RESEARCH ARTICLE

A Provisional Taxonomy of Subjectively Experienced Positive Emotions

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Abstract

Over the past two decades, scholars have conducted studies on the subjective experience of over 30 positive emotional states (see Weidman, Steckler, & Tracy, 2017). Yet, evidence from research on the non-verbal expression and biological correlates of positive emotions suggests that people likely experience far fewer than 30 distinct positive emotions. The present research provided an initial, lexically driven examination of how many, and which, positive emotions cohere as distinct subjective experiences, at both the state and trait levels. Four studies (including two pre-registered replications) using factor and network analyses of 5939 participants' emotional experiences, elicited through the relived emotions task, found consistent evidence for nine distinct positive emotion states and five distinct traits. At both levels, many frequently studied positive emotions were found to overlap considerably or entirely with other ostensibly distinct states in terms of the subjective components used to describe them, suggesting that researchers currently study more positive emotions than individuals experience distinctively. These findings provide the first-ever comprehensive portrait of the taxonomic structure of subjectively experienced positive emotions, with the ultimate aim of inspiring further examination of the positive emotion space at the subjective experiential as well as more biological and behavioral levels of analysis.

Keywords Emotion · Positive emotion · Taxonomy · Subjective experience

In recent years, numerous empirical studies have examined the causal antecedents, correlates, and functional consequences of distinct positive emotions such as awe, compassion, gratitude, and pride (for reviews, see Shiota, Campos, Oveis, Hertenstein, Simon-Thomas & Keltner, 2017; Tugade, Shiota, & Kirby, 2014). A quantitative review of this literature found that over 30 ostensibly distinct subjective positive emotional states were measured or manipulated in studies reported in the journal *Emotion* from 2001 to 2011 (Weidman et al., 2017).

In contrast, studies on non-subjective components of positive emotions (e.g., physiology, non-verbal expression, neural correlates) suggest that there are likely far fewer than 30 distinct positive emotional states. For example, historically, many in the field believed that only one positive emotion was associated with a distinct, cross-culturally recognized non-verbal facial expression (i.e., happiness; Ekman & Friesen, 1971), More recent work has added to this list with a set of 5–10 positive emotions that appear to be expressed and recognized across cultures (e.g., amusement, awe, coyness, interest, and pride, along with happiness; Cordaro, Sun, Keltner, Kamble, Huddar & McNeil, 2018; Cordaro, Sun, Kamble, Hodder, Monroy & Cowen, in press; Tracy & Robins, 2008), or at least within North American populations, for emotions such as contentment and love (Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013). Similarly, when neuroscientists have proposed sets of brain systems corresponding to distinct positive emotions, their lists have typically included relatively few states (e.g., based on his research on rats, Panksepp has listed *seeking*, *lust*, *care*, and *play* as positive distinct emotional states; Panksepp, 2007; Panksepp & Watt, 2011). Furthermore, a review of research on positive-emotion-

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specific physiology led Shiota and colleagues to propose that 10 positive emotion constructs represent distinct, functional entities (Shiota et al., 2017). Consistent with these accounts, a study of the hierarchical structure of emotion words—in which participants sorted a long list of words into categories based on semantic similarity—identified two high-level and 10–12 lower-level distinct positive emotion categories (Shaver, Schwartz, Kirson, & O'Connor, 1987). Together, these various bodies of work using a range of methodological approaches and sources of data converge on the suggestion that there are likely to be no more than 5–12 distinct positive emotions. While none of these lists of positive emotions is likely to represent a definitive or final set, together they strongly suggest that numerous scientists agree that far fewer than 30 positive emotions exist as distinct experiences.

Yet prior studies have not addressed the question of how many positive emotions are *subjectively experienced* as distinct, by which we mean positive emotions whose experience is associated with a set of elements (i.e., thoughts, feelings, and behavioral action tendencies) that are not redundant with elements that characterize the experience of other positive emotions. Furthermore, prior studies have not examined whether those positive emotions that are subjectively distinct align with the positive emotions that researchers regularly treat as if they are distinct. Addressing these questions is critical, for several reasons. First, current research findings regarding certain positive emotions may in fact apply to multiple emotions which have been treated as distinct but in fact are not. For example, *compassion*, *nurturant love*, and *tenderness* have each been conceptualized as a distinct prosocial emotion involving care and concern for dependents yet are treated as distinct entities in the literature (e.g., Buckles, Beall, Hofer, Lin, Zhou & Schaller, 2015; Shiota et al., 2014; Goetz, Keltner, & Simon-Thomas, 2010). Although some researchers may view these constructs as distinct entities, more work is needed to empirically ascertain and define the boundaries among them, given their superficial similarity.

Specifically, if these emotions are largely overlapping subjective experiences, then empirical findings regarding any one of these emotions may actually reflect shared properties among all three, potentially requiring the field to revisit its understanding of these states. To unpack this example further, tenderness has been empirically shown to be elicited by and directed toward vulnerable dependents (i.e., children) regardless of whether these dependents have an acute need (e.g., Hofer, Buckels, White, Beall, & Schaller, 2018; Lishner, Batson, & Huss, 2011; Niezink, Siero, Dijkstra, Buunk, & Barelds, 2012). Yet, in a recent authoritative review of the positive emotion space, nurturant love was similarly defined as "an emotional response to the important adaptive opportunity presented by offspring and other vulnerable kin," and compassion was noted to be "a construct similar to nurturant love" (Shiota et al., 2017, pp. 630 and 633). Furthermore, and

not surprisingly, similar empirical findings have emerged for compassion, which has been shown to be elicited by meek and needy individuals (e.g., the elderly; homeless people; Oveis, Horberg, & Keltner, 2010). In contrast, we are not aware of any empirical work showing that these emotions have *divergent* antecedents or consequences (e.g., showing that a particular antecedent elicits tenderness and compassion but *not* nurturant love). In absence of this kind of work distinguishing between these conceptually similar emotions, it remains possible that researchers are using three different labels to refer to what is in fact the same subjective emotional state. This practice could confuse readers and create the spurious impression of a wider variety of positive emotion experience than is warranted based on empirical data, which would be problematic for the field.

