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Investigating the Automaticity of Constructive Appraisals

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Abstract

Appraisal theories have emphasized that emotions are not reliably caused by specific stimuli but rather by specific constellations of stimuli and concerns (and other types of information). This calls for a constructive process. Our data suggest that, unlike what is often assumed, constructive processes need not proceed in a slow, reflexive manner, but may posses several features of automaticity.

1 Appraisal theory

Appraisal theorists have addressed the observation that there are few if any one-to-one mappings between stimuli and emotions [Roseman and Smith, 2001]. The same emotion can be produced by very different stimuli, and the same stimulus can lead to different emotions on different occasions or in different individuals. Appraisal theorists have tried to discover the commonalities among the encounters that elicit emotions (emotions per se as well as specific emotions).

This exercise led to the suggestion that emotions are reliably produced by constellations of (at least) two elements: a stimulus and a concern[1] for which the stimulus is relevant [Frijda, 1986]. For example, meeting a bear in the woods is not inherently emotion-provoking, it is only so because it is relevant for one's concern for physical safety. Moreover, specific emotions are not evoked by specific classes of stimuli but instead by specific constellations of stimuli and concerns. A constellation of match between a stimulus and a concern leads to a positive emotion whereas a constellation of mismatch leads to a negative emotion, irrespective of the specific stimuli or the specific concerns at stake. A bear in the woods elicits a negative emotion because it constitutes a mismatch with one's concern for physical safety, but so does any stimulus that constitutes a mismatch with some concern. Appraisal theorist have proposed sophisticated rules for the further differentiation of positive and negative emotions into more specific emotions such as joy, hope, anger, fear, sadness, and disgust. Examples of such rules are that anger and sadness are elicited by an actual mismatch, whereas fear occurs in response to a pending mismatch [Arnold, 1960], that the events are more easy to control in the case of anger than in the cases of fear and sadness [Scherer, 1988], and that the mismatch in anger is caused by another person [Lazarus, 1991]. Ultimately, the aim is to propose for each specific emotion a list of dimensions (such as motivational relevance, motivational congruence, certainty, controllability, and agency) that is minimally (or typically) required to characterize its elicitors.

Crucially, appraisal theorists postulate a separate phase or processing step in which the stimulus is evaluated on the proposed dimensions. The process that mediates between an event and the ensuing emotion is called appraisal. The appraisal process is subdivided into different components. Each component deals with a different dimension or aspect of the encounter. An appraisal of goal relevance determines whether the stimulus is relevant or irrelevant for the person's concerns. An appraisal of goal congruence determines whether the stimulus constitues a match or mismatches with a relevant concern. An appraisal of certainty determines whether the match or mismatch is pending or whether it already happened. An appraisal of controllability determines whether a person can prevent a pending mismatch, or undo the consequences of an actual mismatch. An appraisal of agency determines whether the source of an event is animate (self/other) or inanimate.

According to Ferguson and Bargh's [2003] definition of a constructive process as one that combines information from a variety of sources[2], appraisal meets the criteria of a constructive process. If emotions are indeed elicited by constellations of stimuli and concerns rather than by stimuli alone, then the mediating process should be able to determine the nature of the constellation and not simply the nature of the stimulus. Suppose that chocolate cake makes a person happy when she is hungry (motivational state 1) but disgusted when she has just eaten five

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[1] The term concern is used here in a broad sense covering all kinds of motivational concepts such as goals, desires, needs, drives and standards.

[2] We define the term constructive in this minimal sense, leaving out connotations of consciousness that the term may have been burdened with in the past.

pieces of it (motivational state 2). Before an emotion of happiness or disgust can arise, information about the stimulus must be combined with information about the motivational state.

Constructive processes are involved in certain individual appraisal components such as motivational relevance, motivational congruence, expectancy, and some forms of controllability. For example, to determine whether a stimulus is motivationally congruent requires a comparison between the stimulus (i.e., actual state) and a concern (i.e., desired state). A comparison is also required to determine whether a stimulus (i.e., actual state) conforms to one's expectations (i.e., expected state). To determine the controllability of a negative event often requires a comparison of one's actual potential with the potential required to prevent or overcome the event. Finally, a constructive process is also required to integrate the outputs of appraisal components into an appraisal pattern. This pattern ultimately determines the nature of the ensuing emotion.

2 Criticism

The constructive appraisal process has been criticized as being overly mentalistic and too complex to be executed automatically. This means that it would not be able to operate in suboptimal conditions such as when there is a lack of time, a lack of attentional capacity, subliminal stimulus input, and when there is no intention to engage in the process. It is therefore not considered to be a plausible antecedent of emotions that occur in suboptimal conditions (i.e., spontaneous emotions). There are at least two possible strategies to deal with these allegations. I discuss them below.

