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On the Causal Role of Appraisal in Emotion

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Abstract

Many appraisal theories claim that appraisal causes emotion. Critics have rejected this claim because they believe (a) it is incompatible with the claim that appraisal is a part of emotion, (b) it is not empirically supported, (c) it is circular and hence nonempirical, and (d) there are alternative causes. I reply that (a) the causal claim is incompatible with the part claim on some but not all interpretations of the causal claim and the part claim, (b) the lack of empirical support can be remedied, (c) there may even be ways to cope with the circularity problem, and (d) it is unclear to what extent the alternative causes differ from appraisal.

Keywords
appraisal, causation, component, emotion, feeling

Many appraisal theories defend the claim that emotions are caused by appraisal, a process in which stimuli are evaluated on a number of variables such as goal relevance, goal congruence, intrinsic valence, coping potential, expectancy, and agency. I start by presenting definitions of the concepts of emotion, appraisal, and causation. This allows me to clarify how I think the causal claim should be understood. After that I discuss a number of objections that have been raised against this claim and I propose possible replies.

Definitions

Emotion

The set of emotions can be defined with an intensional and an extensional definition. An intensional definition specifies the necessary and sufficient conditions for an instance to belong to a set (i.e., a collection of necessary conditions that are jointly sufficient). An extensional definition lists all the instances or subsets within a set. As such, it reveals the internal structure of the set.

Intensional definition. Appraisal theorists have put forward various criteria to demarcate the set of emotions from other sets (cf. Frijda & Scherer, 2009; Moors, 2009; Scherer, 2009a): (a) Emotions are episodes, that is, phenomena with a restricted (usually short) duration. (b) They typically include the following components: changes in (i) stimulus evaluation or appraisal, (ii) action tendencies, (iii) peripheral and central somatic responses, (iv) expressive behavior (facial, vocal, gross), and (v) emotional experience or feelings, conceived of as the reflection of all the other components (plus the stimulus) into consciousness. For example, a noise in the hall at night may be appraised as goal incongruent. This activates the tendency to undo the incongruence, which is manifested in bodily responses preparing for behavior. Traces of all of this surface into the feeling component and may or may not be labeled as fear.

The previous criteria may be necessary, but they are not sufficient for calling something an emotion. For example, dropping an egg on the floor may produce all of the previously mentioned components, but few would call this an emotional episode. Therefore, appraisal theorists have proposed additional criteria. (c) It has been proposed that an emotion occurs when a stimulus is appraised as goal relevant, that is, when it signals the satisfaction status of a goal or concern (Frijda, 1988; Lazarus, 1991b; Moors, 2007; Oatley & Johnson-Laird, 1987; but see Ellsworth, 1994; Scherer, 1984). Some theorists add that the goal should be sufficiently high in the person's goal hierarchy (Moors, 2007) and/or that it should be appraised as urgent (Frijda, 1988). Dropping an egg on the floor is clearly relevant for the goal to keep the egg intact, but this goal is probably not at the top of one's goal hierarchy. (d) Frijda (1986, 2007; Frijda & Zeelenberg, 2001) proposed that the action tendencies in emotions have control precedence, that is, they call for priority over other nonemotional action tendencies. (e) Scherer (2000, 2009b) proposed that emotions are characterized by a high

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degree of synchronization among the components (i.e., they are coordinated in time and correlated in intensity) because they are all guided by the same adaptational goal or tendency (e.g., to be safe or to remove an obstacle). I suspect that any goal-directed activity is characterized by a fair degree of synchronization, but that it is highest for goals that have priority. (f) Like most philosophers, some appraisal theorists insist that the feeling component not only includes a phenomenal aspect or what-it-is-likeness, but also an intentional aspect or object-directedness (e.g., feeling angry at the boss or about an insult; Deonna & Scherer, 2010; Frijda, 2005; Ortony, Clore, & Collins, 1988).

