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Coherent with laughter: Subjective experience, behavior, and physiological responses during amusement and joy

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ABSTRACT

Emotion research historically has adopted a fairly homogeneous view of positive emotions. The aim of the current study was to explore how two positive emotions, amusement and joy, differ in subjective, behavioral, cardiovascular, and respiratory characteristics. Thirty-nine participants viewed two film clips, each selected to elicit amusement or joy. As predicted, participants reported more amusement, showed more positive facial expressions and laughter, and exhibited less heart rate deceleration and a larger increase in respiratory amplitude in response to the amusement clip than in response to the joy clip. In addition, subjective, behavioral, and physiological indicators were more closely related in amusement than joy, which was largely attributable to laughter during amusement. The current study adds to a growing literature suggesting the importance of adopting a more nuanced conceptualization of positive emotion.

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1. Introduction

Emotion researchers historically have studied one positive emotion — usually referred to as happiness — and several negative emotions (Ekman, 1992; Schwartz et al., 1981; Stemmler, 1989; Werner et al., 2007). Recently, however, efforts have been made to better understand the potentially unique contributions of different positive emotional states (Argyle, 2001; Avia, 1997; Edwards and Cooper, 1988; Fredrickson, 2000; Keltner and Shiota, 2003; Sauter and Scott, 2007). As noted by Shiota et al. (2004), different positive emotions serve different functions in relationship development and maintenance, depending on the type and stage of relationship. For example, a potential romantic partner's display of joy may provide important information about his or her sociability, and hence desirability. Shared amusement may facilitate the establishment of values and norms among members of a social or ethno-cultural group (Zilberg, 1995) and laughter displays can serve as both incentive and reward for behavior (Provine, 2000). Thus, if positive emotions are not isomorphic in function, it is reasonable to expect that they would differ in their experiential, behavioral, and physiological components. In particular, positive emotions associated with laughter (e.g., amusement) may have a different architecture and serve unique interpersonal and physiological functions. The current study compares self-report, behavioral, cardiovascular, and respiratory responses, along with the interplay among these components (i.e., coherence; Ekman, 1992), in amusement and joy.

Identifying the behavioral and physiological characteristics of different positive emotions is made challenging by inconsistent terminology in the current literature. For example, humorous stimuli (e.g., comedy film clips) have been used to elicit emotional states described as "joy" (Britton et al., 2006; Hubert and de Jong-Meyer, 1991; Johnson and Fredrickson, 2005), "mirth" (Goel and Dolan, 2007), "amusement" (Giuliani et al., 2008), "happiness" (Dawkins et al., 2007), and even "exhilaration" (Ruch, 1995). In addition, positive emotion terms such as "joy" and "mirth" have been used somewhat interchangeably (Panksepp, 2000), and combined descriptors such as "happiness/amusement" (Roberts and Levenson, 2006) and "joy/laughter" (Block et al., 1991) are often used. This blending of terminology is confusing, and also at odds with theoretical positions asserting that positive emotions (e.g., joy and amusement) are not equivalent (Izard, 1977; Shiota et al., 2004). In the current study, we use the term "amusement" to refer to the emotion evoked by humorous material and "joy" to refer to the emotion brought about by well-being, success, or good fortune (Merriam-Webster Online, 2010). We use these terms rather than "happiness," which we believe may encompass or describe both of these emotional states.

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1.1. Previous research on differences among positive emotions

Early studies argued that there are unique experiential and behavioral profiles for the basic emotions of fear, disgust, sadness, anger, surprise, and happiness, and that these are accompanied by distinct patterns of autonomic nervous system (ANS) activation (Ekman et al., 1983). Although debated (Russell, 1980), it is generally agreed that the clearest distinctions in physiology are found when negative emotions are compared to positive emotions. Negative emotions are usually characterized by greater physiological activation and positive emotions are more often typified by physiological deactivation (Andreassi, 2007; Ekman et al., 1983; Fredrickson and Levenson, 1998; Fredrickson et al., 2000).

The growing interest in creating a more nuanced understanding of specific positive emotions (e.g., Shiota et al., 2004) has inspired researchers to look more closely at responses that may distinguish them from one another. Empirical evidence provides support for differences in both subjective experience and behavior among various positive emotions. For instance, several studies have found differences in self-reports between amusement and contentment (Christie and Friedman, 2004; Fredrickson and Branigan, 2005; Fredrickson et al., 2000). Differences have also been found among awe, amusement, and pride in emotional displays (Shiota et al., 2003) and between variants of "happiness" in facial electromyographic responses (Lang et al., 1993). Taken as a whole, these findings provide support for the idea that specific positive emotions, like negative emotions, involve distinct subjective and behavioral responses.

