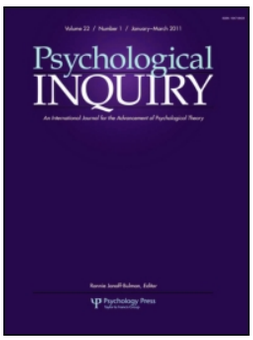

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How to Study the Structure of Emotions? A Welcome Call to Action and a Pragmatic Proposal

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The field of affective science is fraught with conflicting views on the question of how emotions should be conceptualized. In her target article, Agnes Moors (this issue) reviews much of the ongoing debate by summarizing the extensive literature on various models of emotion, including affect program (or basic emotion) theory, appraisal theory (both discrete and dimensional variants), and psychological constructionism. The roots of this debate, about how emotions should be conceptualized, run deep; many of the central ideas behind what Moors refers to as "classical" theories, such as the understanding that emotions are discrete universal states that are evolutionarily prepared to serve adaptive functions, can be traced to Darwin (1872). These ideas became entrenched in the emotions literature decades ago, through pioneering work supporting the contention that certain basic emotions come in distinct packages that manifest similarly across cultures (e.g., Ekman & Friesen, 1971; Izard, 1971; Tomkins, 1962).

Yet, despite accumulating evidence supporting this claim, to this day affective scientists continue to debate whether classical theories do, in fact, offer the best way to conceptualize emotions; only 3 years ago, an issue of *Emotion Review* was dedicated to outlining the tenets of several competing conceptualizations, including classical theories (Tracy, 2014) and what Moors refers to as "skeptical" theories—those that, in stark contrast, attempt to explain emotions as emergent experiences that are constructed from a variety of lower level components, rather than as discrete, functional packages (Barrett, 2014; Moors, 2014). Moors's review reminds us that psychological scientists continue to conceptualize emotions from contradictory perspectives.

Fortunately though, where debate persists, the opportunity for theoretical advancement emerges. In our view, Moors's article usefully alerts the field at-large to this ongoing area of debate, and therefore has the potential to stimulate research aiming to adjudicate between the classical and skeptical theories of emotion. In this commentary we focus on one line of research that could prove fruitful toward this end: studies that seek to test the validity of one primary tenet of the classical theories that Moors describes, namely, that certain components are intrinsic to each emotion and occur with some regularity across a representative sample of episodes of that emotion. For example, classical theorists contend that, across a representative sample of *fear* episodes, a certain set of experiential components (i.e., certain cognitions, subjective feelings, somatic sensations, and desires to act) reliably and consistently occur.

Importantly, this proposition represents a critical point of divergence between classical and skeptical theories; as Moors points out, whereas classical theories such as affect program theory assume beyond-chance, probabilistic co-occurrence of specific components for each emotion (e.g., Roseman, 2011; Tracy, 2014), skeptical theories such as psychological constructionism do not (e.g., Barrett, 2014; Russell, 2003). Although pinpointing the relative coherence of specific components within an emotional episode is therefore crucial to adjudicating between classical and skeptical theories of the structure of emotion, Moors notes that almost no studies have empirically tested the extent to which various emotional components co-occur within emotional episodes. As a result, "there is currently no consensus about the exact number of components to include in the emotion" (Moors, this issue, p. 2). In what follows, we offer a proposal for how future studies might empirically test the validity of the classical theoretical stance regarding the structure of emotions—focusing primarily on subjective, experiential components—and we describe the kinds of results that might support this account and challenge competing accounts offered by skeptical theorists.

What Is the Structure of Emotions?

As outlined by Tracy (2014), classical theories contend that each emotion comprises a set of experiential, cognitive, behavioral, and physiological components, each of which should be linked to the evolutionarily recurrent situation that elicits that emotion, in such a way that each component functions to increase the organism's likelihood of surviving or reproducing in response to the particular elicitor. This view implies a beyond-chance, probabilistic co-occurrence of certain components within instances of a given emotion.

However, there will never be a one-to-one relation between the elicitation of a given emotion and each of its components, especially in humans, who have a particularly high degree of cognitively driven flexibility in stimulus-response patterns. This is because, in any given emotion instance, there are numerous reasons why each component may or may not occur (e.g., an individual experiencing fear may try to suppress certain undesirable components of that emotion), resulting in a

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high degree of variability in emotional responding. Due to this variability, as well as the considerable error in measurement that typically occurs for many emotion components, we should not expect to observe the same set of components in *every* instance of a given emotion. Instead, we should expect a tendency for each component to occur with each emotion on average, such that, across a large sample of individuals representative of a population, a component theoretically linked to one emotion is more likely to occur within an episode of that emotion than is some other component not theoretically linked to that emotion.