Extensional definition. There are two broad approaches to dividing the set of emotions into subsets (cf. Ortony & Turner, 1990). (a) The basic emotions view organizes the set of emotions into subsets called basic emotions, and they sometimes add subsets called nonbasic emotions. Basic emotions are the building blocks of emotional life; nonbasic emotions are mixtures or elaborations of them (Lazarus, 1991b; Roseman, 1996). (b) The subemotional parts view (Ellsworth & Scherer, 2003; Ortony & Turner, 1990; Scherer, 1994; C. A. Smith, 1989) takes the values of (one or more) components as the building blocks; these combine to form the subsets of emotions. For example, Scherer (1984) proposed that there are as many subsets of emotions as there are patterns of appraisal values (and these are infinite).

Appraisal

To arrive at a definition of appraisal, I rely on Marr's (1982) proposal that any process can be described at three levels of analysis: at the functional level, a process is described as the relation between an input and an output. This level also specifies the conditions under which the process operates. At the algorithmic level, a process is described in terms of the mechanisms that translate input into output as well as the format of the representations on which the mechanisms operate. At the implementational level, a process is described in terms of brain activity.

I propose an intensional definition of appraisal at the functional level of analysis: appraisal is a process that takes a stimulus as its input and produces values for one or more appraisal variables as its output (Moors, 2010; Moors & Scherer, in press; for similar proposals, see Reisenzein, 2001; Roseman & Smith, 2001; Wehrle & Scherer, 2001). Defined in this way, appraisal is dedicated to the processing of specific types of information, but not to a particular type of mechanism, format of representations, or set of conditions (Arnold, 1960; Frijda, 1993; Lazarus, 1991b; Leventhal & Scherer, 1987; Moors, 2010; Oatley & Johnson-Laird, 1987; Scherer, 1993). Possible mechanisms underlying appraisal are rule-based (i.e., computation of appraisal values), associative (i.e., activation of learned associations between a stimulus representation and the representation of appraisal values), and sensory-motor (i.e., activation of an innate association between a stimulus representation and the representation of appraisal values). The format of the representations can be conceptual/propositional or sensory/perceptual. Appraisal can operate under various conditions (e.g., the presence/absence of an intention, conscious stimulus input, attentional capacity and/or time; Moors & De Houwer, 2006). Thus, appraisal can be more or less automatic.

The output of the appraisal process is a representation of appraisal values. Again, there are no constraints on format or conditions. According to Scherer (2009b), the appraisal representation is unconscious, but part of it can become conscious. The part that does become conscious becomes part of the content of the feeling component (conforms to the idea that feelings are the reflection of the other components into consciousness). Only the intentional part of the feeling component is available for verbal report (Block, 1995).

The current definition of appraisal is broad in terms of conditions and possible underlying mechanisms and representations, but it is not all-inclusive. There are two restrictions. First, I reserve the term appraisal only for processes that deal with appraisal variables (e.g., goal congruence, coping potential, agency). Processes dealing with other variables (e.g., size, gender, color, location) do not count as appraisal. Which variables do and do not count as appraisal variables is still a matter of some debate. Second, the levels-of-analysis framework adopted here is grounded in notions such as mechanisms and representations. This does put *some* constraints on the types of mechanisms that can underlie appraisal. Mechanisms that are not mediated by or do not result in a representation do not count as potential mechanisms underlying appraisal. I define a representation in purely functional terms, as something that is invoked to explain variable (as opposed to fixed) input–output relations (Bermudéz, 1995; Moors, 2007). Thus, the sensory-motor mechanism mentioned before only counts as an appraisal mechanism if it is defined as the activation of an innate association between sensory features and a *representation* of appraisal values, but not if it is defined as the activation of a direct innate association between sensory features and motor responses (e.g., the startle response).

I use "appraisal" (in singular form) to refer to the appraisal process and "appraisals" (in plural form) to refer to the appraisal values that form the output. Note that the distinction between appraisal process and appraisal output is not absolute if the appraisal process is considered at the functional level of analysis, that is, as the relation between an input and an output.