Second, arriving at a better taxonomic understanding of subjectively experienced positive emotions could facilitate subsequent cross-modal analyses of the positive emotion landscape. If a distinct set of subjectively experienced positive emotions is identified, it would be fruitful to compare this set with those positive emotions that are distinct at the biological, behavioral, or physiological levels. It is of course possible that different emotions may emerge as distinct across levels of analysis. Still, comparative work identifying emotions that do show distinctness across modalities could prove useful because, historically in affective science, this has been a defining criterion for considering emotions as "discrete" or "basic" in an ultimate sense (e.g., Ekman, 1992). Comparative work of this nature is particularly needed in the positive emotion domain: whereas converging evidence over the past half-century has pointed to a small set of negative emotions that are distinct in subjective experience and biological or behavioral features (i.e., anger, contempt, disgust, embarrassment, fear, sadness, and shame; Ekman & Friesen, 1971; Harmon-Jones, Bastian, & Harmon-Jones, 2016; Keltner, 1995), the study of distinct positive emotions (as opposed to the positive affect *dimension*; Russell & Barrett, 1999) has proliferated only since the turn of the century, with little attention paid to taxonomic questions.

Historical precedent also suggests that taxonomic work providing an examination of which positive emotions are distinct at the level of subjective experience could prove generative both in systematizing inquiry in this domain as well as inspiring additional work aimed at refining the taxonomic structure. This was the case for the Linnaean taxonomy, a hierarchical classification system proposed by eighteenth century biologist Carl Linnaeus in which plants, animals, and minerals form three higher-order classes, with many subcategories for each (e.g., animals included mammals, amphibians, and insects). Not only did this system provide the first-ever comprehensive framework through which to classify the planet's diverse species, it also generated an initial knowledge base upon which subsequent revisions have been made (e.g., moving from a five-kingdom classification to a three-domain

classification). In the psychological realm, during the late twentieth century, multiple research teams produced convergent findings suggesting that personality could be described by five broad dimensions: Extraversion, Neuroticism, Conscientiousness, Agreeableness, and Openness/Intellect (e.g., Goldberg, 1990). The resulting Big Five paradigm has been extremely generative and unifying over subsequent decades (John, Naumann, & Soto, 2008). Yet at the same time, personality scientists have shown a particular affinity for challenging the Big Five structure and proposing potential revisions or modifications, all of which has created a vibrant research environment in the area of personality structure (e.g., Ashton & Lee, 2007; Block, 1995; DeYoung, Quilty, & Peterson, 2007). We expect that a taxonomy of distinct subjectively experienced positive emotions may be similarly generative.

The Present Research

We conducted the first comprehensive examination of the structure of subjectively experienced positive emotions at both the state and trait levels, based on a data-driven analysis of the words used to describe thoughts, feelings, and behavioral action tendencies that typically characterize these states. We began with a broad set of commonly studied positive emotions and aimed to identify which of these emerged as experientially distinct, as opposed to sharing largely overlapping subjective content. We did so by eliciting these potentially distinct positive emotional states using the relived emotion task, in which participants describe in detail a past emotional experience and rate their current feelings in response, and we used factor analysis to determine how many and which positive emotions emerged as distinct subjective state experiences (Studies 1–2) and trait dispositions (Studies 3–4). We then used network analyses to examine the structural interrelations among each positive emotion that emerged as distinct.

With these results, we compared the structure of subjectively experienced positive emotions that emerged at the state and trait levels. We anticipated that state positive emotions might show a more diffuse structure, given that states capture within-person variability from moment to moment and are driven by specific contextual factors and appraisals that can promote differentiated experiences (e.g., Roseman & Smith, 2001), whereas traits capture between-person variability and may be shaped more by a person's general tendency to feel positively across contexts (e.g., Russell & Barrett, 1999). We also anticipated that our findings would speak to the ongoing debate in affective science over whether the emotion space is best characterized by discrete or dimensional models. If we uncovered a diffuse taxonomy of positive emotions with many states/traits emerging as distinct, it would support discrete models (e.g., Keltner & Haidt, 1999; Tracy, 2014; Shiota

et al., 2017). In contrast, an emergent taxonomy dominated by a small number of dimensions that in part reflect core affective components such as pleasantness, controllability, or activation would lend more support to dimensional models (Roseman & Smith, 2001; Russell & Barrett, 1999; Watson & Tellegen, 1985).

To prioritize robustness, we employed large samples (total $N = 5939$), and Studies 2 and 4 were pre-registered replications of Studies 1 and 3, respectively. Additionally, for state positive emotions we replicated our analyses across samples of students (Study 1) and adults (Study 2). Data, syntax, and materials for all studies, as well as pre-registrations for Studies 2 and 4, are available on the Open Science Framework (https://osf.io/8h6gc/).

Study 1

Method

Participants

A total of 2390 individuals participated in Study 1. Of these, 1985 were undergraduate students participating in exchange for course credit and 405 were MTurk workers. We excluded 106 students (5% of that subsample) and 32 MTurk workers (8%) for either not writing about a positive emotion experience as instructed or failing a Likert-based attention check. This left a final sample of 2252 ($n = 1879$ students, $M_{age} =$ 20.15; SD = 3.45; 60% women, 24% Caucasian, 47% East Asian, 15% South Asian, 14% other; $n = 373$ MTurk workers; $M_{age} = 35.22$; SD = 11.81; 48% women, 61% Caucasian, 20% South Asian, 7% East Asian, 6% Hispanic/Latino, 6% other). Demographic data were not collected for 346 (18%) participants in the student sample due to experimenter error; these participants completed a version of the survey for which we forgot to include demographic questions. With this large sample size of 2252 participants (and 67 variables), we far exceed the typical recommendations for sample size, as well as the ratio of participants-to-variables, for our primary exploratory factor analyses (Costello & Osborne, 2005; MacCallum, Widaman, Zhang, & Hong, 1999).

