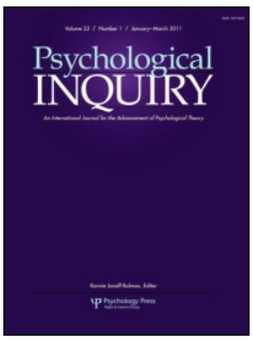

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TARGET ARTICLE

Integration of Two Skeptical Emotion Theories: Dimensional Appraisal Theory and Russell's Psychological Construction Theory

Agnes Moors[a,b,c]

[a]Research Group of Quantitative Psychology and Individual Differences, KU Leuven, Leuven, Belgium; [b]Center for Social and Cultural Psychology, KU Leuven, Leuven, Belgium; [c]Experimental Clinical and Health Psychology, Department of Psychology, Ghent University, Ghent, Belgium

ABSTRACT

This inquiry attempts to integrate two skeptical emotion theories: dimensional appraisal theory and Russell's (2003) psychological construction theory. To bring out the skeptical elements of these theories, I compare them first with two classic theories: affect program theory and discrete appraisal theory. The skeptical theories are similar to each other in that they replace the concept of emotion with the concept of emotional episode, and that they organize the variety within the set of emotional episodes according to dimensions instead of vernacular emotion subsets. Their differences concern the strength of the relations among the components in emotional episodes and the scientific status of the set of emotional episodes. To make an informed decision about the elements to keep and to revise from both theories, I engage in a separate analysis of the behavior-related components and the experience component, guided by insights from general behavior theories and general theories of consciousness. The analysis of the behavior-related components suggests the relatively uncharted idea that the so-called emotional aspect of behavior can be caused by a goal-directed mechanism. The analysis of the experience component reveals that different theories have emphasized different aspects of experience and hence different paths toward experience. The inquiry ends with an integrated theory that rejects the scientific status of emotions or emotional episodes, but accepts the scientific status of the components and sees strong causal relations among them.

KEYWORDS

Emotion; affect program; appraisal; constructivist; goal-directed

The emotion domain is characterized by a profusion of theories and complex debates with no hope of a quick settlement. Dialogue and debate have a function in science. They help sharpen weaknesses in existing theories and foster the development of potentially better ones. Tendencies toward further fragmentation are ideally balanced by efforts toward integration. Integrative efforts, however, have been rather scarce in the emotion domain. Integration is more than the mere summation of the assumptions of both theories. True integration does not tolerate inconsistencies or redundancies and has the freedom to critically examine some of the assumptions in the original theories. The current article is an attempt to integrate two emotion theories: dimensional appraisal theory (e.g., Moors, 2013, 2014a, 2014c; Scherer, 2009a, 2009b; dubbed Flavor 2 appraisal theory in Moors, 2014c) and Russell's (2003, 2012) version of psychological construction (PC) theory. These are skeptical theories that have grown out of criticism against two classic theories: affect program theory (Ekman, 1992; Izard, 1972; Tomkins, 1962)[1] and discrete appraisal theory (Lazarus, 1991; Roseman, 2013; dubbed Flavor 1 appraisal theory in Moors, 2014c). I analyze classic and skeptical theories by describing their agendas within a framework of scientific theory development.

Theory development in science often takes the form of a cycle spanning four steps. The first step is a provisional demarcation or working definition of the phenomenon. This is often a descriptive definition, a description of the way in which laypeople demarcate the set. A descriptive definition often consists of a list of superficial features. In the second step, an explanation is developed in which the to-be-explained phenomenon (explanandum) is linked to an explaining fact (explanans). Common types of explanations are structural ones (which specify the components of the phenomenon) and causal-mechanistic ones (which specify factors and mechanisms that cause the phenomenon). In the third step, the explanation is tested in empirical research. If this explanation is sufficiently supported, there can be a fourth step in which a scientific definition is formed, in which the explanans replaces the initial list of superficial features. The scientific definition is a prescriptive definition, one in which scientists prescribe how a set should be demarcated. Prescriptive definitions often take an intensional format: They specify the necessary and sufficient conditions for an exemplar to belong to a set (one condition that is both necessary and sufficient or a set of necessary conditions that are together sufficient). To illustrate, the phenomenon of water is provisionally demarcated as transparent, odorless fluid that runs in rivers and falls out of the sky. A structural explanation then links water (explanandum) to H_2O (explanans). To empirically validate this explanation, samples of water are collected

CONTACT Agnes Moors agnes.moors@kuleuven.be Research Group of Quantitative Psychology and Individual Differences, KU Leuven, Tiensestraat 102–Box 3713, 3000 Leuven, Belgium.

[1]The affect program theory, discrete appraisal theory, and dimensional appraisal theory (in singular form) discussed here refer to idealizations that are not necessarily and probably not fully instantiated in any of the existing theories. The authors whom I provide as examples are representative for some but not all of the assumptions inherent in these idealizations.

and checked to see whether the molecular structure of these samples is indeed H_2O. After sufficient confirmation, a scientific definition can be proposed in which water is now equated with H_2O. Having a molecular structure of H_2O is both a necessary and sufficient condition for sorting something in the set of water. In sum, theory development often starts from a descriptive set. Explanations are then developed in the hope that they will provide a common denominator that can be used to demarcate the set. If such a denominator is found, the set receives the status of a scientific set. If such a denominator cannot be found, however, researchers may decide that the set is not scientific and shift to another set (explanandum) instead (Bechtel, 2008). The latter case is illustrated by the phenomenon of air, which was taken by Aristotle to be one of four fundamental materials (next to water, fire, and earth). Air could be provisionally demarcated as a transparent, odorless gas that fills the sky and our lungs. When scientists discovered that air could not be captured by an elegant structural explanation (air is composed of many molecules, such as oxygen, nitrogen, and carbonite), however, they decided air was not an adequate scientific set and abandoned it. Instead, all the components in air were taken as new explananda, initiating new scientific cycles.

The development of classic and skeptical emotion theories can be described as cycling through these same four scientific steps. Classic theories take emotion to be analogous to water. They take for granted that the descriptive set of emotion (or some part of it) will one day be turned into an adequate scientific set. Their job is simply to discover an explanans that serves as a common denominator of the set. Skeptical theories arise as a reaction to classic theories. Their agenda is to examine and perhaps reform common sense, rather than vindicate it. As it turns out, at least one type of skeptical theory—PC theory—takes emotion to be more like air: not itself a scientific set, but made up of components that each belong to separate scientific sets.

The article is structured as follows: The first section describes a first cycle as it is conducted by classic theories. The second section lays out a second cycle in which skeptical theories list the problems they see with classic theories and propose solutions to these problems. As it turns out, the two skeptical theories have commonalities with each other, but also differences. In the third section, I attempt to integrate the two skeptical theories. To this end, I follow PC theory's suggestion to run new cycles, one for the behavior-related components and one for the experience component. This should guide us in deciding which elements to keep from both theories and which ones to revise. The current theoretical exercise goes beyond integrating two emotion theories in that it also suggests ways in which to bridge the gap between the emotion domain and the domains of behavior and of consciousness. It also points at avenues for future empirical research.

Cycle 1

Explanandum

For classic emotion theories, the phenomenon to be explained is emotion. These theories seek to fix the boundaries of the set of emotions and to account for the variety within this set. The set of emotions is provisionally demarcated with a descriptive definition in the form of a list of typical features such as that it is relatively brief, characterized by intense physiological responses, and a high degree of pleasure or displeasure. The variety in the set of emotions often takes the form of a list of prototypical subsets as recognized in everyday vocabulary such as joy, anger, fear, sadness, and so on.

Explanation

Structural explanations specify the components of an instance of a set. Causal-mechanistic explanations specify the causal factors and mechanisms that produce those instances. Both types of explanations span different levels of analysis (Bechtel, 2008; Marr, 1982). I distinguish between three broad levels (with possible sublevels in each): an observable level, a mental level, and a brain level. The observable level houses observable inputs and outputs. The mental level specifies the mental mechanisms intervening between these inputs and outputs. These mechanisms can be described in terms of the *type of content* of the intermediate representations and/or in terms of the *operations* acting on these representations. The mechanisms can be decomposed into submechanisms and sub-submechanisms, until, at the ultimate stages of decomposition, they can be mapped onto brain mechanisms.

Structural Explanation

A structural explanation of emotion specifies the components of a single instance of emotion. Often-cited components are (a) a cognitive component, with changes in information processing (e.g., evaluation of a stimulus as a threat; categorization of bodily responses as fear); (b) a motivational component, with changes in action tendencies (e.g., the tendency to flee); (c) a somatic component, with changes in peripheral (e.g., an adrenaline rush) and/or central physiological responses (e.g., amygdala activation); (d) a motor component, with changes in overt behavior (e.g., a startled facial expression and actual flight behavior); and (e) a subjective component, with changes in experience or feelings (e.g., feeling scared). Note that the components in this list are not all situated on the same level of analysis. The motor component and the peripheral part of the somatic component belong to the observable level; the central part of the somatic component belongs to the brain level;[2] and the cognitive, motivational, and feeling components belong to the mental level. Indeed, an information process takes the stimulus and possibly other sources of information as its input and produces a representation with some content as its output. An action tendency is a type of goal. It is the representation of an action in which a person wants to engage. Subjective experience takes place when the content of a representation reaches consciousness.

There is currently no consensus about the exact number of components to include in the emotion. Some authors include the entire list and treat emotions as multicomponential episodes (Clore & Centerbar, 2004). Others identify emotions with

[2]Parrot (2007) noted that all mental activity has a brain substrate and hence that the central part of the somatic component should not be considered as a separate (part of a) component.

one, two, or nearly all components, and treat the remaining components as causes and/or consequences of the emotion. Emotion has been equated with the experience component (James, 1890), the peripheral part of the somatic component (Watson, 1919), the central part of the somatic component (i.e., an affect program; Tomkins, 1962), the motivational plus the experience component (Frijda, 1986), all components except the cognitive component (Izard, 1972; Lang, 1994), and all components except the motor component (Zeelenberg & Pieters, 2006).