Causation

There are various theoretical approaches to causation (cf. Schaffer, 2008). One approach that captures several intuitive aspects of causation is Mackie's (1974) proposal that a cause is a necessary part of a set of conditions that are jointly sufficient for the effect. For example, throwing a firecracker in a building is the cause of a fire if it is a necessary part of a set of conditions including combustible material and oxygen that are jointly sufficient for the fire. If there are other causes (e.g., a smoldering cigarette), they are necessary parts in other sufficient sets. This view provides no theoretical basis to separate "the cause" from "the other enabling conditions" because all conditions in one

sufficient set are equally necessary. Yet people tend to select as "the cause" the condition that was absent at a time when the effect was absent, but present at a time when the effect was present. They also tend to select as "the cause" an action or process (e.g., throwing the firecracker in the building) rather than a static object (e.g., the firecracker). Taken on its own, specifying a set of necessary conditions that are jointly sufficient is not different from giving an intensional definition (cf. earlier). One important difference is that causation has a direction (i.e., a cause causes its effect but not the other way around), traditionally cashed out in temporal terms (causes precede their effects; cf. Hume). An implication is that causes should be separate from their effects.

Appraisal as a Cause of Emotion

Most appraisal theories (e.g., Lazarus, 1991b; Roseman & Smith, 2001) propose that the influence of a stimulus on emotion is mediated by appraisal. The stimulus is designated as the remote cause of emotion and appraisal as the proximal cause. To be precise, the stimulus is only one condition in a sufficient set; other necessary conditions are the person's goals, expectations, and power. Similarly, the presence of the appraisal process is only one condition in a sufficient set; another possible condition is that the output of this process is goal relevant/urgent.

Appraisal is responsible not only for the occurrence of emotions, but also for their intensity and quality. The differences in intensity and quality that theorists seek to explain depends on the extensional definition of emotion that they endorse. Proponents of a basic emotions view more often have a molar approach to emotion. They seek to explain the occurrence of specific (basic and/or nonbasic) emotions. Proponents of a subemotional parts view more often have a molecular approach to emotion. They seek to explain the values of components of emotions without linking them to specific emotions.

Each component of emotion may be treated in a molar or a molecular way itself. Molar here means that the component is treated as a unitary variable; molecular means that the component is split up into several variables. Examples of molar values are appraisals of danger, loss, and offense, the tendencies to flee and fight, smiling and scowling face, and feelings of fear, sadness, and anger. Examples of molecular values are values on appraisal variables such as goal relevance, goal congruence, and coping potential; action tendency variables such as level of activity and direction of movement; activities of various facial muscles; and values on feeling variables such as valence and arousal. Considering the aforementioned, causal appraisal hypotheses may take many different forms: molar or molecular appraisals may be linked to specific emotions, or to molar or molecular values of other components.

Contemporary appraisal theorists (e.g., Ellsworth & Scherer, 2003; Lazarus, 1991b) accept that the influence of appraisal on other components is fed back to the appraisal component (i.e., recurrence) where a new appraisal starts (i.e., reappraisal). For example, an appraisal of low coping potential may lead to the tendency to flee. Successful flight behavior, in turn, may lead to a reappraisal of coping potential as high. Appraisal may (but need not) be simple (in terms of number of appraisal variables and complexity of mechanisms) in a first round and may be updated and extended in subsequent rounds (Frijda, 1993; Scherer, 2009b). Furthermore, the processes in each of the components do not need to be completed before they can produce changes in later components (i.e., immediate efference; Scherer, 2009b). Finally, some appraisal theorists (Lazarus, 1991b) see appraisal as a necessary cause of emotion, but most of them (Ellsworth & Scherer, 2003; Frijda, 2007; Roseman & Smith, 2001) see it as a typical cause, accepting marginal instances of emotions that are not caused by appraisal. All in all, most appraisal theorists draw a nuanced causal picture.

Objections and Possible Replies

The causal claim has met with various objections. I review a selection of these objections and propose possible replies. This allows me to defend the causal claim and flesh out its details.

