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Holes in the case for mixed emotions

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Holes in the case for mixed emotions

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I thank Erin Hardin for any number of things, including helpful comments on this manuscript and for suggesting that we go see *Life Is Beautiful* some years ago. I also thank Peter McGraw for his many years of collaboration. Address correspondence to Jeff T. Larsen, Department of Psychology, Austin Peay Building, Knoxville, TN 37996. Email: Jeff.larsen@utk.edu

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Abstract

Theories of the structure of affect make competing predictions about whether people can feel happy and sad at the same time. Larsen, McGraw, and Cacioppo (2001) presented some of the first evidence that people can experience such mixed emotions, but it has turned out to be anything but an open-and-shut case. Even though my colleagues and I and others have since provided stronger evidence for mixed emotions, holes in the case remain. I lay out those holes and suggest strategies for testing them in future research. I also explore the possibility that the case may never be closed, in part because the competing hypotheses may not be entirely falsifiable. Fortunately, hypotheses need not be falsifiable to be useful. Research on mixed emotions has been generative and the body of research will continue to shed light on the structure of affect.

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There is considerable debate about whether we can ever experience an emotion without being aware of it in the moment (Berridge & Winkielman, 2004), but I would like to suggest that people are never aware of experiencing hubristic pride. What we experience at the time is confidence. Some 15 years ago, I walked into my dissertation defense confident that people can feel happy and sad at the same time and armed with evidence from several studies. This was noteworthy because philosophers (e.g., Socrates [Plato, trans. 1975, Hume, 1739/2000) had speculated about mixed emotions and early psychologists had debated about mixed emotions (e.g., Ebbinghaus, 1902; cited in Wolgemuth, 1919; Wundt, 1896). Moreover, contemporary models of the structure of affect make competing predictions about mixed emotions. Whereas the circumplex model (e.g., Russell & Barrett, 1999) contends that polar opposite emotions like happiness and sadness are mutually exclusive (Russell & Carroll, 1999), the evaluative space model (Cacioppo & Berntson, 1994) allows for the possibility that they can co-occur. Although the committee members (Barbara Mellers, Phil Tetlock, & Richard Petty) found the studies informative, they also came up with several alternative interpretations for the findings that had escaped me. It became clear that what I had taken for confidence had actually been hubris. In the years since, further evidence for mixed emotions has accumulated as my colleagues, students, and I and other researchers (e.g., Schimmack, 2001, 2005) have addressed most of the alternative interpretations that came up that day. McGraw and I recently reviewed this evidence in order to make the case for mixed emotions (Larsen & McGraw, 2014). Here I hope to cross the aisle in order to challenge the existing evidence and speculate about how to provide stronger tests of mixed emotions in future research.

The competing hypotheses

The debate is one about the structure of *core affect*, which Russell and Barrett (1999) defined as the most elementary consciously accessible feelings that people can experience. According to Russell and Barrett's (e.g., 1999) circumplex model, core affect can be described in terms of two psychologically irreducible dimensions. One of these dimensions is the bipolar valence dimension, which ranges from unpleasant states (e.g., sadness) through the neutral point (i.e., no valence) to pleasant states (e.g., happiness). If valence is irreducible (see Barrett & Bliss-Moreau, 2009), happiness and sadness should be mutually exclusive (Russell & Carroll, 1999). In contrast to this *bipolarity hypothesis*, the evaluative space model (Cacioppo & Berntson, 1994) contends that the positive and negative affective substrates underlying the bipolar valence dimension are separable, which gives rise to the *bivariate hypothesis*, which holds that happiness and sadness can co-occur.

There has been abundant evidence for the bivariate hypothesis (Larsen & McGraw, 2014), but the debate has persisted largely because of questions about the validity of the measures that have been employed to measure core affect. Valid measures of a construct must demonstrate sensitivity to the construct of interest. Consider our initial evidence for mixed emotions (Larsen et al., 2001). We simply handed moviegoers a survey as they walked into a theater to watch *Life Is Beautiful* or as they walked out of the theater. The two critical questions were: *Do you feel happy?* and *Do you feel sad?* These questions are presumably sensitive to happiness and sadness, respectively, so the finding that people were more likely to say *yes* to both questions after the film than before provided evidence that people can feel happy and sad at the same time. Of course, sensitivity is necessary but not sufficient: measures must also demonstrate specificity. Imagine a zoologist who is searching for a white raven but has a

fictitious disorder called gray blindness that prevents people from distinguishing white from light shades of gray. This zoologist's eyes will be sensitive to the presence of a white raven, but will lack specificity. In the presence of a gray raven, the zoologist might see a white raven. Similarly, as detailed below, there are threats to the specificity of all measures of core affect that have been used in the study of mixed emotions to date.