Authors also vary in whether they treat the components in a molar or a molecular way (Moors & Scherer, 2013). A component is treated in a molar way if it is considered as a single variable that can take on a range of values. A component is treated in a molecular way if it is split into several variables and characterized by a pattern of values. Examples of molar values are appraisals of danger, offense, and loss; action tendencies to flee, fight, and give in; a startled, scowling, and pouting face; shivering, boiling, and crying; and the experiences of fear, anger, and sadness. Examples of molecular values are values on the appraisal variables goal relevance, goal in/congruence, un/expectedness, and control; values on the action tendency variables level of activity, direction of movement, and direction of adaptation; values on the physiological parameters heart rate, blood pressure, and skin conductance; activities of various facial muscles or facial action units; and values on the experience variables valence, arousal, and dominance.

Causal-Mechanistic Explanation

In their causal-mechanistic explanations of emotions, classic theories specify the external and/or internal input (i.e., the more remote causes) and the mechanisms mediating between this input and the emotion (i.e., the more proximal causes). External input (e.g., the stimulus) is specified on the observable level of analysis, whereas internal input (e.g., goals, expectations) is typically specified on the mental level. Mechanisms can be situated on the mental level (where they can be described in terms of representational content or operations) or on the brain level (where they can be described in terms of brain circuits and/or neurotransmitters).

To compare the mechanisms proposed by different theories, we have to force them into a common mold. Here is a proposal. The transition from stimulus to emotion can be split into two broad parts: a part in which information is extracted from the input, and a part in which this information translates into the emotion. Discrete appraisal theory (e.g., Arnold, 1960; Lazarus, 1991; Roseman, 2013) provides a mechanistic explanation of emotions on the mental level in which it addresses both the extraction part and the translation part. Appraisal is the mental mechanism that takes care of extraction: It takes external factors (the stimulus) and internal factors (goals, expectations, beliefs) as its input and produces representations as its output. Appraisal is described in terms of the content of its output representations and sometimes also in terms of the operations involved in producing these representations. The *content* description states that appraisal evaluates stimuli according to a number of criteria, such as whether they are relevant to and in/congruent with goals or concerns, in/congruent with expectations, easy/difficult to control, and internally/externally caused. The theory does not put restrictions on the *operations* involved in producing this output. Any operation is suitable as long as it delivers a representation with appraisal values (Moors, 2013). Often-mentioned operations are rule-based computation and the activation of an association (C. A. Smith & Kirby, 2001). This is consistent with dual process theories of reasoning (Sloman, 1996) and attitude formation (E. R. Smith & De Coster, 2000) in which types of processes are distinguished on the basis of types of operations. When a stimulus is encountered for the first time, a rule-based operation computes a separate value for each appraisal criterion, and together these values form an appraisal pattern. Once an association is established in memory between the representation of the eliciting stimulus and the appraisal pattern, the same or a similar stimulus can activate this association and reinstall the appraisal pattern. Some appraisal theories add that associations between stimuli and appraisals can also be innate, or that there is a preparedness for some associations to be learned (Leventhal & Scherer, 1987).

For the translation part, the theory proposes that once a pattern of molecular appraisal values is produced, these values are summarized in a molar appraisal value (Lazarus, 1991). For instance, a pattern with the molecular values goal relevant, goal incongruent, and difficult to control is summarized in the molar value danger. This molar value determines the specific emotion that is at stake—in this case, fear—which entails a series of molar values of the other components such as the tendency to flee, an adrenaline rush, a fearful facial expression, actual fleeing behavior, and the experience of fear. The operation involved in the transition from the molar appraisal value to the specific emotion can be couched as the activation of a preexisting association between both. Hypotheses about links between specific appraisal patterns and specific emotions can be found in tables or hierarchical trees of individual appraisal theories.

Affect program theory (e.g., Ekman, 1999; Tomkins, 1962) is especially concerned with the translation part, for which it proposes a mechanistic explanation on the brain level, but it does also fill in the extraction part on the mental level. Affect programs are the brain mechanisms that take care of translation. The theory postulates that there is one affect program for each of a limited set of emotions, called basic emotions. Each affect program has been installed by evolution to serve a unique function. For instance, the affect program of fear serves protection, that of anger serves to remove obstacles, that of disgust serves to avoid poisoning, that of sadness serves to let go of unfruitful goal striving, that of happiness serves to open up for new goal striving, and that of surprise serves to prepare for stimuli with potential implications for goal striving. More recent developments in affect program theory seek to expand these initial six with contempt, pride, shame, awe, love, and so on (Keltner, Tracy, Sauter, Cordaro, & McNeil, 2016).

For the extraction part, one version of affect program theory proposes that affect programs are directly triggered by perceptual features of phylogenetically significant stimuli (i.e., unconditioned stimuli; e.g., loud noises, wild animals, sudden loss of control; Tomkins, 1962). Another version of the theory suggests that affect programs are triggered by

stimuli after they are first appraised (e.g., Ekman, 1992[3]; Tracy, 2014). By inserting appraisal in the stimulus-to-emotion sequence, this version of affect program theory allows for more flexibility, because appraisal combines external inputs with internal inputs and internal inputs can vary within and across individuals.

Empirical Validation

Several lines of research have tried to test the causal-mechanistic (but not the structural) explanations proposed by classic theories. Discrete appraisal researchers have examined hypotheses about causal relations between specific appraisal patterns and specific emotions, such as the hypothesis that goal-incongruent stimuli that are difficult to control lead to fear, whereas goal-incongruent stimuli that are easy to control lead to anger (Ellsworth & Scherer, 2003; Roseman, Spindel, & Jose, 1990). A variety of methods have been used (reviews in Moors & Scherer, 2013; Parkinson, 1997; Roseman & Evdokas, 2004; Scherer, 1988). Appraisals have been manipulated (a) indirectly via real stimuli (Cherek, Lane, & Pietras, 2003; Lewis, Allessandri, & Sullivan, 1990; Nummenmaa & Niemi, 2004; Seligman, 1968; C. A. Smith & Kirby, 2009; C. A. Smith & Pope, 1992; Wiech et al., 2006) or representational stimuli (e.g., films: Kreibig, 2010; scenarios: Kuppens, Van Mechelen, Smits, De Boeck, & Ceulemans, 2007; C. A. Smith & Kirby, 2009; C. A. Smith & Lazarus, 1993), or (b) more directly via semantic priming of appraisal words (Schmid Mast, Jonas, & Hall, 2009) or procedural priming (Neumann, 2000). Emotions have been measured via self-report ratings of emotion words (e.g., Kuppens et al., 2007; Neumann, 2000; C. A. Smith & Kirby, 2009; C. A. Smith & Lazarus, 1993; Wiech et al., 2006) or via one or more of its components (e.g., action tendencies: Frijda, Kuipers, & ter Schure, 1989; somatic responses: Pecchinenda, 2001; facial expressions: Lewis et al., 1990; Roseman, Wiest, & Swartz, 1994; C. A. Smith & Scott, 1997).

Affect program researchers have tried to collect direct and indirect evidence for the statement that each basic emotion is caused by a specific affect program (Ortony & Turner, 1990). Direct evidence would be provided by the discovery of neural substrates that are the unique causes of each basic emotion (such as the amygdala-mediated circuit for fear: Johansen, Cain, Ostroff, & LeDoux, 2011; Öhman & Mineka, 2001; and the insula-mediated circuit for disgust: Wright, He, Shapira, Goodman, & Liu, 2004). Indirect evidence is evidence for implications of the preceding statement. A first implication is that each basic emotion should be characterized by specific somatic and motor responses. As such, researchers have sought evidence for basic-emotion-specific autonomic nervous system activity (e.g., Ekman, Levenson, & Friesen, 1983; reviews in Ekman, 1992; Kreibig, 2010; Levenson, 2014) and basic-emotion-specific expressive behavior (reviews in Ekman, 1999; Keltner et al., 2016; Matsumoto, Keltner, Shiota, Frank, & O'Sullivan, 2008). A second implication is that these specific response patterns should be universal, that is, similar across cultures. If the hardwired neural structures called affect programs exist, they should be present in the members of all cultures, and so should the components that are caused by them (facial expressions: e.g., Ekman, Sorensen, & Friesen, 1969; Elfenbein & Ambady, 2002; Tracy, Shariff, Zhao, & Henrich, 2013; somatic responses: e.g., Levenson, Ekman, Heider, & Friesen, 1992). A third implication is that there should be strong concordance among the components of each basic emotion. If the components of one basic emotion are caused by a single mechanism, then they should strongly concord (reviews in Levenson, 2014; Matsumoto et al., 2008). This means that over occasions, the values of the components that belong to one basic emotion should co-occur more than the values of the components that belong to a different basic emotion. In other words, the within-subset variety should be smaller than the between-subset variety.

Scientific Definition

Classic theories propose explanation-infused scientific definitions of the set of emotions and of the emotion subsets. Discrete appraisal theory defines emotions as multicomponent episodes in which the components are caused by a specific type of appraisal: an appraisal that has produced a representation with the content "goal relevant" (e.g., Lazarus, 1991; see Moors, 2007). Only when a stimulus is appraised as impacting on a goal[4] can an episode be classified as emotional. The goal also must be located high enough in the goal hierarchy. The theory further submits that different emotion subsets are individuated on the basis of the specific appraisal patterns involved. Affect program theory, from its side, defines emotions as multicomponent episodes that are caused by an affect program (Ekman, 1992) or, alternatively, as the affect programs themselves (Tomkins, 1962). This theory further submits that emotion subsets are individuated on the basis of the type of affect program involved. Emotion subsets can further be grouped into basic emotions and nonbasic emotions. Basic emotions have their own affect program; nonbasic emotions are mixtures or elaborations of basic emotions from which they inherit their affect program(s). In sum, both discrete appraisal theory and affect program theory propose that emotions are demarcated from other phenomena by the nature of their causal mechanism: an appraisal of the stimulus as goal relevant and/or the presence of an affect program. Causal mechanisms also form the basis for organizing the variety within the set of emotions: Subsets are formed on the basis of specific appraisal patterns and/or specific affect programs.