Incompatible Roles

Critics have argued against the claim that appraisal is a cause of emotion because they think it is incompatible with the claim that appraisal is a part of emotion, and because they are strongly attached to the latter claim. As Ellsworth (2006) put it, appraisal is no more the cause of emotion than eggs are the cause of a cake; like eggs, appraisal is better conceived of as an ingredient. The claim that appraisal is a part of emotion can itself be understood in various ways. Indeed, appraisal can be (a) an ontological part of emotion, in the sense that it is one among the various components of emotion, (b) part of the content of emotional experience or feelings, and (c) part of the (ordinary or scientific) meaning of emotion words. Objections based on each of these interpretations of "part" ask for a separate set of replies.

Appraisal as a component of emotion. The claim that appraisal is a cause of emotion (C1: A → E) and the claim that appraisal is a component of emotion (C2: E = AB, with B = the other components) implies that appraisal causes something of which it is a part (part–whole causation; C3: A → AB), which implies that appraisal causes itself (auto-causation; C4: A → A). This violates the rule that causes should be separate from their effects (C5; cf. Reisenzein & Schönpflug, 1992). Theorists have dealt with this puzzle by reverting to eight strategies. Many of these strategies were originally developed for beliefs (Neu, 1977; Thalberg, 1979, 1980) or belief–desire compounds (Castelfranchi & Miceli, 2009) instead of appraisals, but they can easily be applied to appraisals.

A first strategy often taken by critics of appraisal theories is to simply reject that appraisal causes emotion (C1). A second strategy is to accept that C1 and C2 lead to C3 (part–whole causation) but to reject that C3 implies C4 (auto-causation). To defend this idea, Lazarus (1991a, 1991b) invoked the analogy of microbes (A) that cause a disease (AB) of which they are still part. Considering that microbes have offspring, however, one

could object that the microbes that caused the disease are different from those that are part of (or present during) the disease. Lazarus added that an emotion ceases to exist when the appraisal is eliminated, just as a disease stops when the microbes are gone. Here, it seems more felicitous to consider A as a sustaining cause of B rather than as a cause of AB. Neu (1977) invoked the analogy of a car pile-up, in which the collision of the first two cars (A) is both the cause and a part of the pile-up (AB). This may sound plausible as a way of speech, but saying that the first collision caused the entire pile-up, including itself, smells again like auto-causation (Thalberg, 1979). Ellsworth (2013) mentioned the case of water being both the cause and a component of a plant. But again, water cannot cause the plant including itself. Instead of appointing water as the cause of the plant, it may be better to appoint the process of osmosis (roots sucking up water) as the cause of a plant.

This brings us to the third strategy, which is to split up appraisal into process and output, and to appoint the appraisal process as the cause of emotion and the appraisal output as a component of emotion (A → A'B). It may be strange to say that eggs are the cause of a cake, but not that the action of putting the eggs in the dough is the cause of a cake. In any case, if the eggs are in the cake, they must have gotten there somehow. Thus, one way of having our cake and eating it too is by considering two different meanings of the term appraisal.

Another move that (at first glance) relies on two different meanings of appraisal is Castelfranchi and Miceli's (2009) proposal that when something becomes part of a gestalt, it is no longer the same thing. For instance, when a line becomes part of a triangle it is no longer a line but a side of the triangle. Thus, a fourth strategy is to argue that appraisal causes an emotional gestalt in which a different kind of appraisal is a component (A → A'B). The problem with this strategy is that people may perceive or describe the line in isolation as being different from the line in the triangle, but it is still the same line. Instead of appointing the line as the cause of a triangle, I would appoint the action of putting the line against the other two lines as the cause of a triangle (consistent with Strategy 3).