Evaluations or emotions?

Russell (2003) distinguished between core affect and *perceptions of affective quality.* Whereas core affect refers to the experience of emotion, perceptions of affective quality refer to evaluations of stimuli as pleasant or unpleasant, exciting or boring, and so forth. That is, core affect refers simply to how one feels and affective quality refers to how one feels *about* some object. Russell acknowledges that people can perceive objects as having ambivalent affective qualities, but this does not necessitate mixed emotions because evocative stimuli do not always influence core affect. The problem is that our participants may not split hairs as finely as we do and it can be difficult to develop measures that are uniquely sensitive (i.e., specific) to core affect. We might ask questions about core affect (e.g., "Do you feel happy?") but they might answer by reporting on their perceptions of affect quality (e.g., by telling us whether a scene from a film they are watching is pleasant).[1]

In other papers (Larsen & McGraw, 2011; Larsen & Stastny, 2011), I have interpreted findings from studies involving horror films (Andrade & Cohen, 2007) and evocative music (Hunter, Schellenberg, & Schimmack, 2010) as evidence against Russell's concern, but a more

[1] Some notes on terminology will be useful. In that the debate is about core affect, we have attempted to study and measure what could be termed *mixed core affect.* To avoid such jargon, Larsen et al. (2001) used the term *mixed feelings*. One problem with this term was that mixed feelings in the form of ambivalent perceptions of affective quality. In subsequent papers (e.g., Larsen & McGraw, 2011) we have avoided such connotations by adopting the term *mixed emotions*. This term is better, but still not ideal because changes in core affect need not always be accompanied by the occurrence of such discrete emotions as happiness, sadness, anger, and fear. In fact, Larsen and Green (2014) reverted to *mixed feelings* to address this concern.

direct test would require eliciting emotions with stimuli that fall outside of participants' conscious awareness. The idea would be to elicit "mystery moods" (Leander, Moore, & Chartrand, 2009) which occur when people know that they are feeling good or bad, but have no idea why. If people are not aware of the evocative stimulus, their perceptions of the stimulus' affective quality cannot possibly influence their ratings of core affect. Subliminally priming people with positive words (e.g., *music*) or negative words (e.g., *cancer*) can elicit mystery good and bad moods, respectively (Chartrand, van Baaren, & Bargh, 2006). One way to address Russell's (2003) concern will be to investigate whether subliminally priming people with positive *and* negative words leads them to experience mystery mixed moods.

The vacillation hypothesis

Even if people tell us about their core affect (as opposed to their perceptions of affective quality) when we ask them to, they might not tell us how they are feeling right now, at this very moment. Emotions can change rapidly (Ekman, 1992) and ambivalent states might be particularly unstable (Cacioppo & Berntson, 1994). Kahneman (1992) went so far as to draw an analogy between mixed emotions and the perception of the Necker cube. Just as we can only perceive one interpretation of the Necker cube at any point in time, he suggested that we can only alternate between positive and negative emotions. If so, when people report mixed emotions, they might simply be reporting summaries of how they had felt over the course of the last few moments.

In several studies (e.g., Larsen & Green, 2013; Larsen & McGraw, 2011), we have addressed this *vacillation hypothesis* by handing participants a computer mouse and having them watch scenes from *Life Is Beautiful* in the context of what they believed was a study of foreign language comprehension. Their task was to press the left button whenever they felt happy and

the right button whenever they felt sad. The main finding is that people spend more time pressing both buttons at the same time during bittersweet clips than non-bittersweet clips, which we take as evidence against the vacillation hypothesis. In contrast, Barrett and Bliss-Moreau (2009) suggested that even button press data are susceptible to the vacillation hypothesis. The psychological moment may last for as little as 100 ms (Condon & Barrett, 2014). If core affect can change as quickly as ten times each second, we might not be able to expect people to be able to press and release mouse buttons fast enough to keep up with those changes.

