) observed smaller affective priming effects in participants high in alexithymia than in participants low in alexithymia. Finally, there are also indications that working-memory capacity (Klauer & Teige-Mocigemba, 2007) and the level of trait anxiety (Maier, Berner, & Pekrun, 2003) can modulate affective priming effects. In sum, research suggests that there are stable differences in the propensity of people to show automatic affective reactions.

What determines the outcome of automatic affective processing?

In this section, we will consider those variables that determine the automatic evaluation of the affective properties of a stimulus, for instance, whether a stimulus is automatically evaluated as being positive or negative. Although genetic factors undoubtedly also have an impact, the outcome of automatic affective processing is determined primarily by the nature of prior experiences with stimuli and on the nature of the context in which the stimuli are presented. Hence, we will focus on those two determinants.

Prior experiences. Research has shown that automatic affective reactions toward an object can result from direct experiences with that object. We have already discussed studies on mere exposure which showed that the repeated presentation of a stimulus can change the liking of that stimulus even when people are not aware of those presentations (e.g., Kunst-

Wilson & Zajonc, 1980). Research on evaluative conditioning is also relevant in this context. Evaluative conditioning studies have shown that stimuli that often co-occur with positive stimuli (e.g., the aftershave of a loved one) tend to be liked more than those that often go together with negative stimuli (e.g., the aftershave of an enemy; see De Houwer, Thomas, & Baeyens, 2001, and De Houwer, in press, for reviews). Such direct experiences have been shown to influence not only non-automatic affective reactions such as self-reported liking but also automatic evaluative reactions such as captured by affective priming effects (e.g., Hermans et al., 2003). Automatic affective reactions can result also from indirect experiences with an object, that is, from information about the object that is communicated via verbal instruction or picked up via observation. For instance, simply telling people that members of a (fictitious) social group called “niffites” tend to behave in a bad manner will result in automatic negative reactions toward the members of that social group (Gregg, Banaji, & Seibt, 2006; also see De Houwer et al., 1998). The fact that a single instruction can lead to automatic affective reactions contradicts the common assumption that automatic reactions (affective or otherwise) are acquired slowly as the result of many experiences. It also raises important questions about whether or how automatic affective reactions that result from instructions differ from those that result from repeated direct experiences.

Current Context. The outcome of affective processing is highly dependent on the context in which stimuli are presented (see Blair, 2002, for a review). For instance, the same Black person might automatically evoke a negative reaction in the context of a backstreet alley but a positive reaction in the context of a basketball game (e.g., Wittenbrink, Judd, & Park, 2001). Automatic affective responses also depend on the goals that we have at a particular moment in time. For instance, food automatically evokes a much more positive reaction when we are hungry than after eating a large meal (e.g., Seibt, Häfner, & Deutsch;

2007; also see Ferguson & Bargh, 2004; Moors & De Houwer, 2001). In sum, contrary to the idea that automatic affective reactions are fixed and inflexible, many results have shown that automatic affective reactions are highly malleable.

What are the effects of automatic affective processing?

Research has shown that the outcome of automatic affective processing (e.g., whether a stimulus is evaluated as positive or negative) can have multiple effects on behavior. We will make a distinction between direct and indirect effects, that is, effects that are not (direct) or are (indirect) assumed to be mediated by other cognitive or affective processes.

Direct effects. Stimuli that are evaluated as being positive tend to be approached whereas stimuli that are evaluated as negative tend to be avoided. There is evidence showing that such effects arise even when participants do not have the goal to evaluate stimuli and when little time is available (e.g., Solarz, 1960; Chen & Bargh, 1999). Such evidence has been interpreted as revealing a direct impact of automatic affective processing on (approach or avoidance) behavior (e.g., Chen & Bargh, 1999) There is, however, some debate about whether this link is mediated by cognitive processes (see Eder & Rothermund, 2008; Kriegelmeyer, Deutsch, De Houwer, & De Raedt, 2009). For instance, Eder and Rothermund (2008) argued that positive (negative) stimuli automatically activate responses if and only if they are mentally encoded as being positive (negative). They showed that changes in the mental coding of responses (e.g., telling participants that pulling a joystick towards the body is actually moving the joystick downwards) also changed the way in which positive and negative stimuli activated those responses. Recent results by Kriegelmeyer et al., however, suggest that in some cases, approach and avoid responses are activated by positive and negative stimuli irrespective of how they are cognitively represented.