Cycle 2

Skeptical theories note problems with the choices made by classic theories in several of the steps in Cycle 1. This leads them to run a new cycle, in which they make alternative choices to solve these problems.

[3] In some writings, Ekman (e.g., Matsumoto & Ekman, 2009) reduced the appraisal mechanism to a simple matching mechanism that does nothing but recognize perceptual features of unconditioned stimuli.

[4] I define a goal as the representation of a valued outcome. Thus, *goal* is an umbrella term covering all kinds of conative concepts such as desires, wishes, needs, concerns, intentions, and action tendencies.

Explanandum

Skeptical theories see problems with the structural explanations provided by classic theories. They believe it is arbitrary whether one identifies emotion with one rather than another, or even with the entire collection of components listed. This probably also explains the striking lack of consensus. Another issue is that some discrete appraisal authors (e.g., Lazarus, 1991) have insisted on including appraisal (cognitive component) in the emotion while claiming that appraisal is the cause of emotion. This implies the problematic notion of part–whole causation (see Moors, 2013). To circumvent these problems, skeptical theories propose shifting the explanandum from "emotion" to "emotional episode" (e.g., Moors, 2014c; Russell, 2012). Their starting point is a descriptive definition of the set of emotional episodes, which comprises those episodes that laypeople consider to be emotional. Unlike classic theories, however, their aim is not to vindicate common sense but to critically examine it.

Explanation

Structural Explanation

Emotional episodes can have the same broad range of components that I discussed in Cycle 1. It may further be noted that PC theory makes more fine-grained distinctions within the component of experience: One type of experience is core affect, which is a mixture of the experience of valence and arousal; another type of experience is emotional meta-experience, which is when a person interprets her state as an emotion, or as a specific emotion (e.g., anger, fear).

Causal-Mechanistic Explanation

Skeptical theories reject the causal-mechanistic explanations proposed by classic theories, based on their reading of the empirical evidence for these explanations (see reviews by Barrett, 2006; 2011; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012; Mendes, 2016; Ortony & Turner, 1990; Russell, 1994). I reiterate four important lines of criticism before discussing the alternative mechanisms proposed by the skeptical theories.

Criticism of Classic Research. A first line of criticism concerns the amount of evidence. Meta-analyses and reviews suggest that the evidence for affect programs and somatic responses specific to basic emotions is weak to nonexistent (e.g., Cacioppo et al., 2000; Larsen, Berntson, Poehlmann, Ito, & Cacioppo, 2008; Murphy, Nimmo-Smith, & Lawrence, 2003; Phan, Wager, Taylor, & Liberzon, 2002; Quigley & Barrett, 2014). Recent cross-cultural studies do not support the universality of basic-emotion-specific expressions (e.g., Gendron, Roberson, van der Vyver, & Barrett, 2014), and many studies that investigate concordance among components of basic emotions show discordance instead (Evers et al., 2014; Hollenstein & Lanteigne, 2014; Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). There are no large-scale meta-analyses of discrete appraisal research, but evidence is mixed, leading some authors to conclude that appraisal patterns are not necessary and sufficient for specific emotions (Kuppens et al., 2007).

A second line of criticism is methodological. Russell (1994; Nelson & Russell, 2013) critically examined the evidence for the existence and universality of basic-emotion-specific facial expressions. He listed a series of methodological biases that could have led to the prematurely optimistic conclusions in both recognition studies (in which participants match emotion labels to facial expressions) and production studies (in which participants produce facial expressions to emotion labels or other stimuli). The most detrimental criticism was that recognition studies are not what is needed to demonstrate the specificity of facial expressions for basic emotions (Russell, Bachorowski, & Fernández-Dols, 2003). Production studies are needed, and preferably ones in which spontaneous rather than instructed expressions are produced. Reviews of recent (spontaneous) production studies in the laboratory (Reisenzein, Studtmann, & Horstmann, 2013) and the field (Fernández-Dols & Crivelli, 2013), however, do not support the presumed link between facial expressions and basic emotions. For instance, people smile not always or not only when happy, but also when proud, embarrassed, or in pain (Russell, in press).

In response to both lines of criticism, proponents of affect program theory insist on a more rose-colored reading of the empirical literature (Ekman, 1999; Keltner et al., 2016), and they persevere in their quest for affect programs and other responses using more sophisticated tools (e.g., Vytal & Hamann, 2010). In addition, they argue that specificity, universality, and concordance are still the default, but they call on factors (e.g., the subthreshold intensity of emotions that can be elicited in the lab) and mechanisms (e.g., emotion regulation and mixed emotions) that prevent the default from playing out. Another strategy is to present basic emotion subsets as families in which there is room for sub-subsets with partly different profiles. For instance, the anger subset comprises irritation, anger, and rage; the fear subset comprises worry, fear, anxiety, and panic. A final strategy is to attribute weak results to the use of static stimuli in a single modality (static face) and to seek evidence for specificity with dynamic stimuli and across modalities (moving face, voice, gesture, posture, touch; Keltner et al., 2016).

Discrete appraisal research has also been criticized from a methodological angle (Frijda & Zeelenberg, 2001; Moors & Scherer, 2013; Parkinson, 1997). The worry is that relations found between appraisals and emotions may reflect conceptual relations in people's minds, in the form of stereotypic scripts, rather than actual causal relations in the world. This risk is highest in studies that use verbal material and studies that use self-report (participants have no detailed insight in appraisal-emotion relations and therefore fill in the gaps by consulting their stereotypic scripts). This risk is reduced in experimental studies in which appraisals are manipulated indirectly via nonverbal stimuli and in which emotions are measured via nonverbal components (e.g., action tendencies, facial expressions). Indirect manipulation of appraisal, however, has the disadvantage that it is difficult to determine whether the effects are mediated by appraisal or by other information processes (Parkinson, 1997). Further note that reliance on stereotypic scripts can also be invoked to explain positive effects found in facial expression studies, especially those with posed or caricatured expressions (Barrett, 2011; Fridlund, 1994; Lindquist & Gendron, 2013; Parkinson, 2013).

A third line of criticism runs deeper still; it contests the logic behind the classic research program (Fridlund, in press; Moors, 2012). To demonstrate that basic emotions are characterized by specific responses, researchers should demonstrate a relation between the basic emotion, on the one hand, and the response, on the other hand. Measuring the response is relatively easy. Measuring or manipulating the basic emotion, however, has to happen via one (or more) of the emotions' components. As a result, researchers end up investigating the relation between two (or more) components. Several studies designed to demonstrate the basic-emotion-specificity of certain responses do in fact investigate the relation between two components. For instance, Ekman et al. (1983; Levenson, 1992) manipulated emotions via facial expressions (i.e., motor component) and measured somatic responses (i.e., somatic component). Rosenberg and Ekman (1994) induced emotions via stimuli—which can be expected to pass through the cognitive component—and they measured facial expressions (i.e., motor component). Clearly, demonstrating the relation between two components is not proof of the relation between a component and a basic emotion. Many studies do not even examine the relation between two components but between a component and an emotion label. In facial recognition studies, participants match facial expressions with emotion labels; in instructed production studies, they produce facial expressions based on emotion labels.

Discrete appraisal research suffers from a similar problem. Studies designed to test hypotheses about links between specific appraisal patterns and specific emotions have manipulated or measured appraisals (i.e., cognitive component) and they have measured emotions, either by measuring components other than appraisal (e.g., motivational component, experience component) or via ratings of emotion labels.

But what if the relation between two components would be considered as a first step in establishing concordance among all components of a basic emotion? It could be argued that if the components supposedly characteristic of a basic emotion show high concordance, affect program theory has what it needs. The basic emotion itself is just a term that summarizes the package. Here too, caution is due because not every type of concordance provides evidence for affect program theory. First, the concordance should fit with the hypotheses of affect program theory. This implies that the concordance among components of one basic emotion (e.g., fighting and the experience of anger) should be greater than that among components of different basic emotions (e.g., fighting and the experience of fear). Second, the concordance should be demonstrated at the molar level: either among molar values or among *patterns* of molecular values. Demonstrating concordance among *single* molecular values is not sufficient, because the latter observation would also be consistent with the skeptical approach. Skeptical authors (Ortony & Turner, 1990) have suggested that the most robust relations may not be found among the molar component values proposed by affect program theory but rather among molecular component values. For instance, they expect the concordance between the molar values of appraisal of offense, tendency to fight, scowling face, fighting behavior, and experience of anger to be less robust than the concordance between the molecular values of appraisal of goal incongruence, tendency to undo the incongruence, furrowed brow, and experience of goal incongruence (C. A. Smith, 1989). These molecular values can be part of many emotional episodes (e.g., anger, fear, sadness, regret, and disappointment) but also of nonemotional episodes (e.g., effort).

It is true that one brand of skeptical theory, dimensional appraisal theory, also expects concordance at the molar level. The type of concordance that they expect, however, is not in line with affect program theory. According to dimensional appraisal theory, each pattern of molecular appraisal values should produce a specific pattern in the ensuing components (i.e., concordance at the molar level). Yet the number of possible patterns is infinite, and they cannot be meaningfully classified into vernacular emotion subsets.