In future research, we can test just how analogous the experience of mixed emotions is to the perception of the Necker cube. We will first ask participants to spend some time watching and attending to their perceptions of the Necker cube. Afterwards, they will watch a bittersweet film. They will be instructed to press one button whenever they feel happy, a second whenever they feel sad, a third whenever they are experiencing happiness and sadness simultaneously, and a fourth whenever they are vacillating between happiness and sadness in the same way that they vacillated between the two interpretations of the Necker cube. The vacillation hypothesis predicts that people will spend more time reporting that they are vacillating during a bittersweet clip than during a control clip. More important, it predicts that they will spend equally negligible amounts of time reporting simultaneously mixed emotions during both the bittersweet and control clips. In contrast, the bivariate hypothesis predicts that people will spend more time reporting simultaneously mixed emotions during bittersweet clips.

Beyond direct measures of emotional experience

Self-reports are generally considered the gold standard for assessing emotional *experience* (i.e., conscious feelings) and the debate over mixed emotions is a debate about the *experience* of emotion. As Barrett and Russell (1999) made clear, the circumplex model is mute

with respect to other aspects of emotion (e.g., facial expressions) and the physiological substrates of experience (e.g., patterns of central & peripheral nervous system activation). Even so, I suspect that we are approaching the limits of what can be learned about the time course of mixed emotions from self-report measures. Fortunately, we can learn more by supplementing self-report measures with indirect measures of emotion, which refer broadly to measures in which participants do not directly answer questions about their emotional experience.

A variety of indirect measures can be used to measure emotion (e.g., the implicit positive and negative affect task; Quirin, Kazén, & Kuhl, 2009; functional magnetic resonance imaging; Grabenhorst, Rolls, Margot, da Silva, & Velazco, 2007), but it is unclear whether any of them have enough temporal resolution to shed light on whether people can simultaneously feel happy and sad. Facial expressions of emotion, which can come and go in as little as one-third of a second (Sayette, Cohn, Wertz, Perrott, & Parrott, 2001), are more promising. In fact, Ekman and Friesen (1975) suggested that mixed emotions may yield what Harris and Alvarado (2005) termed *mixed smiles* (i.e., genuine, Duchenne smiles accompanied by expressions of negative affect such as furrowed brows; see also R. J. Larsen & Diener, 1992).

Harris and Alvarado (2005) investigated whether being tickled elicits mixed emotions. Just as participants reported that being tickled was both amusing and unpleasant, analysis of their facial expressions revealed that being tickled elicited just as many mixed smiles as pure Duchenne smiles. Nonetheless, Harris and Alvarado raised the possibility that subjects may have smiled not to express positive affect but to mask their negative affect. A closely related possibility is that tickle elicited *miserable smiles* (Ekman & Friesen, 1982), which people express to convey that they can endure some stressful experience. Supportive evidence for both of these possibilities comes from the finding that a cold pressor task elicited even more mixed

smiles than did tickle. In another study, Griffin and Sayette (2008) showed heavy smokers a lit cigarette for 30 sec and found that nearly one-quarter of them displayed mixed smiles for at least 300 msec. As with Harris and Alvarado's (2005) mixed smiles, however, it is possible that smokers' mixed smiles were merely masking smiles or miserable smiles.

In sum, mixed smiles have been documented, but it is not clear whether they reflect mixed emotions. My lab is currently taking a closer look at the relationship between the experience of mixed emotions and facial expressions of emotion by having people watch bittersweet film clips, which are presumably less likely to prompt socially desirable responding than tickling them or showing them lit cigarettes. We further reduce social desirability concerns by leaving people alone while they watch the clips and only tell them that we videotaped them after the study. During the study, participants provide moment-to-moment measures of their positive and negative affect. We are also asking naïve judges to watch each participant's videos and provide moment-to-moment measures of the participants' positive and negative affect. The question is whether judges will detect more mixed emotions on participants' faces when participants were watching bittersweet scenes from *Life Is Beautiful* as opposed to a collection of scenes from *Steel Magnolias* that are in, in turns, neutral, only pleasant, and only unpleasant.