Procedure

Selection of Emotions to Include We included 17 positive emotions in this research: admiration, amusement, attachment love (i.e., love that a one feels for a committed caregiver), authentic pride, awe, contentment, empathy, enthusiasm, gratitude, hope, hubristic pride, interest, nurturant love (i.e., love that a one feels for a dependent), romantic love, schadenfreude, sympathy, and tenderness. These 17 emotions were a subset of a broader set of 23 positive emotions that were found,

based on a comprehensive quantitative analysis, to be a target of research in at least three empirical studies reported in the journal *Emotion* during its first decade of publication, from 2001 to 2011 (see Weidman et al., 2017). To derive that original list of 23 positive emotions, we coded those studies on the basis of a consensual definition of positive emotions, as those that involve pleasant feelings (although, we acknowledge, others have defined positive emotions in a variety of ways, including as those that lead to socially desirable consequences; cf., Solomon & Stone, 2002). The original set of 23 positive emotions was reduced to 17 after excluding six emotions that were found, in a series of bottom-up, factor-analytic investigations, to be (a) entirely overlapping in subjective content with other emotions included in the set (i.e., happiness, joy, and elation were found to be redundant with contentment), (b) best conceptualized as broad core-affect dimensions (i.e., calmness is best conceptualized as low arousal), (c) best represented by a blend of multiple emotions already included (i.e., compassion was found to be comprised of components representing empathy and sympathy), or (d) a superordinate category best represented by narrower emotions already included (i.e., love was found to be a broad category not distinct from narrower feelings of attachment, nurturant, and romantic love; Weidman & Tracy, in press). In contrast, all 17 of the emotions included here were previously found to have at least some distinctive subjective experiential content (i.e., Tracy & Robins, 2007; Weidman & Tracy, in press). The present research therefore represents an attempt to uncover a provisional taxonomy of the most commonly studied subjectively experienced positive emotions that have been demonstrated to have at least some distinctive subjective content.

Two emotions in this set may warrant additional explanation for their inclusion: hubristic pride and empathy. Hubristic pride may not be an entirely positive emotion, but it was included here because a person who often experiences this emotion typically derives some pleasure from these feelings, even if those feelings do not lead to socially desirable outcomes (see Tracy & Robins, 2007; Tracy, Cheng, Robins, & Trzesniewski, 2009). Empathy was included because although it has been defined in myriad ways, not all of which are primarily positive or even emotional in nature (e.g., the ability to take another's perspective; see Cuff, Brown, Taylor, & Howat, 2016, for a review), numerous affective scientists view empathy as a predominantly positive emotional experience (Morelli, Lieberman, & Zaki, 2015), and we identified multiple studies that conceptualized empathy in this manner (e.g., Greitemeyer, Osswald, & Brauer, 2010; Van Lange, 2008).

Selection of Emotion Terms Participants completed 67 items meant to represent these 17 positive emotions. Fourteen of these items were taken from the Authentic and Hubristic Pride Scales, which were developed through a comprehensive, bottom-up process meant to identify the subjective

components characterizing lay-person experience of pride (Tracy & Robins, 2007). The remaining 53 emotion items were taken from reliable 5–8 item self-report scales previously developed for assessing the remaining 15 positive emotions (Weidman & Tracy, in press). These scales were also developed in a predominantly bottom-up manner, in which lay persons were asked to generate thoughts, feelings, and action tendencies that characterized the experience of each positive emotion. This yielded an initial pool of 1014 subjective components. Multiple iterations of factor analysis were used to narrow this over-inclusive pool down to sets of components that consistently characterized experiences of one positive emotion (e.g., admiration), in that they loaded strongly on a factor representing that emotion (i.e., above .40) and showed low cross-loadings (i.e., less than .30) on factors representing conceptually similar emotions (e.g., for admiration, these included awe and gratitude). This process yielded a total of 101 subjective components, including 5–8 for each emotion, which were converted to self-report scale items for each emotion (see Weidman & Tracy, in press; see https://osf.io/8h6gc/ for a complete list of scale items).

To reduce participant burden for the current studies, we conducted a pilot study to trim the number of items included in each scale. Three-hundred and fifty adults were recruited to participate through Amazon Mechanical Turk (MTurk). Forty-seven (13%) were excluded for either failing to write about an emotional experience or failing a Likert-based attention check item, leaving a final sample of 303 participants ($M_{age} = 36.09$; SD = 11.99; 51% women; 66% Caucasian, 10% East Asian, 8% African American, 5% Hispanic/Latino, 11% other). We asked participants to complete the RET by recalling an occasion when they "experienced a pleasant emotion in a social situation." We chose this prompt because it provided an opportunity to write in an open-ended manner about an episode of any specific positive emotion(s) in the kind of situation positive emotions typically occur, given that many of the positive emotions participants reported on are frequently experienced in social situations (e.g., admiration, empathy, authentic pride). As a pilot effort to assess experiences of a wide range of positive emotions, we viewed this approach as more appropriate than one that would target any single specific emotion and consequently exclude others. In contrast, in Studies 1-2 of this manuscript, we used more targeted prompts (e.g., asking participants to write about an episode of admiration), consistent with our goal of examining the structure of positive emotions in situations centered on specific positive emotions. After being prompted to write about a pleasant emotion in a social situation, pilot study participants reported the extent to which all 101 items on the 15 positive emotion scales characterized their emotional experience, using a five-point scale (1 = "not at all"; 5 = "very much"). We did not create short versions of the Authentic and Hubristic Pride Scales because the full-

length versions of these scales have received considerable attention in prior research, and we aimed to maintain consistency with prior work.