A fourth line of criticism reminds us of the status of all indirect evidence for the existence of affect programs (Ortony & Turner, 1990). If researchers accept indirect evidence as valid, they fall prey to the fallacy known as affirming the consequent. An argument of the form "if p then q," "q," therefore "p" is invalid because the truth of the premises ("if p then q" and "q") does not imply the truth of the conclusion ("p"). For instance, evidence for the universality of a facial expression ("q") does not prove that affect programs exist and cause facial expressions ("p"), because facial expressions could also stem from the fact that different cultures encounter similar stimuli leading to similar learning histories (i.e., convergent cultural evolution: Fridlund, 1994; also called species-constant learning: Ekman, 1999). Crivelli, Jarillo, and Fridlund (2016), moreover, challenged the truth of the premise "if affect programs exist, there should be universals" based on the argument that natural selection produces not only uniformity but also diversity among cultures.

Alternative Mechanisms Proposed by Skeptical Theories. Taking these criticisms together, skeptical theories conclude that the mechanisms proposed in classic theories (appraisals that are summarized in a molar appraisal value, which then activate an affect program) are implausible and untestable, and they propose alternative mechanisms in turn. Given that emotional episodes comprise components, a good place to start is to focus on the mechanisms causing the components (Moors, 2013).

Like its discrete counterpart, dimensional appraisal theory (e.g., Scherer, 2009a, 2009b) sees appraisal as the mental mechanism that takes care of extraction. The theory also specifies a collection of appraisal criteria (e.g., goal relevance, goal in/congruence, un/expectedness, control, agency) and is liberal in the operations it allows to be involved in appraisal (rule based or associative). The crucial difference between both versions of appraisal theory concerns the mechanism that they propose for the translation of appraisal values to the values of the other components. As previously mentioned, discrete appraisal theory hypothesizes that a pattern of molecular appraisal values is summarized in a molar value and that the molar value fixes the discrete emotion subset. Dimensional appraisal theory, on the other hand, hypothesizes that each appraisal value has a separate influence on, and hence partially contributes to, the eventual action tendency. Examples of hypotheses are that goal relevance increases the intensity of the action tendency, goal in/congruence determines the direction of the action tendency (avoidance/

approach understood as an increase/decrease in distance or contact), and low/high control determines the action tendency's direction of adaptation (from person to stimulus/from stimulus to person). The operation involved in the translation of appraisal values to action tendency values again seems to be associative. The action tendency, in turn, activates the somatic responses, which prepare and support the overt behavior that follows. Aspects of all components can emerge into consciousness, where they constitute the content of experience. A person can categorize or label her experience as anger, fear, and so on, but this is not necessary. If the person does label her experience, the label can also figure into consciousness and contribute to the experience. Appraisal theories further accept that later components can be fed back to earlier components (i.e., recurrence) and that appraisal can already influence the other components when only one molecular appraisal value has been generated (i.e., immediate efference). Detailed hypotheses about links among appraisal values and values of other components have been listed by Scherer (2001a; Moors & Scherer, 2013; Scherer & Ellgring, 2007).

Russell's (2003, 2012) PC theory also sets out to explain how the various components in emotional episodes come about. Unlike appraisal theory, PC theory does not assume strong causal ties among the components (at least not as we understand these components today). Components may exert causal influences on each other, but these influences are weakened by additional causal influences exerted by the stimulus.[5] Based on the assumption that components are only weakly linked and that each proceeds somewhat on its own, PC theory argues that each of the components must be studied in its own right. As a matter of fact, most components refer to phenomena that are already the subject matter of specialized research areas. For instance, action tendencies and overt behavior are the subject matter of behavior research; experience is the subject matter of consciousness research. Thus, PC theory recommends handing over each of the components in the emotional episode to its respective research area, or at least to learn about these areas and incorporate their insights.

PC theory does provide its own mechanistic explanation for the part of experience that it calls emotional meta-experience. Emotional meta-experience arises when people interpret or categorize their core affect in terms of the general set of emotions (e.g., "I experience an emotion") or in terms of specific subsets of emotions (e.g., "I experience anger").

Empirical Validation

Several lines of research test the causal-mechanistic explanations of skeptical theories. Dimensional appraisal research examines hypotheses about causal relations between specific appraisal values and specific values of other components without linking these components to specific emotions (review in Moors & Scherer, 2013; Scherer & Ellgring, 2007). Examples are studies that investigate the influence of (a) goal in/congruence or valence on approach/avoidance tendencies (reviews by Eder & Hommel, 2013; Krieglmeyer, De Houwer, & Deutsch, 2013), on somatic responses (Aue & Scherer, 2008; Kreibig, Gendolla, & Scherer, 2010), and on facial action units (C. A. Smith, 1989); (b) un/expectedness on the tendency to repair/be passive (Bossuyt, Moors, & De Houwer, 2014b) and on facial action units (e.g., eyelid and eyebrow raiser; Kaiser & Wehrle, 2001); (c) high/low control on fight/flight tendencies (Moors et al., 2016; McGregor, Nash, & Inzlicht, 2009) and overt aggression (Galinksy, Gruenfeld, & Magee, 2003; Geen, 1978; McCloskey, Berman, & Coccaro, 2005); and (d) internal/external agency on the tendency to repair/be passive (Bossuyt, Moors, & de Houwer, 2014a) and overt aggression (Kulik & Brown, 1979). Dimensional appraisal theory aspires to back up its mental-level explanations with brain-level explanations. To this end, researchers seek to identify the neural signatures of various appraisal criteria (e.g., Sander, Grafman, & Zalla, 2003; Walentowska, Moors, Paul, & Pourtois, 2016; review in Brosch & Sander, 2013).

Support for PC theory's assumption that the categorization of core affect results in emotional meta-experience comes from evidence that manipulating the accessibility of emotion categories influences the emotion one ascribes to one's own or another person's state. For instance, Lindquist, Barrett, Bliss-Moreau, and Russell (2006: see also Gendron, Lindquist, Barsalou, & Barrett, 2012) found that when an emotion category was satiated (e.g., by repeating an emotion word 30 times), recognition of this emotion in facial expressions was impaired compared to when it was primed (by repeating the word three times). Lindquist and Barrett (2008) showed that participants who were primed with an emotion category by focusing on an angry versus fearful person in a picture, interpreted their own core affect as anger versus fear, as indirectly suggested by the amount of risk they took in a subsequent task.

Scientific Definition?

Both PC theory and dimensional appraisal theory deny that vernacular emotion subsets form a good basis for organizing the variety in the set of emotions. Instead, they agree that the descriptive set of emotional episodes is composed of an infinite number of subsets that are best organized by placing them in a multidimensional space. This conclusion is not only based on their reading of the empirical literature that there is no convincing evidence that appraisals or affect programs cause specific vernacular emotions. It is also based on the causal-mechanistic explanations that skeptical theories have developed themselves. PC theory rejects the idea that components are caused by a common mechanism and therefore expects these components to be loosely connected. Dimensional appraisal theory assumes that there are an infinite number of appraisal patterns that give rise to an infinite number of action tendencies, somatic responses, and experiences, which combine into an infinite number of subsets of emotional episodes. Some of these subsets may fit the profile of vernacular subsets, but most of them do not.

Note that the mere infinity of the number of possible emotional episode subsets is not in itself irreconcilable with classic theories. After all, the subsets could still gravitate around or be clustered into higher order subsets corresponding to the

[5] Appraisal theory has argued in return that most of the stimulus influence is captured in and hence mediated by appraisal. This is why appraisal theory assumes strong, albeit not perfect, causal ties (Moors, 2014a; Scherer, 2001b).

vernacular emotional episodes. This would be consistent with affect program theory's notion that basic emotions are families (Ekman, 1992). True skeptical theories, however, reject gravitation. The argument is that organizing emotional episodes in these families is not scientifically interesting because there is no deep ground, such as a dedicated mechanism, to confer a special status to these families. Skeptical theories argue instead that the variety in the set of emotional episodes is best organized by placing the episodes in a multidimensional space. PC theory proposes a space formed by the experience dimensions valence and arousal, and perhaps also dominance (although these are not exhaustive in describing the variety). Dimensional appraisal theory, from its side, proposes a space formed by appraisal dimensions such as goal relevance, goal in/congruence, un/expectedness, control, and agency.[6] An analogy with color is useful here. Color physicists propose three dimensions to organize the infinite variety in the color spectrum: hue, value, and chroma. The clustering of this infinite variety according to vernacular color words (red, green, yellow, blue, purple) is possible but not scientifically interesting to a color physicist.

PC theory and dimensional appraisal theory agree that the variety in the set of emotional episodes is not well captured by vernacular emotion subsets. However, they disagree about whether the descriptive set of emotional episodes can be turned into a scientific set. Dimensional appraisal theory puts forward several interrelated criteria that would be shared by the majority of the emotional episodes. According to this theory, emotional episodes are collections of components, typically placed in the following causal order: appraisal, action tendency, somatic responses, and overt behavior. The experience component does not occupy one position in this sequence but receives input from each of the other components soon after they have occurred. These components and their causal relations are present not only in emotional episodes, however, but also in nonemotional episodes. For instance, losing the soap in the shower also leads to appraisal (e.g., goal incongruence), an action tendency (e.g., tendency to pick up the soap), somatic responses (e.g., blood flowing to the hands), overt behavior (e.g., picking up the soap), and experience (e.g., of aspects of all the other components). This means that the components and their causal relations are not sufficient for demarcating the set of emotional episodes. The difference between emotional and nonemotional episodes, according to dimensional appraisal theory, is that the stimuli in the former are appraised as more goal relevant than the latter (as in discrete appraisal theory). As a result, the action tendency in the former has more control precedence (i.e., it demands higher priority over other goals; Frijda, 1986). Another consequence is that there is more concordance among the components of emotional than nonemotional episodes. Scherer (2000) coined the term *synchronization* for this. Crucially, the type of concordance at stake here is not the type predicted by discrete appraisal theory and affect program theory, which is gated into six basic emotion families, but concordance in the sense that each of the infinite appraisal patterns results in a specific package of the other components. Note, however, that the three criteria of goal relevance, control precedence, and synchronization are gradual in nature. This implies that the distinction between emotional and nonemotional episodes is not categorical but gradual. Losing the soap in the shower need not be a completely cold affair, but it is certainly less emotional than losing a friend. In sum, dimensional appraisal theory endows emotional episodes with two special components (appraisal of higher goal relevance, action tendency with higher control precedence) and a special relation among components (higher synchronization).