A fifth strategy is to deny the causal claim (C1) in a strict sense, but to rephrase it so as to preserve its core. Appraisal theorists who take appraisal to be a component of emotion (C2) cannot strictly say that appraisal is the cause of emotion (C1) without running into trouble with regard to C5, but they can still say that appraisal is the cause of (one or more of) the other components in the emotion, and this is what matters (Moors, Ellsworth, Scherer, & Frijda, 2013; Moors & Scherer, in press). Thus, this strategy proposes to use the phrase "appraisal causes emotion" merely as shorthand for "appraisal causes the other components of emotion," or "appraisal causes the rest of emotion."

A sixth strategy (Reisenzein, 1995) is to argue that emotions are caused not by appraisal (rejecting C1), but by the information that goes into the appraisal, such as stimuli, goals, expectations, and power. If appraisal is not considered as a cause (C1), it can be considered as a component (C2) without violating C5. It can also be considered as the proximal cause of the other components (consistent with Strategy 6).

A seventh strategy is to accept appraisal as a cause of emotion (C1) and to refute appraisal as a component of emotion (C2; Arnold, 1960; Lazarus, 1966). A similar position has been argued for beliefs or belief–desire compounds (Aristotle, trans. 1908; Descartes, 1649/1989; Reisenzein, in press). I realize that few contemporary appraisal theorists would be willing to embrace this strategy, but I suspect that this is because they are devoted to another meaning of "part"—appraisal as part of the content of feelings—which they conflate with the present one (appraisal as a component of emotion).

An eighth strategy consists in equating appraisal and emotion, thereby denying that appraisal is a cause of emotion (C1) and that it is a component of emotion (C2; based on Thalberg, 1980).

To take stock, Strategy 2 denies the incompatibility between C4 and C5. All other strategies recognize this incompatibility but they propose different ways out. Strategies 1, 6, and 8 deny C1. Strategies 7 and 8 deny C2. Strategies 3 and 4 reinterpret C1 and Strategy 5 reinterprets C2. I endorse Strategies 3 and 5: the appraisal process causes an appraisal output, which is a component of emotion. This appraisal output, in turn, causes the other components of emotion (action tendencies, physiological responses, expressive behavior, and feelings).

Appraisal as part of the content of feelings. Once they are produced, each of the components of emotion (the appraisal output, action tendencies, somatic responses, and expressive behavior) are projected into consciousness where they make up the content of the feeling component. The projection of appraisals into feelings can be considered as a case in which appraisals cause feelings, analogous to the case in which an object causes its image in the mirror. Importantly, when appraisals are projected into feelings, they are not an ontological part of the feeling component; they are only part of the *content* of feelings. Similarly, when an object is projected into a mirror, it is not a physical part of the mirror; there is only an image of it in the mirror. If appraisals are not an ontological part of feelings, there is no risk for auto-causation, and hence no reason for thinking that the causal claim is incompatible with the claim that appraisals are a part of the content of feelings. Stronger even, both claims can be considered as two sides of the same coin. If appraisals are projected into feelings, something must have caused the appraisals first. And a likely candidate for causing appraisals is the appraisal process. If a cake tastes like eggs and looks yellow, it is because somebody put the eggs in the dough.

Appraisal as part of the meaning of emotion. Several authors (e.g., Clore & Ortony, 1991; Frijda & Zeelenberg, 2001; McEachrane, 2009; Parkinson, 1997; Smedslund, 1992) have drawn attention to the fact that appraisal is part of the ordinary and scientific meaning of emotion(s). Specific appraisals are part of the descriptive and prescriptive definitions[1] of specific emotions (e.g., fear is defined as caused by an appraisal of danger, sadness by an appraisal of loss, and anger by an appraisal of

offense). Appraisal is also part of the prescriptive definition of the entire set of emotions (cf. the intensional definition of emotion presented earlier).