Such findings would provide particularly compelling evidence that people can experience simultaneously mixed emotions, at least when they are being asked to report whether they are experiencing positive and negative emotions on a moment-to-moment basis. We are ultimately far more interested in how people experience emotions when psychologists are not asking them questions about those emotions. Collecting self-report measures may influence the very emotions that we are trying to measure by, for instance, calling people's attention to the ambivalent aspects of the stimulus (Larsen & McGraw, 2011). We have addressed this *reactive*

measurement hypothesis in prior studies by showing people evocative films without mentioning our interest in emotion beforehand. After the film, we asked participants open-ended questions about their emotions (e.g., "How do you feel right now?") and found that people are more likely to report more mixed emotions after watching bittersweet clips than after watching control clips. If judges detect mixed emotions in the faces of participants who had been rating their emotions while watching bittersweet films, one follow-up question will be whether they detect mixed emotions in the faces of participants who had been unaware of our interest in emotion.

The specter of unfalsifiability

Scientific hypotheses are most useful if they are falsifiable, but psychological theories are often criticized for being inadequately falsifiable (Meehl, 1978). In stark contrast, Russell and Carroll (1999) were daring enough to state that, "Bipolarity says that when you are happy, you are not sad and that when you are sad, you are not happy" (p. 25). Not only did they make a point prediction about the incidence of mixed emotions, they predicted that the incidence was precisely 0. If this was daring, it was downright courageous to close the article by suggesting that mixed emotions may be obtained in "moments of great emotion…or times of conflict or decision" (p. 26). They essentially invited others to set out to prove them wrong. Upon seeing *Life Is Beautiful* within weeks of reading Russell and Carroll (1999) and experiencing what seemed like mixed emotions of happiness and sadness, I was eager to accept the invitation (and my roommate Peter McGraw was bold enough to call the movie theater manager). As it turns out, falsifying this simple hypothesis has been anything but simple. To the extent that even the most sophisticated measures of happiness and sadness fail to provide valid indices happiness and sadness, the bipolarity hypothesis may ultimately prove unfalsifiable.

On the other hand, the bivariate hypothesis may also be unfalsifiable. The maxim that absence of evidence is not evidence of absence applies. Proving that no one can ever experience mixed emotions in any situation would require observing everyone in all situations, which is no more possible than confirming that every raven in the world is black. The problem is compounded by the fact that even models like the evaluative space model that allow for mixed emotions contend that they are rare (Larsen et al., 2011).

Fortunately, the cumulative nature of the research program serves as a corrective. It can be difficult to make inferences about any particular study viewed in isolation, but a broader view allows stronger inferences. During a train ride with the experimental physicist Paul Dirac, theoretical physicist Wolfgang Pauli reputedly saw some sheep and noted that, "It looks like the sheep have been freshly shorn." Dirac looked at the sheep and, after a time, replied, "At least on this side" (Capri, 2007). Despite his sardonic reply, Dirac knew full well that the sheep were shorn on both sides. We have limited numbers of imprecise observations, but we have considerable ability to come up with reasonable inferences from the balance of those imprecise observations. I will not be so bold as to make a point prediction about how falsifiable the bipolarity and bivariate hypotheses are, but they are falsifiable enough to continue pushing on.

It is also worth noting that falsifiability is not the only mark of a useful hypothesis. The checkered history of cognitive dissonance theory, whose falsifiability has long been questioned (e.g., Greenwald, 1975), serves as one case in point. Even if it is not falsifiable, cognitive dissonance theory has been among the most generative theories in the history of social psychology. The debate over mixed emotions has also been generative. For example, basic questions about mixed emotions have raised tangible questions about the nature of the seemingly ineffable experience of complex emotions such as nostalgia (Wildschut, Sedikides, Arndt, &

Routledge, 2006) and poignancy (Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008). East Asians' better ability to accept contradiction has also spurred research on cultural differences in mixed emotions (Goetz, Spencer-Rodgers, & Peng, 2008). My colleagues and I have also proposed that mixed emotions may foster healthy coping (Larsen, Hemenover, Norris, & Cacioppo, 2003). In sum, the debate over mixed emotions has been generative even if the competing hypotheses involved are unfalsifiable. Finish lines are useful not only because they tell us where to stop. They also tell us where to go.

Looking ahead

Where am I am and where am I going? Several metaphors present themselves. Just as Diogenes of Synope reputedly carried a lamp around town in broad daylight shedding light where none was needed, one possibility is that I have answered a question that has already been answered. When I ask groups of undergraduates to raise their hands if they think people can feel happy and sad at the same time, a majority of hands shoot up within moments. When I then mention that I have spent more a decade trying to answer this same question, I get quizzical looks. Of course, science would still be in the dark ages if we relied upon laypeople's intuitions and haphazard measurement. Moreover, Greenwald (2012) identified the disagreement about the structure of affect as being one of 13 long-standing unanswered theoretical debates in the fields of social and cognitive psychology and others have been able to generate alternative interpretations as readily as I have (Barrett & Bliss-Moreau, 2009; Russell, 2003). It appears that answers to questions about mixed emotions are not as plain as day.