PC theory argues that none of this is the case. The components in emotional episodes are not caused by a dedicated mechanism or a specific content, and they are not concordant. The very same mechanisms are responsible for so-called emotional components as for so-called nonemotional components. The theory does not elaborate on these mechanisms but argues that this part of the puzzle should be handed over to the appropriate research area. The question of how action tendencies, somatic responses, and behavior are caused must be solved by behavior theories. The question of how the experience component is caused must be solved by theories of consciousness. Thus, the phenomenon that people call emotional episode is not itself a scientific set but is made up of components that each belong to separate scientific sets (analogous to air).

To summarize, PC theory and dimensional appraisal theory have several commonalities: (a) They both shift the explanandum from emotion to emotional episode and its components, and (b) they take the descriptive set of emotional episodes to be composed of an infinite number of subsets that are best organized by placing them in a multidimensional space and not into clusters corresponding to vernacular subsets. In addition to these similarities, both theories also differ on two major counts: They disagree about (a) the strength of the causal relations among components and (b) the scientific status of the set of emotional episodes. So how can we arrive at an integration between both theories? Which elements do we keep and which ones do we revise? In the hope to generate answers, I take the prudent starting point to not presuppose any causal links among components and to not presuppose that emotional episodes are different from nonemotional ones. Instead I examine these issues by following PC theory's suggestion to tie in with the area of behavior research to learn more about the behavior-related components (action tendencies and behavior) and with the area of consciousness research to learn more about the experience component. Turning to these other areas can be considered as the start of two new scientific cycles (Cycle 3a: behavior-related components; Cycle 3b: experience component). For each of these cycles, I state the explanandum and describe the explanations (i.e., Steps 1 and 2), I apply these explanations to the emotional case, and I outline how some of these explanations can be empirically validated (i.e., Step 3). I conclude the article with an attempt at integrating both theories.

Cycle 3a: Behavior-Related Components

Explanandum and Explanations of Behavior in General

The explanandum in the domain of behavior (spanning the subdomains of learning, motivation, action, and decision

[6]Note that the dimensions of PC theory can easily be mapped onto appraisal dimensions: arousal onto goal relevance and un/expectedness; valence onto goal in/congruence; and dominance onto control.

making) is behavior, and theories in this domain provide causal-mechanistic explanations. One popular type of theory are dual process theories, which distinguish between two types of mechanisms, based on the type of content of the representations (Balleine & Dickinson, 1998; Dickinson & Balleine, 1994; Heyes & Dickinson, 1993)[7]: a goal-directed and a stimulus-driven mechanism. The goal-directed mechanism assesses the utility of one or more action options. The utility of an action option is based on the values of the outcomes of the action and on the contingencies between the action and the outcomes, also called the expectancies that the action will lead to the outcomes. Defined at the mental level of analysis, the goal-directed mechanism is one that is mediated by representations of values and expectancies of one or more action options. The action option with the highest utility activates its corresponding action tendency, and this action tendency may translate in overt behavior. The behavior produced in this way is called instrumental behavior. The representational content of a goal-directed mechanism with one action option can be formalized as an [S:R-O^{v}] link: Given a certain stimulus, action option R may (with a certain probability) lead to outcome O with value v. Accordingly, the sequence from stimulus *S* to overt behavior *R* can be formalized as: $S \rightarrow$ [S:R-O^{v}] $\rightarrow R$.

To account for the evolution of behavior over time, the goal-directed mechanism is embedded in a cycle (in line with cybernetic models of action control; Carver, 2015). The cycle starts with a comparison between a stimulus and a *first* goal (i.e., representation of a valued outcome). If this comparison yields a discrepancy, the organism activates a *second* goal, which is to reduce the discrepancy. This can be done by acting (i.e., assimilation), by choosing a different first goal, (i.e., accommodation), or by biasing the interpretation of the stimulus (i.e., immunization; Brandtstädter & Rothermund, 2002). The utility of acting (compared to the other options) and of specific action options determines whether an action tendency will be activated and which one. The action tendency, which is a *third* goal, may translate into overt behavior and produce a certain outcome. This outcome is fed back to the comparator, where it constitutes the stimulus input to the next cycle. The cycle is repeated until there is no discrepancy left. Note that several cycles may run in parallel (corresponding to multiple goals) and that some of them are hierarchically organized, implying that a discrepancy in a lower order cycle can itself constitute a discrepancy in a higher order cycle.

The stimulus-driven mechanism, by contrast, is mediated by the association between a representation of specific stimulus features and a representation of a specific action or response—formalized as an [S-R] link. The representation of an action can be considered as an action tendency, which may or may not translate in overt behavior. The behavior produced in this way is called reactive behavior. The sequence from overt stimulus *S* to overt behavior *R* can be formalized as: $S \rightarrow$ [S-R] $\rightarrow R$.[8]

The representations in goal-directed and stimulus-driven mechanisms can have various origins. The [S:R-O^{v}] links in the goal-directed mechanism can be installed via an operant conditioning procedure (in which a response is followed by an outcome in the presence of a stimulus) but also via verbal instruction, observation, or logical inference (Heyes & Dickinson, 1993). The [S-R] link in a stimulus-driven mechanism can be innate (e.g., specific noxious stimuli are wired together with avoidance from birth) or it can be established via several learning procedures: (a) an overtrained operant conditioning procedure (which is supposed to turn an initial [S:R-O^{v}] link in an [S-R] link)—the behavior resulting from this procedure is called a habit, (b) a mere associative learning procedure (in which stimuli are repeatedly paired with responses without being followed by an outcome), and (c) the setting of implementation intentions (Gollwitzer & Sheeran, 2006).[9]

Dual process theories typically endorse a default-interventionist architecture (e.g., Wood & Neal, 2007; Wood & Rünger, 2016): The stimulus-driven mechanism is the default mechanism and the goal-directed mechanism can intervene only under special conditions. This architecture is rooted in the conviction that there is a trade-off between optimality and automaticity.[10] The stimulus-driven mechanism is seen as simpler, which makes it more automatic but also more rigid, and therefore more prone to produce suboptimal behavior in some cases (depending on whether the [S-R] link is suitable for the occasion at hand). The goal-directed mechanism is seen as more complex, and therefore less automatic, but also more flexible and therefore more apt to produce optimal behavior. Thus, when operating conditions are poor, the system is thrown back at the less optimal, stimulus-driven mechanism. The more optimal, goal-directed mechanism can correct the course of action induced by the stimulus-driven mechanism but only when operating conditions are ample.

Another architecture is parallel-competitive: The stimulus-driven and goal-directed mechanisms operate in parallel but compete to determine behavior. The competition is often won by the stimulus-driven mechanism because of its presumed automatic nature. Here too then, the stimulus-driven mechanism is the dominant determinant of behavior.

A novel architecture, recently proposed by Moors, Boddez, and De Houwer (in press), is also parallel-competitive, but here the goal-directed mechanism is hypothesized to often win the competition—and hence to be the default determinant of behavior. To arrive at this hypothesis, Moors et al. (in press) first argued that the goal-directed mechanism can also be relatively automatic[11] so that there will be many occasions on which both mechanisms operate in parallel and enter in

[7]This type of dual process theory differs from the type just discussed in which types of mechanisms are distinguished on the basis of types of operations (rule based vs. associative). Moreover, I reject the common practice to map goal directed onto rule based and stimulus driven onto associative (see Moors, 2014b).

[8]A third type of behavior, which I do not consider here, are reflexes (e.g., the knee-jerk reflex). A reflex refers to the activity of (groups of) muscles caused by nonrepresentational mechanisms (see LeDoux, Schiller, & Cain, 2009).

[9]Several of these routes exemplify ways in which goal-directed and stimulus-driven mechanisms can interface.

[10]A mechanism is more optimal if it can bring about a higher degree of overall goal satisfaction; it is more automatic if it can operate with fewer operating conditions such as time and attention (Moors, 2016).

[11]Three arguments for this position are that (a) the goal-directed mechanism can vary from simple to complex, and the more simple variants are likely to be more automatic; (b) the goals at stake in the goal-directed mechanism may compensate for the lack of other conditions (time, attention); and (c) the goal-directed mechanism (defined in terms of a specific representational content) may recruit associative operations instead of rule-based ones. Note that the third architecture rejects the assumption that the goal-directed mechanism is nonautomatic but accepts the assumption that it is more optimal.

competition. If they do enter in competition, the system should give more weight to the goal-directed mechanism because this mechanism is more likely to produce optimal behavior. The stimulus-driven mechanism gets to determine behavior only under special conditions such as (a) when the operating conditions are extremely poor, hindering even the most simple goal-directed mechanism to operate or to be completed, and (b) when the action tendency in the goal-directed mechanism is formulated at a too high level of abstraction so that it does not enter in competition with the [S-R] link. As an illustration of the latter case, if a driver from Belgium moves to the United Kingdom and finds herself driving on the left side of the road, the goal to simply drive will not suffice to overrule the habit to drive right; for that to happen, the goal to drive left may need to be constantly reactivated. Taken together, the explanatory territory of the stimulus-driven mechanism is strongly reduced in this architecture compared to the other two. Here, most so-called self-regulation conflicts are not conflicts between the stimulus-driven and the goal-directed mechanism but rather between two goal-directed mechanisms that are each at the service of a different goal. The conflict experienced by a heavy drinker is not between the stimulus-driven temptation to drink and the goal to stay healthy but between the goal to feel high and the goal to stay healthy.