3 First strategy

A first strategy that many appraisal theorists [e.g., Smith and Kirby, 2001] have turned to is to supplement the supposedly slow, laborious appraisal process with a fast, automatic retrieval process as described in network theories of emotion.

Central to network theories [e.g., Leventhal, 1980; Bower, 1981; Lang, 1985] is the idea that emotions are recorded in memory and that activation of these recordings causes emotions. Network models assume that initially only a handful of biologically relevant stimuli (e.g., snakes, sudden loss of support) elicit unconditioned emotional responses and that the range of stimuli that evoke these emotional responses is progressively elaborated through conditioning procedures. When an emotional episode takes place, information about stimuli, responses/action tendencies, meanings, and feelings is encoded in memory in distinct nodes. For each specific emotion, these nodes are organized in a schema. A newly encountered, neutral stimulus acquires emotion-eliciting power through repeated pairings with a stimulus that is already part of an emotional schema. When the new stimulus is encountered again on a later occasion, the associated emotional schema is automatically activated and an emotion is produced. Schemata may be triggered by stimuli that are either identical or similar to the ones represented in the schema (i.e., generalization).

Appraisal theorists who have turned to this strategy have made the additional assumption that the output of previous constructive appraisals can also be stored in memory and retrieved on a later occasion on the basis of mere stimulus input [van Reekum and Scherer, 1997].

4 Second strategy

Appraisal theorists who have adopted the first strategy agree with the critics that constructive appraisal can only occur in optimal conditions. In suboptimal conditions, constructive appraisal is replaced by memory retrieval. Retrieval on the basis of stimulus input alone is not a constructive process (a constructive process requires minimally two inputs), and therefore permits less flexibility. Suppose that a person is hungry and is served chocolate cake. If conditions are optimal, the person engages in a constructive appraisal of the cake, resulting in the outcome that the cake is congruent with her motivational state and hence positive (or to-be-approached). An association is then formed in memory between the representation of the chocolate cake and the outcome positive. On a later occasion, when conditions are suboptimal, the person is to rely on the stored outcome. This outcome is appropriate when the person is in the motivational state in which the association was originally formed (hungry), but inappropriate when she is in a different motivational state (satiated). In this way, the flexibility that appraisal theory inititally set out to address is abandoned in suboptimal conditions. I consider this to be a weakening of appraisal theory and propose a second strategy to respond to the critics. This strategy consists in the empirical investigation of the automatic nature of constructive appraisals. Rather than assuming a priori that complexity and automaticity do not go together, it should be determined empirically how much complexity can be handled in suboptimal conditions, and thus how much flexibility is allowed.

There is growing support for the automatic execution of constructive processes, outside [Tzelgov *et al.*, 2000; Van Opstal *et al.*, 2005] as well as inside the domain of emotions [Moors and De Houwer, 2001; Moors *et al.*, 2004; Moors *et al.*, 2005]. In a first series of studies, we focused on the constructive comparison process involved in the appraisal of motivational congruence (or what we call motivational valence). In a typical experiment, participants received a series of trials and each trial consisted of two phases: a goal-inducing phase and a priming phase. In the goal-inducing phase, a game rule stipulated that one color would yield a reward (10 points) and another color would not. Participants then played a game in which they tried to produce the rewarded color by pressing a key at the right moment. In the priming phase, a prime stimulus was presented in the rewarded or the non-rewarded color. The color of the prime stimulus provided the only feedback about the participants' performance.

The prime stimulus had a positive valence when it was in the rewarded color (indicating success) but had a negative valence when it was in the non-rewarded color (indicating failure). Importantly, the rewarded color and the prime color were randomly varied across trials. In this way, there was no opportunity for participants to attach a fixed valence tag in memory to each color. To determine the valence of the primes, participants could not rely on a fixed stored valence tag. They had to combine information about the rewarded color (desired situation) and the prime color (actual situation) on each trial. The prime was presented very briefly (200 ms) and immediately (after 100 ms) followed by a positive or negative target word. Participants had to evaluate the targets as quickly as possible. In this and similar experiments, we obtained robust priming effects, with faster responses and less errors when prime and target valence corresponded than when they were opposite. Such priming effects indicate that the constructive process necessary to determine the prime valence can occur in the conditions created in the experiments. These conditions (e.g., short time between onset of prime and onset of target; the task during the priming phase was to respond to the targets as quickly as possible) argue for the relative automaticity of this process, in the sense of fast, efficient, and unintentional [cf. Moors and De Houwer, in press].

In a second series of studies that we are currently conducting, we focus on the constructive comparison process involved in the assessment of some forms controllability (e.g., with regard to an opponent). Data will be discussed when available.