We used the data that emerged from this pilot study to construct short versions of the 15 positive emotion scales. First, to prioritize distinctiveness of each scale, we selected the three items from each scale that had the lowest average correlations with all other items in the data set, excluding items on the same scale (e.g., the average correlation between each item on the admiration scale and the other 96 non-admiration scale items in the data set). Next, we computed the internal consistency for these three-item composites; if this value fell at .70 or above, then the composite was used as the short scale for the given emotion. If the internal consistency fell below .70, we added the item from the respective positive emotion scale with the fourth-lowest correlation with all other items in the data set and re-computed the internal consistency. If the internal consistency was still below .70, we then added the item with the fifth-lowest correlation with all other items. The one exception to this stopping rule concerned the contentment scale. We settled on a three-item composite to measure this emotion even though this composite showed an internal consistency of .68. We made this decision to avoid using either "I felt happy" or "I felt content" as scale items, given that these items are also typically used to assess the emotional dimension of pleasantness (Barrett & Russell, 1998).

This process yielded a total of 53 items, 3–5 for each scale which, coupled with the 14 items from the Authentic and Hubristic Pride Scales, yielded the 67 items that participants completed in this study. These positive emotion scales showed good internal consistencies on average (αs = .68–.84; M = .74; SD = .04). Importantly, these short scales captured highly similar content as the original, full-length scales: correlations between the original and short version of each scale exceeded .85 (M = .92; SD = .04); the mean reported intensity aggregated across all 15 original scales (M = 3.16, SD = 0.68) was nearly identical to the mean intensity aggregated across all 15 short scales (M = 3.19, SD = 1.00); and the correlation between the profile of the 15 individual means (i.e., the rank-ordering of mean-intensities) across the original and short scales was .82 (see Table S1). The resulting 17 scales showed adequate to good internal consistency in Study 1 following episodes of each target emotion (e.g., α = .60 for the admiration scale following admiration episodes; αs = .57–.87; M = .68, SD = .08; see Tables S2-S18).

Participant Tasks Participants were asked to complete the relived emotion task (RET; Ekman, Levenson, & Friesen, 1983), in which they recalled and described in detail a state experience of one positive emotion; this type of recall methodology is widely used and has been shown to reliably elicit distinct emotion experiences (e.g., Ekman et al., 1983; Siedlecka & Denson, 2019). Participants completed this task twice, for two different emotions randomly selected from a list of 17 positive emotions. An average of 211 participants completed the RET for each of the 17 emotions (SD = 68.63; range 153–363).

Prior to each RET, participants read a definition of the emotion they were asked to recall, to ensure that all participants interpreted the emotion term in a similar manner, given that single emotion words are often interpreted differently by different people (Shaver et al., 1987). For example, participants instructed to recall an episode of admiration were told, "By admiration, we mean a situation in which you felt a great deal of respect for a specific person, strongly valued that person's opinion, and wanted to strive to emulate that person." Of importance, the definitions that participants read for each emotion were based on phrases from the items included in each full-length scale that were *not* ultimately included in the short scales used to measure each emotion (short scales were used to reduce participant demand). For authentic and hubristic pride, these definitions were based on prior work (Ashton-James & Tracy, 2012). Definitions used for all emotions are available at https://osf.io/8h6gc/.

After completing each of the two RETs, participants rated the extent to which each of 67 emotion terms characterized their feelings during the emotional experience (1 = "not at all"; 5 = "very much"). These items were presented in a randomly determined order for each participant.

Results

Analytic Plan To derive a taxonomy of subjectively experienced state positive emotions, we performed a meta-analytic factor analysis following a procedure outlined by Becker (1996). We first computed an aggregate correlation matrix among all 67 items used to measure each positive emotion included in the study. This involved meta-analyzing the 17 correlation matrices for the 67 items using r to z transformations (i.e., one 67 × 67 correlation matrix each following narratives of admiration, amusement, awe, etc.). This method has both theoretical and practical advantages for our purposes: First, it yields an aggregate correlation matrix among all 17 positive emotions of interest, with each correlation in this matrix representing the average relation between any two emotions across situations meant to elicit all 17 emotions under consideration. Colloquially, this matrix can be understood as indicating the degree of co-occurrence among each pair of commonly studied positive emotions in a wide range of contexts in which positive emotions are felt, but not necessarily contexts that target the two positive emotions in question (e.g., the degree to which admiration and gratitude co-occur across many positive emotional scenarios, including but not limited to those specifically eliciting admiration and gratitude). We view this attempt to aggregate across positive emotional contexts—thereby canceling out idiosyncrasies that might result from studying experiences occurring in any single

positive emotional context—as well-suited to our aim of holistically mapping the subjective experiential positive emotion domain (but also see Table S46 for the average, minimum, and maximum value for the correlation between each positive emotion pair). Second, on a practical note, this aggregate correlation matrix is an ideal input for our key planned analysis: A meta-analytic factor analysis of the 17 frequently studied positive emotions (Becker, 1996).

Indeed, we next used this aggregate positive emotion correlation matrix as input into an exploratory factor analysis (EFA). To determine the optimal number of factors to extract, we first employed Velicer's minimum average partial (MAP) method using the *Psych* package in R (Revelle, 2019). MAP computes the average squared partial correlation among all variables in a data set, following the extraction of each subsequent factor. When the average partial correlation reaches a minimum, it signifies that no meaningful variance remains in the data, and it is recommended that one extracts the number of factors corresponding to that minimum. MAP is considered one of the best metrics for determining the number of factors to extract from a data set (D. Condon, personal communication, July 12, 2018; Zwick & Velicer, 1986).