Indirect effects. Automatic affective processing can also influence behavior in an indirect way. First, studies have shown that affective stimuli attract attention, even when people do not have the intention to evaluate the stimuli affectively nor the intention to attend those stimuli (see Yiend, this volume, for a review). There is some indication that the attentional effects of automatic affective processing are driven primarily by the evaluation of the arousal level of the stimuli rather than the evaluation of valence (e.g., Vogt, De Houwer, Koster, Van Damme, & Crombez, 2008). The fact that automatic affective processing has an effect on attention in its turn allows for a host of additional, downstream effects. For instance, the increase in the amount of attention that is assigned to (certain) affective stimuli is likely to increase the impact of those stimuli on current behavior and to improve memory for those stimuli.

Second, automatic affective processing can also influence behavior through the effects it has on mood. For instance, Chartrand, van Baaren, and Bargh (2006), showed that the subliminal presentation of positive stimuli results in a positive mood which, in its turn, leads to a more superficial processing of stimuli in the environment. Such findings show that automatic affective processing cannot only have immediate, short-term effects on cognition and behavior (e.g., via the activation of approach or avoidance responses), but also more global and long-lasting effects.

"Implicit measures" of automatic affective reactions. Given the important impact that automatic affective reactions can have on behavior, researchers started looking for ways to measure individual differences in automatic affective reactions in an attempt to better predict and understand individual differences in behavior. For instance, Fazio, Jackson, Dunton, and Williams (1995) found that an affective priming measure of automatic affective reactions to faces of Black persons predicted subtle aspects of how participants interact with a Black person. Findings such as these have led to an explosion of research on implicit measures, that

is, measures of automatic (affective) reactions. It is beyond the scope of this chapter to review all of these studies (see De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009, and Fazio & Olson, 2003, for reviews). Nevertheless, the sheer number of studies on this topic shows how important the topic of automatic affective processing has become in modern psychology.

On which cognitive processes is automatic affective processing based?

The core assumption of the cognitive approach in psychology is that the impact of the environment on behavior is mediated by the activation and transformation of mental representations that encode information about stimuli in the environment. Cognitive models of automatic affective processing thus postulate that automatic affective reactions to stimuli in the environment occur only when mental representations about the affective properties of those stimuli have been activated or formed. Different cognitive theories differ in their assumptions about the nature of the intervening representations and the processes by which these representations are formed and transformed. Three classes of models can be distinguished based on the type of representation that they postulate: Symbolic network models, exemplar models, and subsymbolic network (or connectionist) models. We will briefly discuss each class of models as they relate to automatic affective processing. Finally, we will also discuss models that focus on the relation between automatic and non-automatic affective reactions.

Symbolic network models. The first class of models is based on the idea that knowledge is represented in a semantic network of symbolic nodes. Each node is symbolic in that it is assumed to represent a certain stimulus or concept. The properties and meaning of a concept are reflected in the associations in which the corresponding node is involved. For instance, the fact that birds typically have wings can be represented by the presence of an association between the node that represents the concept “bird” and a node that represents the concept “wings” (e.g., Collins & Quinlan, 1972). Likewise, symbolic network models of automatic affective processing postulate that certain nodes represent the affective properties of stimuli. For instance, the fact that cancer is something bad could be represented by means of an association between the node representing “cancer” and a node representing “bad” (e.g., Bower, 1981; Fazio, 1986). Automatic affective reactions are attributed to the fact that evaluative associations can be activated automatically, that is, in the absence of awareness, cognitive resources, time, or certain goals.

Different symbolic network models of automatic affective processing differ with regard to their assumptions about the processes by which evaluative associations can be activated or about the number and content of the evaluative associations. For instance, Fazio (1986) postulated that only strong, easily accessible evaluative associations can be activated automatically. Others dispute this assumption (e.g., Bargh et al., 1992, 1996). Moreover, whereas some models incorporate the assumption that all affective information about a concept is summarized into a single evaluative association (e.g., Fazio, 1986), others postulate the existence of multiple evaluative associations (e.g., Petty, Briñol, & DeMarree, 2007; Wilson, Lindsey, & Schooler, 2000).