Descriptive definitions are one type of conceptual relation between appraisals and emotions. A conceptual relation is a relation in people's minds between the conceptual representation of an appraisal and the conceptual representation of an emotion (cf. Parkinson, 1997). Note that there may also exist other types of conceptual relations, including unqualified ones (pure associations). Conceptual relations may originally stem from experience with any of the other relations in the world (cause, component, part of feeling content, consequence, co-occurrence), but they may also have other sources (e.g., verbal transmission). The fact that conceptual relations *can* stem from causal relations in the world implies that they are compatible with them. Rather than pondering over the compatibility between conceptual and causal relations, critics have argued that the existence of conceptual relations complicates or even precludes empirical research aimed at testing causal relations (Parkinson, 1997). It is to these problems that I now turn.

Causal Claim Is Not Empirically Supported

An often voiced complaint is that the causal claim has not yet received convincing empirical support (Frijda, 1993; Frijda & Zeelenberg, 2001; Lazarus, 1991b; Moors & Scherer, in press; Parkinson & Manstead, 1992; Scherer, 1993). Showing that appraisal is a cause of emotion/components requires finding a set of conditions in which appraisal is included that is sufficient for emotion/components and showing that it is no longer sufficient when appraisal is eliminated from it (cf. Mackie, 1974).[2] This requires conducting an experiment in which the presence of appraisal is manipulated (i.e., independent variable) and the presence of emotion/components is registered (i.e., dependent variable). Investigating claims about specific appraisals causing specific emotions/components requires manipulating the quality of appraisal and registering the quality of emotions/components.[3]

I briefly recapitulate existing methods for manipulating appraisals and measuring emotions/components and discuss the most important problems. Appraisals can be manipulated (a) indirectly via the manipulation of real (Roseman & Evdokas, 2004) or representational stimuli (e.g., pictures, scenarios; Robinson & Clore, 2001; C. A. Smith & Lazarus, 1993) in the hope that participants will appraise them in a certain way, or (b) directly, with words referring literally to appraisals (i.e., representational stimuli; e.g., Ellsworth & Smith, 1988; P. K. Smith & Bargh, 2008). Emotions have been measured with ratings of emotion words or via the measurement of components other than appraisal, such as action tendencies (Bossuyt, Moors, & De Houwer, 2012), somatic responses (Kreibig, Gendolla, & Scherer, 2010; C. A. Smith, 1989), and expressive behavior (Laird & Bresler, 1992; Scherer & Ellgring, 2007). Methods for measuring these components can be organized into (a) objective (verifiable by others) versus subjective (self-report) ones, and (b) direct versus indirect ones (e.g., behavior can be considered as a direct measure of behavior but an indirect measure of action tendencies; Moors & Scherer, in press).

The indirect manipulation of appraisals via real events allows researchers to have more control over the objective features of the events, but less control over the exact appraisals that participants make. The direct manipulation of appraisals with appraisal words allows more control over the appraisals made, but is more sensitive to demand effects. Moreover, like other representational stimuli, appraisal words run the risk of inducing processes that are different from the ones induced by real stimuli. They may activate conceptual relations between appraisals and emotions, and these may mediate the influence of the manipulated appraisals on the emotions/components measured (cf. Parkinson, 1997). This problem also arises when emotions are measured with ratings of emotion words, but not (or less) when response-related components of emotions are measured, especially when they are measured with objective instead of subjective methods (Frijda & Zeelenberg, 2001).

Causal Claim Is Nonempirical

Some critics have dismissed the causal claim as nonempirical, rather than denouncing the lack of empirical support for it (McEachrane, 2009; Smedslund, 1992; Zajonc, 1984). The argument runs that empirical research can be carried out only with constructs that are logically independent of each other. Appraisals and emotions, it is argued, are not logically independent because appraisals (and their causal role) figure in the prescriptive definitions of emotions. For example, some theorists define fear as caused by an appraisal of danger. If so, it makes no sense to empirically investigate whether fear is caused by an appraisal of danger. That would be equally as absurd as investigating whether sunlight is caused by the sun.