Given a particular pattern of correlations among variables, MAP will yield identical results regardless of the sample size from which those correlations were derived. This fact was critical here, given our interest in comparing the structure of state and trait positive emotions across Studies 1–2 (Ns = 2252 and 2594) and 3–4 (Ns = 384 and 406), which varied in sample size. This property of MAP contrasts with another commonly used method for determining the appropriate number of factors to extract, parallel analysis. In parallel analysis, the eigenvalue for each factor in a dataset is compared to the corresponding eigenvalue generated by many datasets of the same size but comprised of random variables (i.e., random noise data). A researcher extracts the number of factors for which the corresponding eigenvalue in one's data is greater than the 95th percentile of eigenvalues from the random noise data (i.e., the factors in one's data that account for more variance than random noise). Yet, eigenvalues of factors in random noise data will be smaller in large samples, leading parallel analysis to recommend extraction of a larger number of factors as sample size increases (Revelle, 2015). Parallel analysis would therefore not be suitable for determining the number of factors to extract in these studies.

MAP has been shown to systematically underestimate the number of factors characterizing a data set (Zwick & Velicer, 1986), so we used its recommendation as a lower bound. We examined the solution associated with the MAP recommendation, as well as each subsequent solution in which one additional factor was added, up to a 17-factor solution (corresponding to the 17 potentially distinct positive emotions

included in Study 1). For example, if MAP recommended eight factors, we examined the eight-factor solution, nine-factor solution, ten-factor solution, and so on, up to the 17-factor solution. We stopped this process when adding an additional factor did not yield a factor which (a) was theoretically interpretable as a positive emotion and (b) consisted of at least three items with primary loadings of > .40 (see Clark & Watson, 1995; Weidman & Tracy, in press). We reasoned that this procedure would allow us to identify the maximum number of positive emotions which could plausibly be considered distinct subjective entities. For the sake of completeness, we report several additional fit statistics provided by the VSS command in R for each possible factor solution (i.e., BIC, Complexity, MAP, RMSEA; see Table S19).

How Many State Positive Emotions Emerged as Distinct Subjective Experiences?
MAP recommended extracting eight factors. Following the procedure described above, we found that each factor in the eight-factor solution met our loading criteria and was interpretable as a distinct positive emotion. The nine-factor solution included an additional factor in which all three items representing *interest* loaded at or above .42. In contrast, the ten-factor solution included an additional factor on which only one item had a primary loading above .40 (and only two items had primary loadings above .35). We therefore determined that a nine-factor solution best characterized the data. We subsequently extracted nine factors in an EFA with maximum likelihood estimation and oblimin rotation. These nine factors explained 46% of the variance in the data and individual factors explained 9, 7, 6, 5, 5, 4, 4, 4, and 3% of the variance, respectively.

These factors appeared to capture nine distinct emotional experiences (see Table 1). Factor 1 captured *authentic pride* and factor 2 captured *hubristic pride* and also included all three schadenfreude items, though these items had much lower loadings than those for hubristic pride. Factor 3 (which we labeled *love*) captured a blend of attachment love and tenderness, and factor 4 (labeled *compassion*) captured a blend of empathy, sympathy, and nurturant love. Factor 5 captured *amusement*, factor 6 captured *hope*, factor 7 captured *gratitude* but also included components of admiration, factor 8 captured *awe*, and factor 9 captured *interest*.

Figure 1 depicts network analyses of the structural interrelations of these nine distinct state positive emotion experiences, and Fig. 2 depicts the structural interrelations among all 17 state positive emotions initially included in the study (see Borsboom & Cramer, 2013). In Fig. 1, the nine positive emotional experiences are well dispersed spatially, reflecting the fact that they are relatively orthogonal experiences and show only modest intercorrelations (M = .16; SD = .12, range = − .12 to .45; see Table 2). In contrast, in Fig. 2, several of the 17 emotions are tightly clustered (e.g., attachment love,

Table 1 Factor loadings for higher-order meta-analytic factor analysis of state positive emotions (Study 1)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Authentic pride	I felt accomplished	**0.79**								
Authentic pride	I felt like I was achieving	**0.76**								
Authentic pride	I felt successful	**0.75**	0.11							
Authentic pride	I felt fulfilled	**0.61**		0.11					0.11	
Authentic pride	I felt confident	**0.59**				0.11				
Authentic pride	I felt like I had self-worth	**0.58**			−0.10					0.14
Authentic pride	I felt productive	**0.58**		−0.18	0.17	0.15	0.10	0.12		0.12
Enthusiasm	I was on top of the world	**0.54**		0.22	−0.18	0.14		−0.12	0.25	
Contentment	I felt that all was right in the world	**0.48**		0.24	−0.11	0.16			0.16	−0.14
Attachment love	I felt secure	**0.46**		0.30			−0.10			
Admiration	I felt motivated to work harder	**0.40**		−0.14		−0.10	0.30	0.33		
Contentment	I wanted to stay in the moment	0.32		0.26	−0.13	0.25			0.17	
Hubristic pride	I felt arrogant		**0.77**					−0.11		
Hubristic pride	I felt egotistical	0.11	**0.73**							
Hubristic pride	I felt conceited		**0.72**							
Hubristic pride	I felt stuck up		**0.71**							
Hubristic pride	I felt snobbish		**0.70**							
Hubristic pride	I felt pompous		**0.67**			0.13				
Hubristic pride	I felt smug		**0.67**							
Schadenfreude	I wanted to point out someone else's shortcomings		**0.52**		0.16		0.16			
Schadenfreude	I thought that someone had it coming		**0.42**		0.21	0.18	0.14			−0.12
Schadenfreude	I thought that someone had brought something bad upon him or herself		0.37		0.29		0.13			−0.14
Attachment love	I felt a close bond with someone			**0.72**				0.10		
Tenderness	I felt a strong connection with someone			**0.71**						0.13
Tenderness	I felt warmth for someone		−0.10	**0.64**	0.12			0.12		
Tenderness	I felt great care toward someone			**0.59**	0.30					
Attachment love	I felt accepted by someone	0.21		**0.50**				0.21		
Tenderness	I wanted to hold someone's hand	−0.13		**0.43**	0.12		0.21	0.21		
Romantic love	I had a craving for someone		0.13	0.37		0.16	0.24		0.15	−0.12
Empathy	I tried to help find a solution to someone else's problem				**0.61**					
Nurturant love	I wanted to help someone grow	0.20		0.16	**0.56**					
Nurturant love	I wanted what was best for someone		−0.11	0.31	**0.51**					
Nurturant love	I tried to show patience with someone			0.13	**0.47**		0.20			
Sympathy	I felt pity for someone		0.31		**0.47**	−0.19			0.17	
Sympathy	I worried that someone would not be okay	−0.23	0.14		**0.46**		0.11		0.18	
Sympathy	I felt bad for someone	−0.10	0.25		**0.46**	−0.25			0.20	0.11
Nurturant love	I wanted to sacrifice my own needs for someone			0.31	**0.41**				0.15	
Empathy	I tried to relate to someone else's experience				0.35			0.20		0.19
Empathy	I reflected on a time I had experienced a similar situation as someone		0.13		0.30	0.12	0.10	0.14		
Amusement	I laughed					**0.72**				
Amusement	I was entertained					**0.68**				0.18