Application to Emotional Behavior

In this section, I analyze the mechanisms for emotional behavior proposed by affect program theory and discrete and dimensional appraisal theories through the lens of dual process theories from the behavior domain. This reveals that all three emotion theories are single process theories when it comes to emotional behavior but dual process theories—with a default-interventionist architecture—when it comes to the entire realm of behavior. In the light of PC theory's suggestion to invoke the same mechanisms for emotional and nonemotional behavior, I then argue to adopt a dual process theory for emotional behavior—and preferably one with the parallel-competitive architecture proposed by Moors et al. (in press).

Affect Program Theory and Discrete and Dimensional Appraisal Theory

In affect program theory and both versions of appraisal theory, emotional behavior—at least the emotional aspect of behavior[12]—is caused by a mechanism in which the representation of stimulus features ([S]) leads to a fixed action tendency (i.e., the representation of an action [R]). This fits the format of a stimulus-driven mechanism.

In affect program theory, stimulus features ([S], perceptual or abstract) give rise to an affect program, which in turn activates the emotion package, comprising an action tendency ([R]), somatic responses, behavior, and experience. One might object that this theory proposes a [S-affect program-R] link rather than a [S-R] link. However, the theory does maintain that representations of stimulus features ([S]) dictate a fixed affect program and that the affect program dictates a fixed action tendency ([R]). Moreover, an affect program is a mechanism situated on the brain level; it can thus be compatible with an [S-R] connection on the mental level.

At first blush, appraisal theories (both versions) show significant overlap with the goal-directed account. Indeed, the appraisal of goal in/congruence overlaps with the first phase in the action control cycle in which a discrepancy between a stimulus and a first goal is detected (see earlier). In addition, the appraisal of control refers to the expectancy of a person's total repertoire of action options. Still, I argue that appraisal theories are not redundant with the goal-directed account. The appraisal mechanism produces a representation of stimulus features (i.e., appraisal pattern), after which this representation is tied to a fixed representation of an action (i.e., action tendency). The goal-directed mechanism, by contrast, produces a representation of action features (i.e., values and expectancies of action options), after which the action option with the highest utility gets to activate its corresponding action tendency.

A sharp observer may raise two objections to my analysis. A first objection is that the distinction between the evaluation of stimuli and the evaluation of actions is artificial because every outcome of a goal-directed mechanism can in principle be captured in a stimulus feature. The outcome "fleeing has the highest utility" can be captured in the stimulus feature "to be fled from." Such a stimulus feature—one that captures the utility of a specific action option—can be called an affordance.[13] This means that the goal-directed mechanism is indistinguishable from an appraisal mechanism that would output an affordance. To date, however, none of the existing appraisal theories have appraisals of affordances in their lists. The appraisal of control may well refer to the expectancy and hence the utility of the *total* repertoire of action options, but it does not specify the utility of *specific* action options afforded by the stimulus. There are no appraisal criteria called "to be fled from" or "to be attacked."

A second objection is that for each possible input, the goal-directed mechanism should be able to output at least one optimal action. Hence, the fact that the translation from appraisal to the other components happens in a fixed fashion does not in itself make appraisal theory empirically distinguishable from a goal-directed account. To date, however, none of the existing appraisal theories has a list of appraisal criteria that provides an exhaustive description of inputs. Take the case of an encounter between two street fighters. The first person sees herself as stronger than the second person, but the second person notices an escape route. An appraisal pattern with the values goal incongruent, unexpected, easy to control, and external agency does not provide an exhaustive description of the input because it does not specify whether the person sees herself as stronger or whether she notices an escape route. This nonexhaustive character of the appraisal pattern does create a gap between appraisal theory and the goal-directed account in the sense that they make different predictions for some cases. Based on the hypothesis that goal-incongruent stimuli that are easy to

[12] In my description of these theories, I use the term *emotional behavior* as shorthand for the emotional aspect of behavior. As I explain later, however, I do not endorse a distinction between emotional and nonemotional behavior myself.

[13] I define affordance here within a mental framework, unlike Gibson (1977), who introduced the term *affordance* to refer to an objective stimulus feature.

control lead to the tendency to fight rather than to flee, appraisal theory predicts that both persons will activate the tendency to fight. The goal-directed account makes the same prediction for the person who sees herself as stronger (the tendency to fight because fighting has the highest utility) but the opposite prediction for the person who notices an escape route (the tendency to flee because fleeing has the highest utility).[14] Thus, appraisal theory predicts optimal action tendencies in typical cases but not in atypical cases (Scherer, 2001b).

To increase optimality, however, affect program theory and both versions of appraisal theory postulate that after the stimulus-driven mechanism has produced an emotional action tendency (e.g., to fight), goal-directed mechanisms can take over that do take into account the concrete affordances of the situation. A goal-directed mechanism called "planning" gates the abstract action tendency into a more concrete one (e.g., fighting can be done by kicking, punching, or shouting). A goal-directed mechanism called "regulation" corrects the initial action tendency when needed (e.g., fighting can be replaced by fleeing if fighting has zero utility).[15] Both planning and regulation can contribute to the eventual overt behavior, but they both deliver a nonemotional aspect to this behavior (Scarantino, in press; Scherer, 2001b). This is the reason why some emotion theories prefer to keep the motor component (or part of it) outside of the emotion (e.g., Frijda, 1986; Scherer, 2009a).

To summarize, affect program theory and both versions of appraisal theory are single process theories when it comes to emotional behavior, but dual process theories when it comes to the entire realm of behavior: Stimulus-driven mechanisms produce emotional action tendencies that can be refined or regulated by goal-directed mechanisms. This is in line with a default-interventionist architecture.

PC Theory

PC theory's position that the components in emotional episodes do not differ from the components in nonemotional episodes opens up the possibility that emotional behavior is caused not only by stimulus-driven but also by goal-directed mechanisms. Let me push this idea even further. Following the parallel-competitive architecture that I proposed earlier (Moors et al., in press), goal-directed mechanisms should even determine the lion's share of the emotional behavior. To date, only a handful of authors seem to explicitly consider the possibility that goal-directed mechanisms are the primary determinants of emotional behavior (e.g., Bushman & Anderson, 2001; Eder & Hommel, 2013; Eder & Rothermund, 2013; Frijda, 2005; Moors et al., in press; Parkinson, 2008). I suspect that other authors overlook or even reject this possibility because it contradicts several widespread intuitions about emotional behavior. I discuss two such intuitions and explain how they can equally well be fitted in a goal-directed account.

A first intuition is that emotional behavior often has a suboptimal or irrational flavor (e.g., Cosmides & Tooby, 2000; Plamper, 2012). Emotional behavior often does not seem to fulfill but rather to go against people's goals. Fighting can be very costly in that it can ruin a relationship, and avoiding eye contact can ruin a job interview. However, the irrational flavor of emotional behavior may also be fitted into a goal-directed explanation if certain complexities are taken into account. A first complexity is that agents have multiple goals. Behavior that is not conducive to one goal may still be conducive to another goal that has a higher value. For instance, fighting may be nonconducive to the goal of preserving one's relationship but it may be conducive to the goal of upholding one's social status, and the latter goal may currently have a higher value. The goal with the higher value may be less visible (both to the agent and the researcher) because it does not align with (internalized) social norms. Indeed, assigning a higher value to status than to relationships is not very noble and therefore does not reveal itself easily. Another possibility is that one goal has a higher expectancy of being attained by the action than other goals by other actions. Social status may not have a higher value but be considered more vivid and therefore as more easily attainable than relationship preservation (in line with the availability heuristic; Tversky & Kahneman, 1974). A second complexity is that there are constraints in the number of action options available for reaching a goal. Agents may go for a suboptimal action option when more optimal options are unavailable or overlooked. For instance, a person may take recourse to fighting to restore her damaged social status if she does not have other action options in her repertoire (cf. the notion of powerless aggression). An implication of framing the irrational *flavor* of emotional behavior within a goal-directed account is that this behavior does not have an irrational *nature*. Theorists may be reluctant to give up the irrational nature of emotional behavior because they may fear that it will take out its heat. Yet if one adopts appraisal theory's proposal that emotional behavior is caused by action tendencies with high control precedence because they are at the service of highly valued goals, the heat is amply preserved.

A second intuition is that emotional behavior is often automatic in the sense that it has a fast onset and that it is difficult to counteract. Add to this the tenacious assumption that only stimulus-driven mechanisms can be automatic and it is not difficult to see why emotional behavior is thought to be caused by a stimulus-driven mechanism. However, the fast and uncontrollable nature of emotional behavior can also be fitted in a goal-directed account if one accepts that the goal-directed mechanism can also be automatic, and if one accepts appraisal theory's proposal that emotional behavior is at the service of highly valued goals. Highly valued goals often require a more urgent fulfillment, hence the fast onset of emotional behavior. In addition, if a goal is high in a person's goal hierarchy, behavior at the service of this goal is more difficult to counteract because there are not many goals that can outrival it. Fleeing may be difficult to suppress if it is to save one's skin.

Empirical Validation

To pit stimulus-driven and goal-directed explanations against each other, experiments can be designed in which both

[14] If this example is not convincing, consider the action tendency to sink through the ground, supposedly characteristic of shame, but with zero utility.