Exemplar models. A second class of models in cognitive psychology is called exemplar models (e.g., Medin & Schaffer, 1978; Hintzman, 1986; Nosofsky & Palmeri, 1997). Like symbolic network models, these models postulate the existence of symbolic representations. However, rather than assuming the existence of nodes that represent concepts, exemplar models assume the existence of exemplars that represent concrete past events. Each separate event is encoded in a different exemplar. The information from different events is not integrated at the time when the events are encountered but only at the time when information is retrieved from memory.

In the context of automatic affective reactions, it can be assumed that different events that contain information about the affective properties of a stimulus (e.g., the experience of pleasant flavor when eating a strawberry; someone telling you how nice strawberry's are) are each stored in separate exemplars. The next time that the stimulus is presented, different exemplars that contain information about stimulus will be automatically activated from memory. The automatic affective reaction will reflect the summary of all affective information that is retrieved from memory upon the presentation of the stimulus (e.g., Klauer, 2008). One could say that one's evaluation of the affective properties of a stimulus is not retrieved from memory but rather constructed on the spot, based on the information that is at that point in time retrieved from memory. Because the activation of exemplars from memory is assumed to be a function of the similarity between the current situation and the past situations stored in the exemplars, the retrieval of information will depend very much on the detailed properties of the current situation. This could explain why automatic affective reactions are very much context dependent (e.g., Schwartz, 2007). Note, however, that network models also contain a number of mechanisms by which context effects can be explained by network models (see Fazio, 2007; Gawronksi & Bodenhausen, 2006).

Exemplar models are clearly superior to symbolic network models in the capacity to account for the embodiment of affective processing. Affective processing is not only associated with a variety of bodily and neural responses, it also seems to causally depend on the presence of specific bodily and neural responses (e.g., Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). For instance, participants are less accurate in judging the emotional nature of disgust- and joy-related words when they are prevented from activating facial muscles that are typically involved in facial expressions of disgust and joy (Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009). Such results are difficult to explain on the basis of symbolic network models in which information is typically represented in an abstract, modality-independent manner. They can be explained on the basis of exemplar models if it is assumed that exemplar representations also contain information about embodied responses that were present in the encoded event.

Subsymbolic network models. The third class of cognitive models postulates the existence of subsymbolic networks (e.g., McClelland & Rumelhart, 1986). Like symbolic network models, subsymbolic network models postulate that knowledge is represented in a network of interconnected nodes. The crucial difference is that the nodes in a subsymbolic network do not symbolize stimuli, concepts, or events. Instead, knowledge is represented as patterns of activation across a large number of nodes. For instance, the concept “bird” is not symbolized by a specific node but by a specific pattern of activation. The affective properties of a concept can be seen as part of the pattern of activation that is evoked by stimuli related to that concept. Given that stimuli in the environment automatically give rise to patterns of activation in the network, the evaluation of the affective properties of a stimulus arises automatically as an aspect of the activation pattern that the stimulus evokes. Although subsymbolic network models are thus compatible with the idea that affective reactions can arise automatically, they have received little attention in research on (automatic) affective processing (see Conrey & Smith, 2007, for an exception).

Models about the relation between automatic and nonautomatic affective reactions. Cognitive models of affective processing have focused not only on how automatic affective reactions come about but also on how these reactions relate to non-automatic affective reactions. Most models allow for the possibility of inconsistent automatic and non-automatic affective reactions even though they differ in their assumptions about how such dissociations can arise. So-called dual-attitude models postulate that both types of affective reactions can be determined by different representations in memory. For instance, Wilson et al. (2000) put forward the idea that a single concept in a symbolic network can be involved in two evaluative associations that contradict each other (e.g., an association between "smoking" and "good" and between "smoking" and "bad"). Dissociations can arise when automatic and non-automatic affective reactions are based on different evaluative associations. Dual-process models, on the other hand, postulate that non-automatic affective reactions can be influenced by processes that do not impact on automatic affective reactions (e.g., Fazio, 1986; Gawronski & Bodenhausen, 2006; Petty et al., 2007). For instance, Fazio (1986) argued that automatic affective reactions are a direct function of the automatic activation of evaluative associations in memory whereas non-automatic affective reactions are modulated by controlled reasoning processes that people engage in when they have the motivation and opportunity to do so. Especially dual-process models have been successful in predicting when automatic and non-automatic affective reactions will overlap (see Gawronski & Bodenhausen, 2006, and Fazio & Olson, 2003, for reviews).