Table 1 (continued)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Amusement	Something seemed funny	−0.16	0.23			**0.59**				
Contentment	I enjoyed the situation	0.34			−0.13	**0.48**	−0.12			
Enthusiasm	I wanted to get other people excited	0.16			0.10	**0.44**	0.12			
Enthusiasm	I felt adventurous	0.21				0.38	0.25	0.12		
Hope	I tried to believe in myself	0.29					**0.56**	0.13		
Hope	I felt challenged			−0.12			**0.50**	0.11		0.18
Hope	I drew on my inner strength	0.24			0.20		**0.48**			
Romantic love	I felt vulnerable	−0.40		0.14	−0.10		**0.47**		0.16	
Romantic love	I was afraid of rejection	−0.20	0.17				**0.47**	0.12		−0.11
Hope	I tried to stay positive		−0.17		0.21	0.12	0.33			
Hope	I engaged in some wishful thinking					0.12	0.32	0.14	0.15	
Admiration	I felt as if I could learn a lot from a specific person							**0.63**		0.11
Gratitude	I thought that a specific person who helped me should be acknowledged							**0.55**	0.10	−0.13
Gratitude	I felt like I had benefitted from a specific person's action			0.15	−0.10	0.14		**0.51**		
Admiration	I felt a desire to become more like a specific person		0.17				0.16	**0.50**		
Gratitude	I felt appreciative toward a specific person			0.39				**0.49**		
Awe	I could not believe what I had just seen			−0.17					**0.66**	
Awe	I was rendered speechless								**0.64**	
Awe	I felt I was in the presence of something quite out of the ordinary							0.11	**0.46**	0.12
Awe	I continued to think about something I had just seen			−0.10		0.12		0.17	**0.41**	0.22
Romantic love	I felt giddy			0.20	−0.15		0.31		0.36	
Romantic love	I felt butterflies in my stomach	0.21		0.11	−0.14	0.25			0.29	
Interest	I paid close attention to what I saw and heard								0.13	**0.55**
Interest	My attention was absorbed			0.12					0.15	**0.53**
Interest	I felt engaged with what I was doing	0.26		0.17		0.12	0.12			**0.42**
Nurturant love	I gave my full attention to someone			0.37	0.14					**0.40**

Emotion scale = positive emotion scale which included an item. Loadings > .40 are bolded; loadings less than |.10| are left blank. $N = 2252$

tenderness, and gratitude), reflecting the fact that these 17 emotions are not all distinct entities, and often show strong intercorrelations (e.g., attachment love and tenderness correlated .65 on average; mean correlation = .28, SD = .17, range = −.24 to .68; see Tables S2-S18). Comparing Figs. 1 and 2 underscores a contribution of the taxonomic work reported here: We parsed a large group of somewhat overlapping state positive emotions into a smaller group of largely distinct experiences.