[15] All three theories foresee the possibility of emotion blending or emotion competition. Stimuli can trigger several emotional action tendencies in parallel that either blend (when they are compatible) or compete (when they are incompatible). Here competition occurs between two stimulus-driven mechanisms.

explanations lead to different predictions. In the street fight example just presented, appraisal theory predicts an initial tendency to fight for the person who sees an escape route (and perhaps later, a tendency to flee), whereas the goal-directed account predicts an initial tendency to flee. Appraisals can be manipulated indirectly via the manipulation of stimuli (e.g., an opponent signals goal incongruence; physical strength and an escape route signal high control). The utility of action options (flee, fight) can be manipulated via the manipulation of stimuli that represent affordances (e.g., physical strength affords fighting, an escape route affords fleeing). Action tendencies can be measured with indirect objective methods: reaction times of instructed actions (e.g., Bossuyt et al., 2014b; Krieglmeyer et al., 2013), spontaneous facial expressions (Frijda & Tcherkassof, 1997), and neuroscientific methods (e.g., TMS/MEP or EEG; Moors et al., 2016). All these indices can be assumed to provide a window into early action tendencies that are not (yet) translated into full-blown overt actions, with the neuroscientific methods presenting a clear temporal advantage. If early action tendencies are dominated by the manipulation of appraisal values, there is support for the stimulus-driven account; if they are dominated by the manipulation of the utility of action options, there is support for the goal-directed account.

In addition to designing new experiments, another strategy would be to design variants of existing experiments cited in the literature as evidence for emotional behavior caused by a stimulus-driven mechanism but in which alternative goal-directed explanations were insufficiently explored (for more details, see Moors et al., in press). Good places to start are abundantly studied stimulus-driven hypotheses such as that positive/negative stimuli lead to the tendencies to approach/avoid (Chen & Bargh, 1999), that ostracism leads to the tendency to fight (Leary, Twenge, & Quinlivan, 2006), and that power leads to the tendency to approach and to loosen inhibition (Keltner, Gruenfeld, & Anderson, 2003). To date, not many studies have pitted stimulus-driven and goal-directed explanations of emotional behavior directly against each other, but there are several sources of indirect support for the goal-directed account, such as stimulus context effects in the production of spontaneous facial expressions (Fernández-Dols & Crivelli, 2013; Parkinson, 2005) and action tendencies (Eder & Hommel, 2013).

One problem that arises in this type of research is that if results favor a goal-directed account, critics may argue that the action tendencies studied are not really emotional. Authors who define emotional action tendencies in contrast with goal-directed ones of course can never be convinced. Authors who define emotional action tendencies as ones that pertain to highly goal-relevant stimuli, however, should be convinced if an increase in goal relevance does not entail a switch from goal directed to stimulus driven.

Cycle 3b: Experience Component

Explanandum and Explanations of Experience in General

Experience is traditionally understood as conscious experience (but see Prinz, 2004; Winkielman & Berridge, 2004). Thus, the domain of choice to increase our understanding of the experience component is the domain of consciousness. The explanandum in this domain is conscious experience, or in short, consciousness. Theories of consciousness have proposed structural explanations (specifying the components of consciousness) and/or causal-mechanistic explanations (specifying the mechanisms involved in the occurrence of consciousness).

Structural theories of consciousness typically distinguish between first-order and second-order consciousness. First-order consciousness has two aspects: an Intentional[16] aspect and a phenomenal aspect. The Intentional aspect refers to the representational content of the experience, what the experience is about or directed at. The phenomenal aspect refers to the qualia or nonrepresentational content of the experience; it is what remains in the experience after the Intentional aspect is stripped away. For instance, it is what seeing red feels like when all there is to know about redness is removed. Philosophers have construed the relation between the Intentional and the phenomenal aspects of experience in various ways. It has been argued that (a) the phenomenal aspect supervenes on the Intentional aspect (Byrne, 2001), (b) the phenomenal aspect is what gives the Intentional aspect its meaning (Natsoulas, 1981), (c) both aspects are mutually dependent, and (d) both aspect are independent and can be separated in special circumstances (Block, 1995). Second-order consciousness is metaconsciousness. It is consciousness of one's own conscious experience. This type of consciousness can also be said to have an Intentional and a phenomenal aspect.

There is a profusion of theories of consciousness that provide a causal-mechanistic explanation of the Intentional aspect of consciousness, and this on various levels of analysis (see reviews by Atkinson, Thomas, & Cleeremans, 2000; Prinz, 2010; Seth, 2007; Van Gullick, 2014). One parsimonious proposal (based on the quality of representation theory; Cleeremans, 2008; and the recurrent processing theory; Lamme & Roelfsema, 2000) is that when the quality of a representation reaches a first threshold, it can form the input of unconscious processes. By increasing this quality up to a second threshold, a low-level recursive amplifying mechanism is put into operation that renders the representation stable and its content conscious. As argued by Moors (2016), the quality of a stimulus representation can be fueled by many sources including stimulus intensity, stimulus duration, attention, goal relevance, un/expectedness, recency, and frequency. These sources are additive and can compensate for each other. For instance, a lack of time can be compensated for by an increase in stimulus intensity or attention.

Given that second-order consciousness also has an Intentional aspect, it is reasonable to assume that this type of consciousness also relies on representational quality. I further propose that second-order consciousness is generated in two steps. In a first step, a representation is activated up to a threshold high enough to reach first-order consciousness. In a second step, this representation is entered in a new information process that generates a new representation. This representation

[16] I follow Searle (1983) in capitalizing the word Intentional to avoid confusion with intentional in the sense of caused by a goal (see Moors & De Houwer, 2006).

again has to attain a quality high enough before we can speak of second-order consciousness.

Application to Emotional Experience

In this section, I apply the distinctions made in the previous section to the case of emotional experience. I first discuss the Intentional aspect of first-order and second-order emotional experience, and then the phenomenal aspect of first-order emotional experience.

Intentional Aspect

Dimensional appraisal theory proposes that the content of first-order emotional experience is the reflection of aspects of all other components of the emotional episode. One episode feels different from the next because one is about danger and the other is about insult, and because both have different action tendencies and physiological responses. Crucially, mental components (i.e., the cognitive and motivational components) already contain representations. Thus, to render the content of these representations conscious, a mere increase in representational quality is sufficient. Observable components (i.e., the somatic and motor components), on the other hand, do not contain representations. Thus, for these components to reach consciousness, they must first be entered in an information process (i.e., another cognitive component) that does produce a representation. Once such a representation is formed, it can again reach consciousness by an increase in representational quality.[17] At least two types of information processes can be distinguished here, based on the content of the representations that they produce: One type produces a representation with purely perceptual (including proprioceptive) features (e.g., a hot flush), which (when conscious) gives rise to raw bodily experience; the other type produces a representation of an emotion label (e.g., fear), which (when conscious) gives rise to labeled experience (see also Scarantino, in press). The second type of experience corresponds to PC theory's notion of emotional meta-experience.

In sum, dimensional appraisal theory focuses on the raw experience stemming from all the other components. PC theory, on the other hand, focuses on core affect, which is the raw experience of valence and arousal, and on emotional meta-experience, which is the labeled experience of core affect. The difference between both theories is merely a difference in emphasis, however. Neither of them rules out the types of experience emphasized in the other theory.

The proposal (made in the section on behavior-related components) that emotional action tendencies are often caused by goal-directed mechanisms has the implication that the content of the experience component will house not just stimulus features (such as appraisal values) but also action features (i.e., values and expectancies of action options). Activation of the latter may result in the mental simulation of potential actions and outcomes (Papies & Barsalou, 2015).

Phenomenal Aspect

The phenomenal aspect of experience can be understood in various ways (Frijda, 2005). A first position is that the phenomenal aspect of experience supervenes on the Intentional aspect of experience. As such, it is the sum of the phenomenal qualities supervening on the representations in/from each of the other components. A second position is that each (basic) emotion has a unique phenomenal quality that is irreducible to the phenomenal qualities of any of the other components. Fear feels intrinsically different from anger, and this has nothing to do with the fact that fear is about danger and anger is about offense or that they are both characterized by different action tendencies and responses. A third position (see Frijda, 2005) is that only valence has a phenomenal quality that is irreducible to the phenomenal qualities of the other components. Thus, different emotions with the same valence have the same phenomenal quality. Instead of considering these three positions as mutually exclusive, they can be seen as each furnishing a different type of phenomenal qualities that one can mix and match at one's discretion, together also with different types of Intentional contents. I favor a parsimonious solution in which representations can have any possible content (related to the components and beyond). This content delivers the Intentional aspect of experience, and supervening on this, the phenomenal aspect of experience. I see no need to postulate additional qualia over and above the ones that supervene on the Intentional aspect of experience. Note that on this picture, experience is a consequence of each of the components. I further speculate that experience of the cognitive component is not a necessary mediator between this component and the ensuing components (see also Bargh, 1997). If the cognitive component does become conscious, however, it should lead to stronger action tendencies (unless there are counteracting forces). This is in line with the idea that conscious representations have a higher quality and therefore should have a stronger influence on subsequent processing and behavior.

Empirical Validation

Most of the consciousness research to date focuses on the Intentional aspect of consciousness. I am not aware of empirical tools that allow studying the phenomenal aspect independent of the Intentional aspect. Therefore, some of the viewpoints just expressed will have to remain speculations for now. Two assumptions that are testable in principle are that (a) the cognitive component does not have to be conscious in order for it to determine the motivational, somatic, and motor components, but (b) when it does become conscious, it will have a stronger influence on these components than when it remains unconscious. Support for the first assumption comes from studies showing that subliminally presented information (about stimulus features and/or the values and expectancies of action options) elicits action tendencies, somatic responses, and/or behavior. Examples are studies in which subliminally presented positive/negative stimuli were shown to induce approach/avoidance tendencies (e.g., Alexopoulos & Ric, 2007),

[17] The mechanism involved in the experience of the observable components is similar but not identical to that involved in second-order consciousness. In both cases, there is an additional information-processing step, but in the former case the result is first-order consciousness of the bodily responses and in the second case the result is consciousness of being conscious.

peripheral physiological responses (Öhman & Soares, 1994), brain activity (Glascher & Adolphs, 2003; Killgore & Yurgelun-Todd, 2004; Vuilleumier et al., 2002), facial expressions (Dimberg, Thunberg, & Elmehed, 2000), and gross behavior (Winkielman & Berridge, 2004).