Once we have collected evidence that individual appraisal components can be processed automatically[3], we can investigate whether the integration of the outcomes of these components can occur automatically as well. We can do this by examining whether different patterns of outcomes lead to the different predicted emotions (or action tendencies) in suboptimal conditions.

5 Final considerations

The following paragraphs serve to frame the present discussion within recent theorizing about appraisal.

A distinction is often made between structural appraisal models and process models of appraisal. Structural models attempt to discover the *structure* of appraisal. They try to identify the appraisal components that are minimally or typically required to elicit and individuate specific emotions. In addition, they try to map different patterns of outcomes of appraisal components onto different specific emotions. Process models, on the other hand, attempt to articulate the nature of the appraisal *process*.

Some authors [e.g., Reisenzein, 2001] have suggested that structural models and process models both address the appraisal *process* but that they provide a different *level* of process understanding [cf. Marr, 1982; Anderson, 1987; Pylyshyn, 1984]. Marr [1982] introduced a distinction between three levels of process understanding. The first level articulates the functional relation between input and output, as well as the conditions in which the process operates. The second level contains information about the formal properties of the processes involved in transforming input into output as well as about the format of the representations of the inputs and outputs (i.e., what is in the black box). The third level is concerned with the physical implementation of processes in the brain. Structural appraisal models are said to address the first (functional) level, whereas process models of appraisal are said to address the second (computational) level. These two levels are to a certain extent independent of each other. That is, a structural model might be compatible with different process models.

However nice the analogy sounds at first, it does not fit entirely. Structural models provide an incomplete account of the functional level (e.g., they do not provide a detailed account of the conditions in which appraisal occurs), and process models not only address aspects of the computational but also of the functional level (e.g., they also address the issue of the conditions). This is not in itself problematic because process models fill in some of the gaps of structural models.

What I do consider to be problematic is that several process models [e.g., Smith & Kirby, 2001] assume a priori mappings between constructive processes and optimal conditions, and between stimulus-based activation of schemata and suboptimal conditions. Based on our empirical data, I propose an elaboration of existing process models of appraisal. I argue that constructive processes that integrate stimulus input and concerns (and perhaps other types of information) can be executed automatically, just as can stimulus-based memory retrieval. Constructive appraisal must not be relegated to conditions in which people have abundant opportunity (time, attentional capacity, conscious stimulus input) and the intention to engage in it. Thus, flexibility need not disappear in suboptimal conditions. Emotions that occur in these conditions may still be adequately tuned to the motivational state of the organism (and perhaps other types of information).

Thus far, we have contrasted constructive processes with stimulus-based retrieval. The contrast is in the complexity of the input: multiple-input (or double-input) vs. single-input. It should be stressed that complexity of the input is a functional matter. Different computational mechanisms may be compatible with the functional requirement of a multiple input. As an example of a computational mechanism, I mentioned the calculation of a comparison algorithm (as involved in the component of motivational congruence). I am aware, however, that

[3] It is worth mentioning that past studies have provided support for the automatic assessment of goal relevance (cf. atttentional bias research), intrinsic pleasantness (cf. standard affective priming research), and some forms of controllability that do not require a constructive process [Moors and De Houwer, 2005].

algorithms are not the only type of mechanism that can handle multiple inputs. Another type of mechanism that would be appropriate is a complex, multiple-input retrieval mechanism, such as the kind described in occasion setting literature [Davidson, 1998] or connectionist models.

This remark begs for a clarification of the distinction between algorithm computation and (complex) memory retrieval. Algorithms are abstract procedures that are not data-specific. A comparison algorithm produces an output irrespective of the specific stimuli or concerns that are at stake. In contrast, a (simple or complex) retrieval process can only produce an output for data (stimuli or stimulus-concern pairs) that were previously encountered and for which an output was stored. Activation can only travel along established traces. However, when the notion of similarity is added [Palmeri, 1997], memory retrieval can also produce an output for new data that are similar to previously stored ones. When the complex retrieval mechanism is supplemented with a generalization mechanism based on similarity, it becomes very hard to empirically disentangle them from algorithm computation. This is especially difficult when similarity is based on more abstract (instead of only superficial) features.

I argued that flexibility calls for a constructive process without going into the debate of whether this process should be implemented by an algorithm or a complex retrieval process. Our data support the idea that constructive processes can be executed automatically, which suggests that automaticity need not be at the expense of flexibility. I also argued that in building process models, appraisal theorists have underemphasized the flexibility they put at the core of their structural appraisal theories [e.g., Smith & Kirby, 2001]. Our research may help bring this flexibility back to center stage.

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