Frijda and Zeelenberg (2001) have proposed to circumvent this problem by measuring emotions via components that are logically independent of appraisals, such as action tendencies, somatic responses, and expressive behavior. This proposal is not without problems, however. First, theorists must be convinced that appraisals are no longer necessary to define specific emotions. Second, to reliably measure an emotion (e.g., fear) with an action tendency (e.g., the tendency to flee), the action tendency should be unique for that emotion (e.g., it should not occur in shame). These two problems strike the molar approach to emotion, which seeks to find the appraisals causing specific emotions, but not the molecular approach, which seeks to establish causal relations between appraisals (e.g., danger) and other components (e.g., the tendency to flee) without linking them to specific emotions (e.g., fear).

Neither approach, however, escapes a third problem, that of how to identify whether the components measured are emotional in a general sense (McEachrane, 2009; Smedslund, 1992). When is an action tendency to fight emotional and when is it cold calculation? When is a frown emotional and when is it a mere expression of effort? Following the intensional definition of the set of emotions presented before, a tendency to fight and

a frown are emotional when they are caused by an appraisal of relevance/urgency.

To break this circularity, appraisal theorists have to present criteria for the definition of the set of emotions that are logically independent of appraisal (Moors, 2012). Examples are control precedence of action tendencies (Frijda, 1986, 1992) and a high level of synchronization among components (Scherer, 2000). Thus, a tendency to fight could be classified as emotional when it has control precedence, or when it is part of an episode with a high level of synchronization (cf. Grandjean, Sander, & Scherer, 2008, for ways to measure synchronization). The merit of these solutions depends on whether these alternative criteria (perhaps combined with the criteria of duration and presence of components) are sufficient for emotion.

Another solution would be to reformulate the appraisal criterion in noncausal terms. The criterion would then state that emotions are *characterized* (in the sense of being part of the feeling content) rather than *caused* by an appraisal of goal relevance/urgency. This would eliminate the circularity of the causal claim. Indeed, there is nothing circular in saying that appraisal causes an episode in which a specific appraisal output is reflected in the feeling component. Thus, to determine whether a tendency to fight is emotional, one could measure whether it is accompanied by a feeling of goal relevance/urgency.

Note that most of the criteria for defining emotions discussed here (duration, goal relevance, urgency, control precedence, synchronization) are gradual in nature. By consequence, they do not allow categorizing episodes as emotional or nonemotional, but only as more or less emotional.

Even if the circularity problem were to prove insurmountable, this would not be a reason in itself for thinking that the causal claim is false, that it does not correspond to an empirical reality (Eilan, 1992; Frijda, 1992). It may be superfluous to empirically investigate the claim that sunlight is caused by the sun, but the claim does reflect a reality in the world, not just in people's minds. Moreover, a claim should not be evaluated only according to its empirical verifiability but also according to its heuristic value (cf. Reisenzein, 1995).

At the same time, the circularity problem should not put a halt to causal appraisal research fitting in the molecular approach. One can study the influence of appraisal variables (low vs. high coping potential) on other components (e.g., tendencies to attack, flee, reconcile) without worrying about whether or not these components are emotional (or by using a perhaps less-than-perfect definition of "emotional"). Thus, recognizing the difficulty of defining emotions independent of appraisal does not force us, as some critics would have it, to throw out the baby with the bath water.

Alternative Causes of Emotion

Critics have put forward alternative causes of emotion: (a) some have mentioned purely physical processes (triggered by direct brain stimulation, hormones, or drugs) and mental processes of minimal complexity that *they* do not count as appraisal (Berkowitz, 1990; Izard, 1993; Zajonc, 1984); (b) transactional theorists (e.g., Griffiths, 2004; Parkinson, 1995) hold that emotions are caused by an estimation of audience reactions to future emotional behavior, also called social appraisal; (c) network theorists (e.g., Bower, 1981) propose the activation of an emotion network in memory as the principal cause of emotion; (d) belief–desire theorists (e.g., Green, 1992; Reisenzein, 2009) put forward beliefs and desires as causes of emotion; (e) Barrett (2006) argues that the categorization of core affect causes specific feelings, and that core affect itself can be caused by various processes including primary appraisal; (f) Russell (2003) accepts appraisal as one of the components in what people call emotions, but he does not consider it as the driving force of the other components; (g) affect program theorists (e.g., Ekman, 1994; Matsumoto & Ekman, 2009) state that emotions are caused by affect programs (i.e., dedicated neural circuits), but they allow some form of appraisal to trigger these affect programs.