Although Moors contrasts this classical theoretical account with the account provided by skeptical theorists, one important similarity emerges between the classical theory and the parallel-competitive model that Moors portrays as a direct offshoot of skeptical theories. In the parallel-competitive model, an individual's behavior during or immediately following an emotional episode is determined by an internal, goal-directed mechanism, in which the utility of any given behavior is computed based on the expected value of the outcome to which it would presumably lead; this mechanism operates automatically and typically overrides more external, direct, stimulus-driven forces that could affect behavior. For example, an individual experiencing anger following a personal slight may decide to confront the person who slighted him or her, based on the automatic and unconscious calculation that doing so would help achieve the goal of maintaining the individual's social status.

Yet Moors argues that the profound effect of goal-directed mechanisms on emotional behavior is often discounted by affective scientists because it violates their intuitive understanding of emotional behavior as being fundamentally irrational, and therefore not typically enacted in service of a broader goal. Moors's view, in contrast to this notion, is that emotional behavior can be understood as goal directed and rational if individuals are seen as simultaneously holding multiple goals. She notes that confronting an individual who initiated a personal slight "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" (p. 11).

Although Moors frames her parallel-competitive model as antagonistic to mainstream classical accounts such as affect program theory, the suggestion that emotional behavior comes online to serve goals is in fact entirely consistent with the classical approach. Revisiting Moors's suggestion using the language of evolutionary theories of emotion, each emotion is understood to have a proximate consequence and ultimate function; the former may be beneficial or detrimental in the short term, whereas the latter is assumed to hold benefits for the individual's fitness in the long run. Using the same example as cited earlier, fighting when angry might have, at a proximate level, the undesirable effect of hurting a relationship but have, at an ultimate level, the beneficial effect of preventing one from being taken advantage of—and thereby conferring status-related benefits.

In sum, classical theories regarding the structure of emotion suggest that a given emotion will reliably and consistently comprise a set of components that represent the functional output of that emotion. Ironically, this view shares a fundamental assumption with Moors's more skeptical model: Emotions are functional, in the sense that they help individuals fulfill higher level goals.

How to Test Whether Classical Theory Is Valid?

We recently tested the validity of one aspect of the classical account of emotions, namely, that certain components constituting a given emotion co-occur reliably and consistently. We focused on subjectively experienced components of emotions, such as cognitions, feelings, and desired actions, and restricted our initial investigation to the domain of positive emotions (Weidman & Tracy, 2016). Our approach included three steps. First, we identified the entire range of experiential components that could plausibly encompass an emotion of interest; this meant asking laypersons to list cognitions, feelings, and desired actions that often accompany experiences of individual emotions and compiling these components into comprehensive lists. To take one example, when thinking about the emotion *gratitude*, participants listed experiential components including *expressing thanks*, *respecting someone*, and *feeling appreciative*. Seeking to uncover the content domain of specific emotions in this way follows theoretically from work on the prototype structure of emotions, which suggests that any emotion can comprise a myriad of different components, all of which characterize instances of the emotion with some frequency but which vary in the exact frequency with which they occur (Russell, 1991; Shaver, Shwartz, Kirson, & O'Connor, 1987). Likewise, this approach follows empirically from recommendations in the construct validation literature suggesting that defining a novel construct must begin with an overinclusive sampling of all content that could plausibly constitute that construct (e.g., Clark & Watson, 1995; Simms, 2008).

Once we identified the full range of components that could plausibly comprise each positive emotion, we next measured the occurrence of these components during episodes of each individual emotion. This meant asking several hundred laypersons to complete the Relived Emotion Task (Ekman, Levenson, & Friesen, 1983), in which they recalled instances of each individual emotion (e.g., gratitude) and then reported the extent to which each subjective component in our initial list characterized their experience during that emotional episode. In assessing individuals' subjective experiences, we used relatively broad phrasing so that each component could be applicable to a variety of situations in which it might manifest. For example, the subjective desire to *express thanks* following gratitude could manifest across contexts in verbally thanking one's benefactor, buying a thank-you gift, or writing a thank-you card, among other possibilities. Although these specific behaviors are superficially distinct, they all emanate from a common underlying desire to express thanks. Our goal was to prevent such superficial variability from masking underlying commonalities in the experience of emotional components (Roseman, 2011; Tracy, 2014).

After we assessed all plausible components of each individual positive emotion across many individual episodes of that emotion experienced by many people, our next step was to test which components reliably co-occurred during these episodes.