Another possibility is that I am like one of those allegorical medieval scholars who argued about how many angels can dance on the head of a pin. Perhaps I have spent all this time trying to answer an unanswerable question. I concur with most emotion theorists (e.g., Barrett,

2006) that emotions are better seen as theoretical constructs rather than natural kinds. In this sense, we cannot discover the properties of emotions in the same way that we can discover the properties of ravens. This might make it foolish to ask questions about whether people can experience any two particular emotions (e.g., happiness, sadness) at a single point in time. On the other hand, such questions are only very slightly removed from questions about whether people can experience any one particular emotion (e.g., happiness) at a single point in time. If questions about the experience of mixed emotions are unanswerable, then questions about the experience of single emotions might also be unanswerable. In the event, we would be forced to discard the vast portion of affective science that has aimed to understand the experience of emotion, which would certainly be foolish.

In one of the paradoxes that Aristotle attributed to Zeno, an unfortunate traveler can only get to his destination by getting halfway closer with each step. One step brings him halfway, the next three-quarters of the way, and the third seven-eights of the way, but he will never arrive. I seem to be on the traveler's road. I do not anticipate ever gathering a final piece of evidence that will allow me (let alone other researchers) to definitively conclude that people can feel happy and sad at the same time. A survey of the alternative interpretations above suggests that we would need to observe mixed smiles from participants who are in the middle of mixed mystery moods but do not know that we have any interest in their emotions. This is unlikely to occur because only intense emotional experiences produce characteristic facial expressions (e.g., Ekman, 1994) and mystery moods are unlikely to be intense. On the other hand, electromyographic recordings of activity over the muscles involved in facial expressions of emotion can be more sensitive than videographic analyses (Cacioppo, Martzke, Petty, & Tassinary, 1988), so it is possible that mixed mystery moods could reveal mixed smiles that are

too faint to be detected by the naked eye (but see Larsen, Norris, & Cacioppo, 2003). I would anticipate such effects to be so small that conducting such a study would require a prohibitive number of participants. If I can bring myself to ask a graduate student to conduct such a study, if the graduate student agrees, and if the study indicates that mystery mixed moods yield facial electromyographic evidence for mixed smiles, I believe my work here would be done. In the meantime, my destination is clearly visible and just as clearly unobtainable.

My fate could be worse. The field's progress toward answering questions about mixed emotions is more similar to that of Zeno's traveler than to that of Sisyphus, who was forced to roll a boulder to the top of a hill in Hades. Every time he neared the top, the boulder would roll back to the bottom, whereupon he had to start all over again. Indeed, stronger tests of mixed emotions have generally provided stronger evidence that happiness and sadness can co-occur, rather than quashing the evidence that had come before. It is important to point out, however, that my task is not to provide stronger *evidence for* mixed emotions. Rather, my task is to provide stronger *tests of* mixed emotions. This distinction highlights a difference between scientists' labors and those of Sisyphus. Scientists should not fight wars with each other to determine which side had it right and which side had it wrong (Lench, Bench, & Flores, 2013). Rather, we should collaborate with each other so that we can get it right (or, at least, less wrong) tomorrow. I began to appreciate the distinction when I approached James Russell at a conference in 2000 and told him that the poster that I was presenting provided evidence against the hypothesis that happiness and sadness are mutually exclusive. He was eager to hear more, spent a good amount of time at the poster the following day, and invited us to submit the paper for a special section he was editing. Russell wants to get it right and so do I. Regardless of whether the

body of evidence ultimately indicates that people can or cannot experience mixed emotions of happiness and sadness, that body of evidence will shed light on the structure of affect.[2]

In the meantime, I try to avoid the hubristic pride that I mistook for confidence as I walked into my dissertation defense. Bob Dylan wrote, “I was so much older then, I'm younger than that now.” The evidence for mixed emotions is more compelling now than it was 13 years ago, but I suspect that I am less convinced now than I was then. Fortunately, looking for this white raven has always been fun and never boring. All the more reason to get back to work.

[2] As an added bonus, the chance that I will be crushed by a boulder is remote.

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