Does automatic affective processing (always) depend on cognitive processes?

The different cognitive models of (automatic) affective processing that we have discussed in the previous section incorporate different ideas about how automatic affective processing *could* depend on the (automatic) activation and transformation of mental representations. Despite the existence of these theories and despite the challenge that was formulated by Zajonc (1984), relatively little research has been directly aimed at testing whether particular cognitive processes and representations *do* underlie automatic affective reactions. There are a number of findings that strongly suggest that automatic affective reactions do at least sometimes depend on the activation and transformation of mental representations. This does not imply, however, that automatic affective reactions always depend on cognitive processes. In the remainder of this chapter, we will provide a brief overview of studies that directly examined the question of whether cognitive processes mediate automatic affective reactions. In line with Zajonc (1984), we define cognition as the formation and transformation of mental representations.

Mere exposure effects. A first set of studies relates to the mere exposure effect, that is, the finding that the liking of a stimulus can change as the result of the repeated exposure of that stimulus. The observation that mere exposure effects do no depend on a conscious recognition of the presented stimulus was one of the corner stones of Zajonc' (1980) claim that affect does not need cognition. More recent findings, however, strongly suggest that mere exposure does depend on automatic cognitive processes, more precisely, the automatic activation of memory traces (e.g., Bonanno & Stillings, 1986; Mandler, Nakamura, & Van Zandt, 1987; Reber, Winkielman, & Schwarz, 1998; Rotteveel & Phaf, 2007). As is known from memory research (e.g., Hintzman & Curran, 1994), automatic activation of memory traces will result in a sense of familiarity or perceptual fluency. If it is assumed that familiarity or perceptually fluency results in an increase in liking, one can explain that repeatedly presented (and thus more familiar) stimuli will be liked more than those that were not previously presented. Memory research has also demonstrated that familiarity or fluency is not always sufficient to support conscious recognition (e.g., Mandler, 1980). Therefore, increases in familiarity, and thus in liking, could be observed even if conscious recognition fails.

Context effects. Studies on the context specificity of automatic affective reactions also provide support for the idea that automatic affective reactions depend on cognitive processes. We already noted that the context in which a stimulus is presented (e.g., a Black person in a backstreet alley or on a basketball court) determines the outcome of automatic affective processing. This implies that the automatic affective reaction is not simply a function of certain “sub-cognitive” features of the stimulus (e.g., the “preferanda” that according to Zajonc, 1980, determine affect) but depends on a combination of features of the stimulus and the context in which the stimulus occurs. Other studies show that also a non-physical, motivational context can modulate automatic affective reactions. For instance, the same stimulus can evoke a positive automatic affective reaction when it signals the achievement of a goal and a negative automatic affective reaction when it signals the failure to achieve a goal (e.g., Moors et al., 2001). It is difficult to imagine how the physical and motivational context can have such a dramatic impact without the intervention of cognitive processes.

Dissociations between affect and cognition. There are, however, also findings that seem to reveal cognitively unmediated affective reactions, that is, affective reactions that do not involve the formation or transformation of mental representations. Most of these findings have in common that they demonstrate effects of the affective properties of a stimulus in the absence of effects of non-affective properties of the stimulus. Assuming that mental representations always encode non-affective properties, such dissociations could be interpreted as evidence for affective reactions under conditions in which mental representations of the stimulus were absent. A first example of such a dissociation comes from studies conducted by Murphy and Zajonc (1993; Murphy et al., 1995). On each trial, they presented a photograph of a human face that expressed either a positive or negative emotion (e.g., happiness, fear, anger). Immediately following presentation of the facial expression, a Chinese ideograph was shown. Participants were asked to indicate how much they liked the ideograph. When facial expressions were presented for 4 ms -which was too brief to allow for a conscious recognition of the face- ideographs that were preceded by positive expressions were liked more than those preceded by negative expressions. No effects were found when faces were presented for 1000 ms, in which case they could be clearly perceived. Murphy and Zajonc (1993) found the opposite pattern of results when other, which they called "cognitive" attributes of the ideographs had to be rated. Judgements of "cognitive" attributes such as size, symmetry, or gender were not influenced by the size, symmetry, or gender of the preceding stimuli when the preceding stimuli were presented briefly (4 ms), but judgements were influenced when the preceding stimuli were presented long enough to be detected (1000 ms).