Support for the second assumption comes from studies showing that supraliminal stimuli have a stronger impact than subliminal stimuli (e.g., Phillips et al., 2004). This being said, there are also studies that report stronger effects of unconscious processes than conscious ones because the conscious ones were counteracted. For instance, Schwarz and Clore (1983) observed that people reported more life satisfaction on sunny than rainy days, unless they were made aware of this potential influence so that they could counteract it. This does not mean that processes *must* be conscious before they can be counteracted. There is evidence (outside the emotion domain) that unconscious processes can also be counteracted. For instance, Verwijmeren, Karremans, Benritte, Stroebe, and Wigboldus (2013) showed that warnings about subliminal ads diminished the impact of these ads on choice behavior, despite the fact that participants had no idea which ad was shown and hence how to correct their behavior. To show that the same principles hold for emotional episodes (at least according to appraisal theory), the studies described earlier should be replicated while the goal relevance of the stimuli is manipulated (the higher the goal relevance, the more emotional the episode).

Integration

Now that I reviewed the potential explanations for emotional behavior and emotional experience in the light of theories on behavior and consciousness in general, let me revisit the issues that I stipulated as dividing dimensional appraisal theories and PC theory. These issues concerned (a) the causal relations among the components in an emotional episode and (b) the scientific status of the set of emotions or emotional episodes.

Causal Relations Among Components

The behavior domain teaches us that there are strong causal relations among information processes, action tendencies, and behavior. If a single piece of information is not linked in a fixed fashion to a specific action tendency, this is because several pieces of information (e.g., multiple goals) exert their influence. From the consciousness domain, I retain that components are reflected in the experience component. This reflection also qualifies as a causal relation.[18] In sum, I accept appraisal theory's position that there are strong causal relations among components of emotional episodes. The only adjustment I make, however, is to broaden the content of the cognitive component so that in addition to the appraisal mechanism, there is now also room for the goal-directed mechanism.

[18]I follow Mackie's (1974) view of causation that a cause is a condition that is an Insufficient but Necessary part of a set of conditions that is itself Unnecessary but Sufficient (i.e., INUS condition). All conditions in the set are equally necessary and therefore equally causal.

Scientific Status of the Set of Emotions

To evaluate the adequacy of a scientific definition, several criteria have been proposed, the two most important ones being similarity and fruitfulness (Carnap, 1950). The similarity criterion states that a prescriptive definition should overlap to a fair degree with the initial descriptive definition (i.e., common sense; Scarantino, 2012). The fruitfulness criterion states that a set should allow for scientific extrapolation, that is, the generalization from one exemplar to the other exemplars in the set (Griffiths, 2004; Scarantino, 2012). This, in turn, implies that the set should be homogeneous, and this in a nonsuperficial way. That is, the exemplars should share deep features such as a common causal mechanism or a common deep structure. To illustrate, "diamond" is a more fruitful set than "jade" because the former refers to only one mineral and the latter to two minerals (jadeite and nephrite). Generalization among diamond exemplars is therefore more justified than among jade exemplars.

One way to assimilate the contrasting positions of dimensional appraisal theory and PC theory about the scientific status of the set of emotional episodes might be to acknowledge that the criteria of goal relevance, goal precedence, and synchronization proposed by appraisal theory are criteria that do well in terms of similarity but not in terms of fruitfulness. Indeed, these criteria can be considered as good approximations of how laypeople would rank episodes from less to more emotional (hence satisfying the similarity criterion), but they do not file for a separate mechanism or deep structure (hence not satisfying the fruitfulness criterion). Indeed, I argued that there is no reason to suppose that goals of high value are handled by a different mechanism than goals of low value: They should both be handled by a goal-directed mechanism.

In a similar vein, it can be argued that PC theory's component of emotional meta-experience is unique to episodes that people call emotional, at least if the content of this experience is "emotional" (hence satisfying the similarity criterion). Yet the "emotional" content of this component does not reify the descriptive set of emotional episodes to a scientific set because the same mechanism is involved in the production of "emotional" and "nonemotional" content (hence not satisfying the fruitfulness criterion). The specific content of one's (conscious) representations is not deep enough a feature to serve as a basis for a scientific definition (for a different view, see Barrett, 2012).

Conclusion

I compared two classic theories (affect program theory and discrete appraisal theory) and two skeptical theories (dimensional appraisal theory and Russell's PC theory) by framing their development in separate scientific cycles. After classic theories ran a first scientific cycle, skeptical theories noted problems with several steps and ran a second cycle in which they proposed their own solutions. First, they noted problems with the set of emotions and proposed shifting the explanandum from the set of emotions to the set of emotional episodes. Second, they pointed at the implausibility and the lack of empirical evidence for the causal-mechanistic explanations of the classic

theories and proposed their own causal-mechanistic explanations in turn. Their own explanations led them conclude that the variety in the set of emotions is better captured by multiple dimensions than by vernacular emotion subsets. In addition to similarities, the two skeptical theories also present differences. These differences concern the strength of the causal relations among the components in an emotional episode and the scientific status of the set of emotional episodes. To be able to make an informed decision about these matters, I followed PC theory's suggestion to study the components in their own right, and I ran two new scientific cycles—one for the behavior-related components and one for the experience component. In each of these cycles, explanations developed in the general domains of behavior and consciousness were applied to the emotional case. The cycle for the behavior-related components revealed a relative blind spot in the emotion domain: that the goal-directed mechanism might play an important role in the emotional aspects of emotional behavior instead of being confined to a secondary, interventionist, role. This idea awaits thorough empirical investigation.

The cycle for the experience component revealed that components that contain representations (i.e., cognitive, motivational) require only an upgrade of their quality to reach consciousness whereas components without representations (i.e., somatic, motor) require an additional information-processing step that does produce a representation, after which this representation can be upgraded. The fact that dimensional appraisal theory and PC theory have historically focused on different components (appraisal theory: cognitive and motivational; PC theory: somatic) may clarify why they have emphasized different mechanisms (appraisal theory: increase in representational quality; PC theory: categorization).

I concluded my exercise with an integration of both theories. In agreement with PC theory (and counter to appraisal theory), I rejected the scientific status of emotions/episodes and of discrete emotion/episode subsets, but I accepted the scientific status of the components (not as components but as sets in their own right). In agreement with appraisal theory (and counter to PC theory's initial formulation) I accepted there to be strong causal relations among the components, with the adjustment that the cognitive component should be stretched to include not only appraisal but also the goal-directed mechanism.

Whether this integrated theory is better seen as an elaboration or a departure from dimensional appraisal theory depends on the role that the appraisal mechanism still gets to play in the goal-directed account. The goal-directed account gives an explicit role to the appraisals of goal relevance and goal in/congruence. Recent formulations also see a role for the appraisal of un/expectedness. In this vein, Railton (in press) suggested that the goal loop could be supplemented with an expectation loop (see also Cunningham, Dunfield, & Stillman, 2013; Ridderinkhof, in press; Van de Cruys, in press). It thus seems that several appraisal criteria still have their place in the integrated theory, and hence that the integrated theory counts as an elaboration of dimensional appraisal theory. Another option might be to stretch the meaning of the term *appraisal*. Instead of defining appraisal as a mechanism in which stimuli are evaluated on the criteria typically listed in appraisal theories, the term could be recast as an information process broadly speaking (but see Scarantino, 2010). The integrated theory can also be seen as an elaboration of Russell's PC theory in that it has worked out some of PC theory's suggestions by providing a mechanistic story for them. Finally, it could be argued that the integrated theory, in rejecting the scientific status of emotion, is no longer a theory of emotion at all. I could live with all the preceding interpretations.

To compare emotion theories, I have purposefully adopted a causal-mechanistic approach, one that is not reductionist but encourages explanations at multiple levels of analysis (Bechtel, 2008). One obstacle in comparing and ultimately integrating theories is that each theory has its own jargon. Instead of engaging in endless cross-translation, I opted for more neutral, formal terms to describe mechanisms. Calling a mechanism perception, appraisal, or categorization does not cut it. All these terms are interchangeable. They all take some input (external and/or internal), and they all have a representation with some content as their output. What counts are the contents of the inputs and outputs, and the operations involved in the transition from input to output. On a broad scale I distinguished between an extraction and a translation mechanism. Appraisal, categorization, and perception are all extraction mechanisms. Perception in perception theories starts with external and internal inputs and ends with perceptual stimulus features. Appraisal in appraisal theory starts with external and internal inputs and ends with abstract stimulus features. Categorization in PC theory starts with external and internal inputs and ends with an emotion label or image.

The mechanistic approach adopted in this inquiry has a more important selling point. Outside the emotion domain, emotion is often depicted as the antipole of functionality and rationality, whereas inside the emotion domain all theories seem to agree that emotions are functional. If we take a close look at the mechanisms that they propose, however, we must conclude that all mechanisms are not created equal in terms of functionality or optimality. The innate stimulus-driven mechanism (in one version) of affect program theory (linking perceptual stimulus features to affect programs) was optimal for our hunter–gatherer ancestors but not always for us (Cosmides & Tooby, 2000). The stimulus-driven mechanism in discrete and dimensional appraisal theories (linking patterns of abstract stimulus features to action tendencies) allows for more optimality because a large part of the contextual variance is captured in appraisal criteria. However, all these theories require the intervention of a goal-directed mechanism to refine or regulate initial action tendencies. The integrated theory proposed here goes one step further down the optimality road in that it casts the goal-directed mechanism also in a leading role. The goal-directed mechanism can use any thinkable stimulus feature to generate the most optimal behavioral solution. It thus forms the perfect candidate mechanism to deal with the contextual variety emphasized in now-popular contextual and situated approaches. Future research should learn if this integrated, goal-directed theory proves to be a fruitful one.

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