1.2. Comparisons of autonomic physiology among positive emotions

Few studies have directly compared physiological responses among positive emotions. In one study that used films to compare amusement and exhilaration, exhilaration was associated with decreases in cardiac pre-ejection period (PEP; suggesting greater sympathetic activation) and increases in heart rate (HR), whereas amusement was associated with increases in PEP and no changes in HR (Harrison et al., 2000). Another study, also using film clips, found no difference in cardiovascular reactivity between amusement and contentment (Fredrickson et al., 2000). Happiness (which may or may not be the same as joy, as noted earlier) has been associated with greater increases in HR than surprise (Cacioppo et al., 1998), and smaller increases in respiratory sinus arrhythmia (RSA) than sexual desire (Ritz et al., 2005). Studies of the effects of positive emotional stimuli on respiration rate and respiratory amplitude have revealed both increases and decreases in both of these indices (for review see Boiten et al., 1994). In sum, many more data are needed to begin to understand whether and how the positive emotions differ from one another autonomically.

In the present study we were particularly interested in examining cardiovascular and respiratory responses in amusement. The view that amusement has a distinct ANS signature has garnered both support (Ekman, 1999) and skepticism (Martin, 2007). One reason to expect differences between amusement and other positive emotions such as joy is the occurrence of laughter (Pearce, 2004), which may have multiple physiological effects. For example, laughter acts on the myocardium, causing increases in HR (Buchowski et al., 2007), and on the respiratory system, leading to more initial exhalations than inhalations, and causes frequent breaks or "interval pauses" during respiration (Fry and Rader, 1977). Much remains to be learned about specific physiological effects of laughter (Panksepp, 2000) and how they may contribute to differences in the architecture of amusement versus a comparable emotion that is not as characteristically associated with laughter, namely joy.

1.3. The current study

For the present study, we used film clips selected to evoke amusement and joy, and compared self-reported emotional experience, emotional facial behavior, and physiological responses (i.e., cardiovascular and respiratory) between the film stimuli. With respect to our physiological measures, in addition to HR, which captures both sympathetic and parasympathetic influences on the heart, we examined cardiac PEP as an indicator of cardiac sympathetic activation and RSA as an indicator of cardiac parasympathetic activation (Cacioppo et al., 1994). We also examined respiration rate and respiratory amplitude, which are typically negatively related to one another, as deeper respirations take more time.

We expected that participants would report emotion-specific subjective experience, namely greater amusement in response to the clip selected to elicit amusement, and greater joy in response to the clip selected to elicit joy. We also expected that participants would display more laughter and greater overall positive facial affect during the amusement clip than during the joy clip. Given our expectation that amusement would be accompanied by laughter, which in turn would exert respiratory influences on the myocardium, we expected amusement would be associated with more RSA and greater respiration rate (RR) and respiratory amplitude (RA) than joy. We also expected laughter to increase HR, as found in previous research (Buchowski et al., 2007). Although Harrison et al. (2000) reported an increase in cardiac PEP (suggesting sympathetic deactivation) during an amusing film, we made no specific prediction regarding PEP because other authors suggest that laughter is associated with sympathetic dominance (e.g., Sakuragi et al., 2002). Finally, to better understand the interplay among subjective experience, behavior, and physiology in amusement and joy, we conducted supplemental analyses to investigate the relations among these three components of emotion during the two emotion conditions.

2. Method

2.1. Participants

The sample included 39 undergraduate students (27 females) ranging in age from 18 to 54 years ($M = 21.5$, $SD = 7.3$). Participants were recruited through an online subject pool for students enrolled in psychology courses. Due to the potential influences of smoking, eating, and drinking on the ANS, smokers were excluded and participants were asked not to eat or drink anything 3 h prior to the experiment. The study was conducted in accordance with the Declaration of Helsinki and was approved by the university institutional review board. Participants provided written informed consent and received research participation credit.

2.2. Film stimuli

Two film clips were used to elicit amusement. One clip (Williams) was 206 s long and depicted comedian Robin Williams doing a standup routine featuring anecdotes about illicit drug use. The other amusing clip (Cosby) was 224 s long and featured comedian Bill Cosby doing a standup routine in which he discusses the challenges of growing up with his mother. The joy clip was 149 s long and featured the figure skater Sarah Hughes reacting to winning the Olympic gold medal at the 2002 Winter Olympic Games. Neutral and sad film clips were also included for a separate study but are not reported here because they are not relevant to the present study's aim of differentiating positive emotions.

The Williams and Cosby clips have been shown in previous research to evoke the specific target emotion of amusement (Goldin et al., 2005; Gross and Levenson, 1995; Hutcherson et al., 2005; Rottenberg et al., 2007). The Olympics clip has been used in prior studies to elicit "happiness" (Gruber et al., 2008, 2010; Werner et al., 2007); however, we used it with the assumption that it would elicit the target emotion joy, given our definition provided above.