This meant analyzing individuals' ratings of the extent to which they experienced each subjective component during various emotional episodes, using exploratory factor analysis (EFA). This procedure allowed us to answer two questions: (a) Does a latent factor emerge that is characterized by high loadings from items representing components thought to constitute a given emotion? (b) If so, which components are most central to the emotion in question, based on the strength of their loadings? For example, we found that when participants wrote about experiences of gratitude, a distinct latent factor emerged that was characterized by strong loadings from subjective component items that had originally been listed for gratitude. Furthermore, the items just listed (i.e., "I wanted to express thanks," "I had a great deal of respect toward a specific person," and "I felt appreciative toward a specific person") were among the highest loading items on the gratitude factor, suggesting that these components are some of the most central to this emotion. Together, these findings suggest that, in line with classical theoretical accounts of the structure of emotions, gratitude is in fact reliably characterized by a set of subjective experiential components, and the exact nature of these components is somewhat consistent across many individual gratitude experiences (Weidman & Tracy, 2016).

Importantly, using EFA to examine the structure of emotion helps explicitly quantify variability in emotional components across episodes of a given emotion and can demonstrate how the variability in subjective components that is inherent to emotional experience is consistent with classical accounts. As just noted, classical theories contend that there will never be an exclusive, one-to-one relationship between any given subjective component and an individual emotion; the most central subjective components for a given emotion will occasionally fail to emerge in an episode of that emotion. By yielding a latent factor representing an emotion that is based on hundreds of individual episodes of that emotion, EFA communicates which subjective components consistently constitute an emotion *on average*, across a large sample of emotional episodes that are certain to differ in specific contextual factors.

Furthermore, factor loadings obtained for individual subjective components precisely quantify the extent to which each component tends to occur within episodes of a given emotion. For example, the three gratitude items just mentioned had loadings on the gratitude factor that would be considered strong by conventional factor analytic standards (λs = .59–.67; e.g., Clark & Watson, 1995; Simms, 2008). Yet these loadings also indicate that each individual component is correlated only .59 to .67 with the latent gratitude construct, implying that a substantial minority of gratitude episodes will *not* be well characterized by a desire to express thanks, respect toward a specific person, or feelings of appreciation. This suggests that components that occasionally fail to occur within an episode of a given emotion might nonetheless be justifiably considered reliable and consistent indicators of that emotion, based on accepted psychometric standards.

The approach we have outlined can be extended in multiple ways to address additional questions related to the structure of emotions. Although our specific example concerned the question of whether an individual emotion (gratitude) reliably and consistently comprises a certain set of subjective components, a similar approach could be used to test whether two or more closely related emotions in fact comprise largely distinct versus overlapping sets of subjective components. Using our approach, a researcher might first generate a list of all components thought to plausibly constitute a set of closely related emotions. In our work, for example, we generated lists of all components thought to constitute *admiration*, *awe*, and *gratitude*—three emotions that have been treated as distinct in prior work (Weidman, Steckler, & Tracy, in press) but which all involve cognitions of other-appreciation—and assessed all of the components that could plausibly comprise these three emotions, following separate episodes of each of these three emotions.

If these emotions in fact comprise distinct sets of components, then EFA should reveal a three-factor solution following episodes of each emotion, with each latent factor characterized by high primary loadings (and low cross-loadings) for the items thought to capture each emotion as well as low correlations between these factors. Indeed, we found distinct factors for admiration, awe, and gratitude following episodes of each, and the items that had initially been listed for admiration tended to load strongly on the admiration factor and weakly on the awe and gratitude factors (and the same pattern emerged for the awe and gratitude items vis-à-vis the awe and gratitude factors, respectively). Of importance, the three factors correlated only .12 to .33 across episodes of each emotion, suggesting a high degree of distinctiveness. Together, these findings suggest that admiration, awe, and gratitude are each reliably characterized by a distinct set of subjective components and that the exact nature of these components is consistent across many individual experiences of each emotion (Weidman & Tracy, 2016).

It is noteworthy that this approach to uncovering the structure of the subjective experiential content of emotions could also be extended to nonsubjective components, assessed via methods other than self-report. For example, scores representing facial muscle movements shown during emotion experiences, or the intensity of galvanic skin responses, could be included in a factor analysis along with scores representing self-reported experiences of subjective components. The resulting analyses could shed light on whether those more objective, physical, and physiological emotional components reliably occur during episodes of individual emotions, as would be evidenced if they loaded strongly—alongside the subjective components—on latent factors representing the emotion in question.

How Does Testing the Validity of Classical Theories Benefit the Field?