Murphy and Zajonc (1993, Experiment 6; see Dijksterhuis & Aarts, 2003, for related findings) observed also a second type of dissociation between the effects of affective and non-affective stimulus properties. On each trial, they presented for 4 ms a picture of a man or women who expressed a positive or negative emotion. After an interval of 1000 ms during which a pattern mask was presented, participants were shown the briefly presented face on one side of a screen and a face that was not presented on the other side. They were asked to indicate which of the two faces had been presented before the mask. If the not presented (incorrect) alternative was a face expressing an emotion of a different valence than the presented face, choice performance was more accurate than when both faces expressed an emotion of the same valence. However, performance did not depend upon whether gender was consistent. Hence, there were effects of the affective properties of faces under conditions that did not seem to allow for effects of non-affective properties of those faces.

A third and final set of dissociation data comes from studies conducted by Klauer and Musch (2002). On each trial, they presented two words that had the same (e.g., HAPPY – RAINBOW) or a different valence (e.g., SMILE – CANCER). Independently of the match in valence, the stimuli also matched or mismatched on a non-affective stimulus dimension (e.g., they had the same or a different color). When participants had to decide whether the stimuli matched on the non-affective dimension (e.g., “Do the words have the same or a different color?”), reaction times were influenced by the (task-irrelevant) match in valence (e.g., faster responses to HAPPY-RAINBOW than to SMILE-CANCER when the words had the same color; vice versa for when the words had a different color). When the match in valence was relevant, however, the (task-irrelevant) match on the non-affective dimension had no impact on performance. Hence, again there was an impact of affective stimulus properties (i.e., match in valence) under conditions where there was no impact of non-affective stimulus properties (e.g., match in color).

Limitations of disscociations. Although dissociations between the effects of affective and non-affective stimulus properties are intriguing, they should be interpreted with care (e.g., Dunn & Kirsner, 2003). In order to interpret these dissociations as evidence for affect without cognition, one needs to assume that the null effects of the non-affective stimulus properties demonstrate the complete absence of mental representations of the stimulus (i.e., the absence of cognition). It is, however, possible that non-affective stimulus properties are represented mentally but do not influence responding. For instance, the failure of Murphy and Zajonc (1993; Murphy et al., 1995) to observe effects of non-affective stimulus properties with short (4 ms) stimulus presentations does not necessarily imply that those properties were not processed under those conditions. As Marcel (1983a, 1983b) pointed out, some stimulus properties have better access to consciousness and can thus influence conscious judgements under conditions that eliminate the influence of other types of information. It is possible that affective information has better access to consciousness than information about "cognitive" properties such as size, symmetry, or gender. Hence, both might have been processed even when only effects of affective properties were observed.

However, arguments like these render the hypothesis that automatic affective reactions depend on automatic cognition unfalsifiable. When there is no evidence for cognitive processing under conditions that do show evidence for affective processing, one can always argue that cognitive processing did occur but could not be observed for one or the other reason. Rather than relying on such post-hoc arguments, cognitive researchers should conduct additional studies to test whether automatic cognition is involved.

Such additional studies have been conducted with regard to the dissociation reported by Klauer and Musch (2002). Spruyt, De Houwer, Hermans, Everaert, and Moors (2009) noted that Klauer and Musch always asked participants to respond in a positive, affirmative manner when stimuli matched on the relevant dimension and to respond in a negative, disconfirming manner when stimuli mismatched on that dimension. The mere fact that the responses were affectively laden could have increased the salience of the affective properties of the stimuli and thus the probability that these properties influenced performance even when they were task-irrelevant. To test this idea, they conducted a new experiment in which participants responded by saying the name of one color (e.g., “blue”) for words that matched on the task-relevant dimension and by saying the name of another color (e.g., “green”) when the words mismatched on that dimension. Under these conditions, a task-irrelevant match in color did influence responses. This shows that a task-irrelevant match on a non-affective dimension can have an impact on performance. Hence, the dissociation that was observed by Klauer and Musch appears to be due to the nature of the responses that they used rather than to differences in the conditions under which affective and non-affective stimulus properties are processed.