A first reply is that the existence of alternative causes undermines the strong view that appraisal is a necessary cause of emotion (Lazarus, 1991b), but not the weaker, more common view (among appraisal theorists) that appraisal is a typical cause of emotion (e.g., Arnold, 1960; Frijda, 2007; Roseman & Smith, 2001; Scherer, 1984). A second reply is that it is unclear whether and how the alternative processes put forward by the critics differ from appraisal: (a) whether a process is too simple to count as appraisal is entirely determined by one's definition of appraisal (cf. earlier); (b) the notion of social appraisal has overlap with the appraisal of coping potential included in all existing appraisal theories, as well as with the proposal that emotion generation and emotion regulation are one (Frijda, 1986; Siemer & Reisenzein, 2007); (c) the activation of emotion networks is akin to the associative mechanisms proposed as one of the underlying mechanisms of appraisal (cf. Moors, 2009); (d) belief–desire theories admit that beliefs and desires have to be compared before they cause emotions (e.g., Reisenzein, 2009), and I see no fundamental difference between this comparison process and appraisal; (e) it is unclear how appraisal differs from the categorization process proposed by Barrett (2006) because appraisal can be considered as a form of categorization (but see Moors, 2009, for a possible difference). Future theoretical work is needed to examine whether and how appraisal differs from these alternative processes (Moors, 2012), but also whether and how appraisal that does figure in other emotion theories (e.g., Barrett, 2006; Bower, 1981; Matsumoto & Ekman, 2009; Russell, 2003) differs from appraisal in appraisal theories (Moors et al., 2013).

Conclusion

Many appraisal theorists claim that appraisal causes emotion. The present article put this claim under the microscope. Appraisal is one link in a more extended causal chain, or rather, cycle. Appraisal determines the fate of goals in light of other available information. The output of this process is made

available to the system so that mind and body can prepare for actions that are ultimately at the service of these goals. I revisited a selection of objections from the literature against the causal claim and proposed a number of possible replies. The following conclusions were reached. First, the causal claim is incompatible with the claim that appraisal is a component of emotion in a strict sense, but this does not touch the heart of the causal claim, that the appraisal process causes the appraisal output, which in turn, causes the other components. In addition, the appraisal output and the other components may be part of the content of feelings. Second, the current lack of empirical support can be remedied by conducting more experimental studies in which real events are manipulated and components are measured instead of emotion words. Third, to solve the objection that causal claims concerning *specific* emotions are circular, theorists may again revert to measuring components of emotions. To solve the circularity of the causal claim concerning emotions *in general*, theorists may consider replacing the causal appraisal criterion in the intensional definition of the set of emotions with the criteria of control precedence, synchronization, and/or the noncausal version of the appraisal criterion. But even if these proposals were to prove only partially satisfying, there would still be plenty to gain from studying the causal influence of appraisals on action tendencies, somatic responses, expressive behavior, and feelings, regardless of their emotional status. Finally, future efforts are needed to pinpoint the differences between appraisal and alternative processes and to work out empirical tests to determine their respective roles in emotion causation.

Notes

1 Descriptive definitions describe the rules that laypersons (implicitly or explicitly) follow when using terms. Prescriptive definitions stipulate the rules that scientists prescribe for using terms (Widen & Russell, 2010).

2 Empirically demonstrating that appraisal is a typical (let alone necessary) cause of emotion is impossible because it would require showing that appraisal is a necessary condition in most (let alone all) sufficient sets of conditions for emotion.

3 Studies in which appraisals are measured instead of manipulated do not allow the drawing of causal conclusions (Frijda, Kuipers, & ter Schure, 1989; Roseman, Spindel, & Jose, 1990; C. A. Smith & Ellsworth, 1987).

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