Ancillary Analyses The scale items included in the aforementioned factor analysis were somewhat imbalanced, in that we used previously validated, 7-item scales to represent each pride facet (Tracy & Robins, 2007), whereas for the other positive emotions, we used a set of 3–5 item scales that were developed with the goal of prioritizing brevity (Weidman & Tracy, in press). Factor emergence and order in this type of analysis are primarily determined by the magnitude and quantity of primary loadings on each factor; factors defined by a greater number of items and/
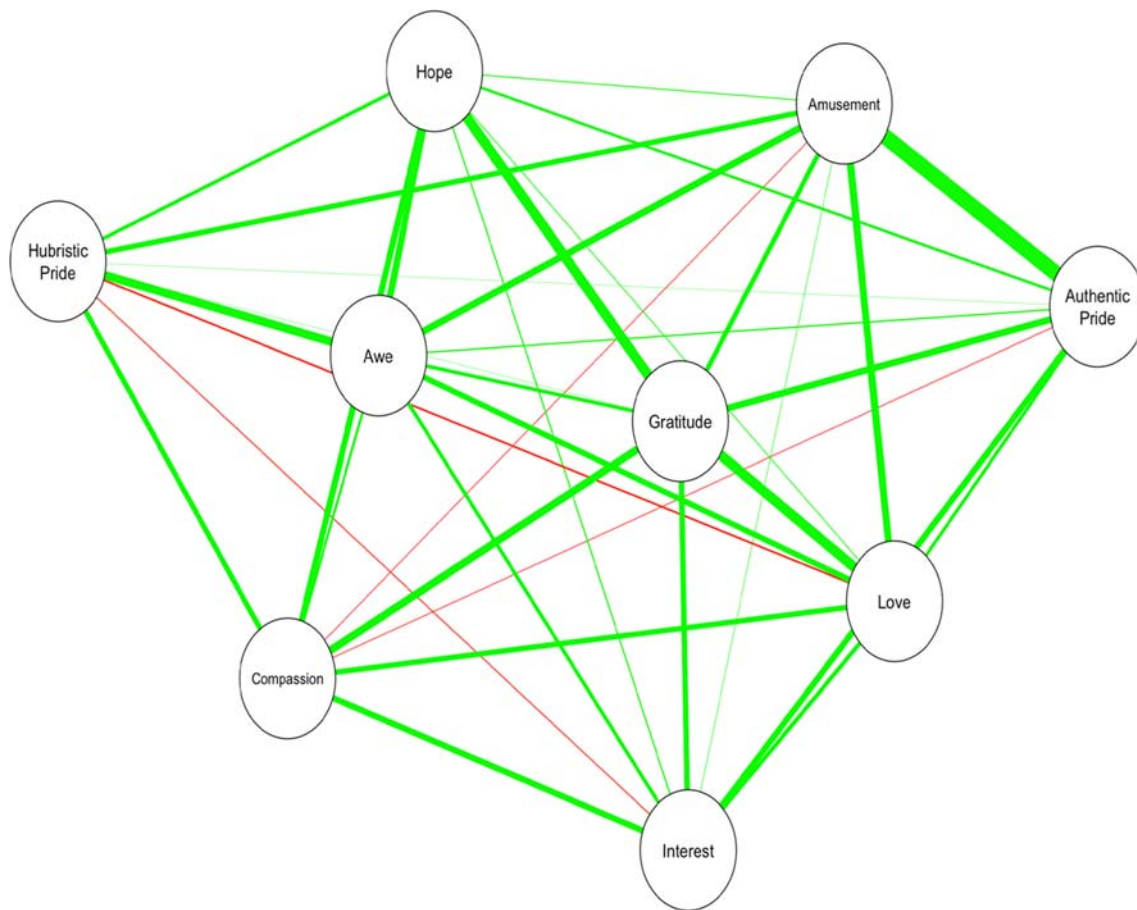
Fig. 1 Network depiction of higher-order state positive emotions (Study 1). Each node represents one positive emotion. Each line represents a correlation between emotions. Green lines indicate positive correlations, red lines indicate negative correlations, and line thickness indicates the magnitude of correlations (thicker lines indicate larger correlations). The position of the nodes within the network is based on an algorithm which causes strongly correlated emotions to cluster in the middle and emotions with weaker correlations to be located more peripherally (Fruchterman & Reingold, 1991; see also Borsboom & Cramer, 2013). This note applies to Figs. 1–8

or items with primary loadings of stronger magnitude will be the first to emerge in a factor analytic solution because these factors account for more variance in the overall solution. The fact that authentic and hubristic pride were represented with more items than the other positive emotions therefore could have artificially increased the likelihood that they emerged as distinct in our factor analysis and, at the very least, this methodological imbalance likely played a role in their emergence as the first two factors in the observed solution. As a result, the ordering of each factor in the overall solution *does not* speak to each emotion's relative strength or importance in an absolute sense.

To ascertain what effect this methodological imbalance may have had, we re-ran the aforementioned factor analysis while including only 3 items for authentic pride (i.e., "I felt accomplished," "I felt fulfilled," "I felt successful") and 3 items for hubristic pride (i.e., "I felt arrogant," "I felt pompous," "I felt stuck up"), and including the same sets of 3–5 items for each of the other 15 positive emotions. Distinct factors again emerged

for authentic and hubristic pride and, in fact, the exact same set of nine positive emotion factors as in the original factor analysis emerged here (see Table S42). Authentic and hubristic pride were the first and third factors in this solution, whereas they were the first and second factors in the original solution; love supplanted hubristic pride as the second factor in the ancillary solution (see Table 1 and Table S42). These findings suggest that the distinctness of the nine positive emotions observed in Study 1 was robust to our original decision of which items to include in the analysis.

Discussion

Study 1 provides initial evidence that state positive emotion subjective experience is defined by nine distinct emotional experiences: amusement, awe, authentic pride, compassion, gratitude, hope, hubristic pride, interest, and love. A few of these factors represented blends of more than one positive
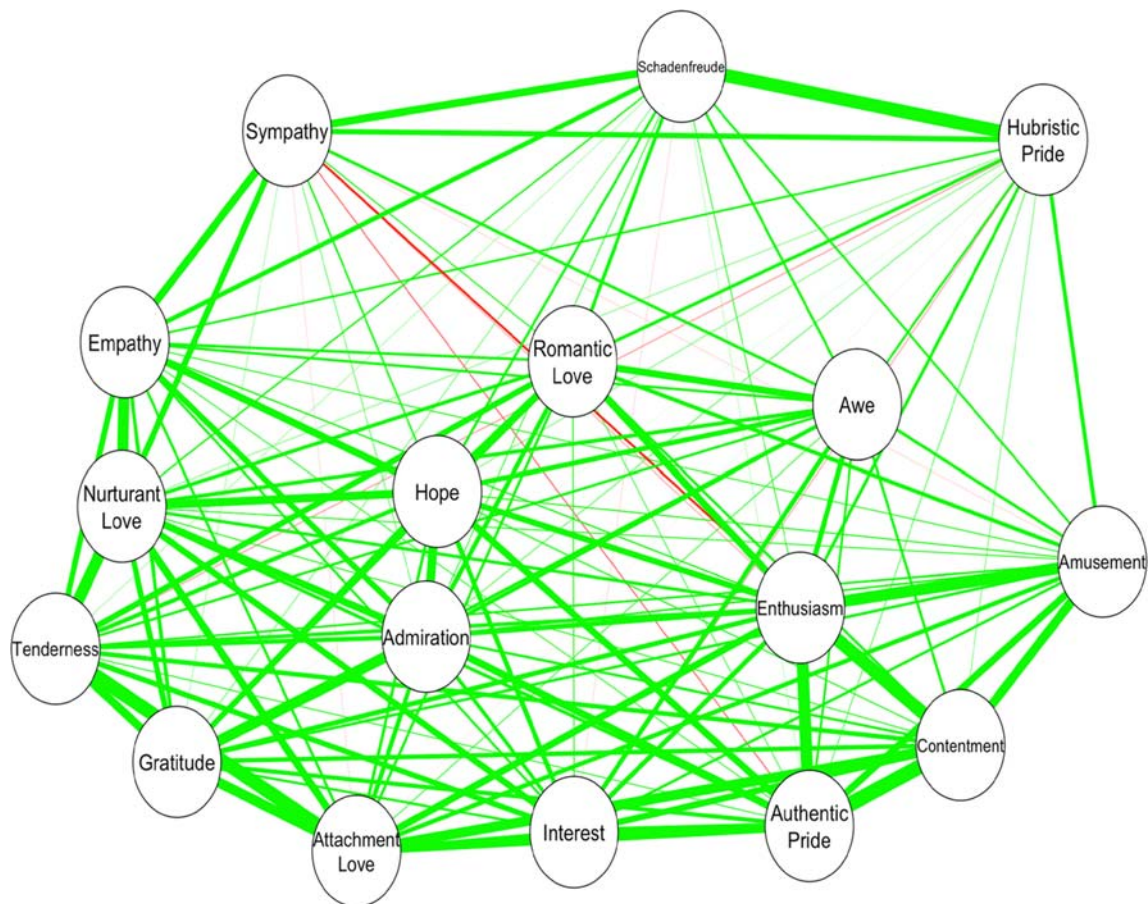
Fig. 2 Network depiction of 17 individual state positive emotions (Study 1)