Neuropsychological evidence. Since the publication of Zajonc’s (1980) seminal paper, there has been an explosion in neuropsychological research about the brain structures that are involved in the processing of affective and non-affective stimulus properties. It is beyond the scope of this chapter to review all of this evidence. Recent reviews of the relevant literature (e.g., Duncan & Feldman Barrett, 2007; Storbeck & Clore, 2007) point to the conclusion that affective and non-affective processing is fundamentally intertwined. In those limited cases where some results could be interpreted as evidence for affective reactions that are unmediated by cognitive processes, additional studies showed that such reactions occur only under very limited conditions. For instance, LeDoux (1990) observed conditioned emotional responses to the presence of a tone in animals whose auditory cortex was removed. However, he also found that cortical areas do play an indispensable role for the establishment of conditioned emotional responses to tones of a particular frequency. It seems only logical that cortical areas have this function. Automatic affective reactions depend very much on the visual details of a stimulus. For instance, perceptually similar words such as “luck” and “lock” are likely to evoke very different automatic affective reactions. In order for a system to generate different affective responses to different stimuli, it must be able to differentiate between the stimuli. Although subcortical pathways may be sufficient to discriminate between clearly different, isolated perceptual stimuli, it is unlikely that more complex, multifeatured stimuli can be differentiated at this level (LeDoux, 1990). Rather, substantial cognitive processing is required to differentiate complex stimuli. It therefore makes sense that cognitive processes precede the automatic affective reactions evoked by complex stimuli (also see Storbeck & Clore, 2007).

Summary and Conclusions

Until Zajonc' (1980) seminal publication, cognitive researchers mainly focused on deliberate, consciously controlled affective judgements but ignored spontaneous, automatic affective reactions. Zajonc made clear that automatic affective reactions do occur and are an important aspect of affective behavior. Subsequent research confirmed the existence and importance of automatic affective processing. During the past 30 years, much has been learned about the way in which automatic affective processing is automatic, the conditions under which automatic affective processing can occur, the variables that determine the outcome of automatic affective processing, the effects that it has on behaviour, the possible cognitive processes on which automatic affective processing is based, and whether cognitive processes actually underlie automatic affective processing. In fact, the literature on automatic affective processing that has accumulated over the past 30 years is so large that we could only briefly summarize some of the most important insights that have been reached.

Although a lot has been learned about automatic affective processing, many issues still need to be addressed in future research. For instance, it is still not clear whether affective processing occurs only in the presence of certain goals. Moreover, there is disagreement about whether certain stimuli (e.g., those with highly accessible attitudes) are more likely to evoke automatic affective reactions than other stimuli. Only a very limited number of studies examined whether there are interindividual differences in the propensity to show automatic affective reactions. Although we know that automatic affective reactions can result from both direct and indirect experiences with stimuli, it still needs to be examined whether the source of an automatic affective reaction determines it properties (e.g., the way in which it is automatic). More research is also needed on how automatic affective reactions impact on behaviour. Measures of automatic affective reactions need to be perfected. Existing models of automatic affective reactions are relatively unsophisticated. They incorporate ideas about the cognitive processes and representations that could produce these reactions but give few details about the way in which affective reactions can be automatic or about how direct and indirect experiences can shape these reactions. Finally, too few studies have directly examined the possibility that affective reactions can occur prior to or in the absence of cognitive processing. Despite these remaining issues of dispute, there is general agreement about the importance of automatic affective processing as a determinant of human behaviour. We are therefore confident that future research will continue to shed new light on this important phenomenon.

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Preparation of this chapter was supported by GOA Grant BOF/GOA2006/001 and Methusalem Grant BOF09/01M00209 of Ghent University to Jan De Houwer. We thank Andreas Eder and Adriaan Spruyt for comments on an earlier draft of this chapter.

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