As noted earlier in this commentary, central to the debates between the classical and skeptical theories that Moors reviews is the question of whether certain sets of components reliably and consistently characterize each individual emotion during various episodes of that emotion. Classical theories tend to endorse this proposition, whereas skeptical theories tend to deny it. The approach we have outlined for examining the structure of emotions is well suited to help adjudicate between these two competing perspectives on the coherence of components within emotional episodes. Based on the research we have conducted thus far, our approach lends support to the

theoretical suggestion that closely related emotions such as admiration, awe, and gratitude are in fact associated with distinct sets of subjective components that, on average, co-occur during experiences of each emotion. As another example of this trend, we found that three forms of love often theorized to be distinct—*attachment love* (also known as *companionate love*), *nurturant love* (also known as *compassionate love*), and *romantic love* (also known as *passionate love*, e.g., Berscheid, 2010; Shiota et al., 2014)—are each associated with distinct sets of subjective components, and these components mapped onto the cognitions, feelings, and desired actions that have previously been theorized to constitute each of the three forms of love (Weidman & Tracy, 2016).

That said, our approach is not a priori confirmatory of the tenets of classical emotion theories regarding the structure of emotion; it can also yield results suggesting that one or more emotions are *not* associated with a distinct set of reliably co-occurring subjective components, in line with skeptical theories such as psychological constructionism. For example, we found that no latent factor emerged for subjective components previously theorized to constitute compassion (e.g., feelings of worry that someone else is suffering and a desire to help find a solution; Goetz, Keltner, & Simon-Thomas, 2010). Instead, when we asked laypersons to report their feelings during episodes of compassion, these components consistently loaded strongly on factors representing two other emotions: empathy and sympathy. This finding suggests that compassion is not itself associated with a distinct set of subjective components but that the components theorized to constitute it are integral to the experience of empathy and sympathy, each of which is reliably associated with a distinct set of components (Weidman & Tracy, 2016).

Importantly, the multivariate, correlational approach we outline here—in which researchers observe the coherence or lack thereof among all components thought to constitute an emotion—would complement the extensive literature employing univariate, experimental methods, in which researchers test whether an induced emotion has a causal downstream effect on a specific experienced component or behavioral outcome. Although multivariate approaches have seldom been employed in prior work on distinct emotions, Kragel and LeBar (2013) recently demonstrated the value and promise they hold for the field. Using multivariate pattern classification—a form of machine learning—these researchers showed that individuals' distinct emotional experiences could be classified at above-chance levels using data from both self-reported feelings and 16 autonomic indices. Furthermore, results based on autonomic data suggested that individuals' autonomic responses clustered into distinct emotional categories, rather than along dimensional lines, supporting the notion that autonomic indices may co-occur in reliable and consistent patterns within episodes of a given distinct emotion (Kragel & LeBar, 2013).

Of course, tests that seek to examine the validity of classical accounts can also yield results that fall into a gray area, potentially leading to more debate over precisely which emotions are associated with distinct sets of components. For example, as described earlier, we found strong evidence that admiration, awe, and gratitude were each reliably characterized by a distinctive set of subjective experiential components; specifically, EFAs of all components thought to constitute these emotions yielded a three-factor solution, and each emotion was consistently represented by a distinct latent factor in these solutions. Yet, hypothetically, we could have instead found that an EFA of all components thought to constitute these three emotions yielded a more ambiguous solution; for example, the scree plot could have failed to show a clear break after the first, second, or third factor. Had we obtained a result along these lines, it would have remained unclear whether the data were best characterized by distinct factors for admiration, awe, and gratitude (supporting the notion that each of these emotions is reliably associated with a distinct set of components), or whether one or more of these emotions should be combined into a single factor (e.g., an admiration + gratitude factor, representing a blend of the two states, which would *contradict* the notion that each of these three emotions is reliably associated with a distinct set of components). More broadly, had we obtained findings along these lines, we would not have been able to provide a conclusive answer to the question of whether admiration, awe, and gratitude can in fact be considered distinct emotional experiences.

Conclusion

We hope the methodological approach we have outlined in this commentary can pave the way for new insights into the ongoing debate between classical and skeptical theorists over how best to conceptualize emotions. Findings from this approach could in turn supplement repeated and frequent reliance on traditional sources of evidence—such as the relative accuracy with which nonverbal emotional cues are recognized across cultures—which continue to result in bifurcation between theoretical camps, rather than integration and theoretical advance (e.g., Gendron, Roberson, & Barrett, 2015; Gendron, Roberson, van de Vyver, & Barrett, 2014; Sauter, Eisner, Ekman, & Scott, 2010, 2015).

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