emotion typically treated as distinct in the empirical literature. For example, we observed one factor that blended subjective elements initially considered to be markers of empathy, sympathy, and nurturant love. Given that the thoughts, feelings, and action tendencies that comprise these emotions have all been theoretically conceptualized as part of an overarching compassion response (e.g., Goetz, Keltner & Simon-Thomas, 2010), we chose *compassion* as the label for this

factor. Importantly, several of the 17 emotions initially included on the basis of being regularly studied as if they are distinct in fact overlapped considerably in subjective content, such that thoughts, feelings, and action tendencies characterizing these emotions loaded on the same higher-order factor.

In addition, several other positive emotions initially included as potentially distinct states—notably contentment, enthusiasm, and romantic love—appeared to in fact represent blends of

Table 2 Factor correlations for higher-order meta-analytic factor analysis of state positive emotions (Study 1)

	Authentic pride	Hubristic pride	Love	Compassion	Amusement	Hope	Gratitude	Awe	Interest
Authentic pride	–								
Hubristic pride	.03	–							
Love	.16	− .12	–						
Compassion	− .07	.21	.20	–					
Amusement	.45	.20	.27	− .07	–				
Hope	.14	.16	.09	.24	.11	–			
Gratitude	.23	.03	.32	.26	.20	.33	–		
Awe	.11	.27	.21	.14	.24	.25	.16	–	
Interest	.23	− .10	.18	.22	.11	.11	.22	.17	–

Factor names are based on an inspection of the highest-loading items on each factor, and mirror those presented in-text. All factor correlations are significant ($p < .05$). $N = 2252$

other emotions in terms of their subjective content, in that items representing these states loaded on multiple higher-order factors. More specifically, contentment and enthusiasm items each loaded weakly on the authentic pride and amusement factors, and romantic love items loaded weakly on factors related to love, hope, and awe. We speculate that these patterns represent organic overlap in the subjective content of these positive emotions; for example, people are likely to feel contentment during episodes of authentic pride, and episodes of romantic love often involve hoping that one's love is reciprocated. Although some might argue that contentment is in fact distinct from authentic pride and amusement (and based on theoretical definitions of these emotions, we would agree), our analyses suggest that, in terms of the way contentment is subjectively experienced based on lay people's reports, it is not.

Study 2

Study 2 was a pre-registered attempt to replicate Study 1 using a different participant population. Based on the results of Study 1, we pre-registered the prediction that nine distinct state subjectively experienced positive emotions would emerge, and that the content of these emotions would correspond to that observed in Study 1 (see https://osf.io/8h6gc/).

Method

Participants

A total of 2971 MTurk workers participated Study 2. As in Study 1, we excluded 377 participants (13%) for either not writing about a positive emotion experience as instructed or failing a Likert-based attention check item. This left a final sample of 2594 (M_{age} = 36.39; SD = 11.71; 59% women; 77% Caucasian, 9% African American, 6% East Asian, 6% Hispanic/Latino, 3% other). With this large sample size of 2594 participants (and 67 variables), we far exceed the typical recommendations for sample size, as well as the ratio of participants-to-variables, for our primary exploratory factor analyses (Costello & Osborne, 2005; MacCallum et al., 1999).

Procedure

Participant Tasks Each participant was randomly assigned to recall and describe in detail a momentary experience of one of the 17 positive emotions included in Study 1. Each emotion was defined in the same way as in Study 1. After completing each RET, participants rated the extent to which each of 67 items characterized their feelings during the emotional experience (1 = "not at all"; 5 = "very much"). These items were presented in a randomly determined order for each participant.

An average of 152 participants completed the RET for each emotion (SD = 10.15; range 135–167).

Positive Emotion Scale Properties The 17 positive emotion scales used in Study 1 showed adequate to good internal consistency in Study 2 following episodes of each target emotion (e.g., α = .66 for the admiration scale following episodes of admiration; αs = .42–.89; M = .65, SD = .12; see Tables S20-S36). Only two internal consistency coefficients fell below .50 (empathy: .42; enthusiasm: .49). These low reliabilities are likely due to the items used to measure these two emotions loading on multiple distinct emotion factors in our higher-order factor analysis; enthusiasm items loaded weakly on the authentic pride and amusement factors, whereas two of the three empathy items showed weak loadings across factors representing compassion, gratitude, and interest (see Table 3). See Table S47 for the average, minimum, and maximum value for the correlation between each positive emotion pair.

Results

Analyses We followed a pre-registered analytic plan to determine the extent to which the nine-factor solution that emerged in Study 1 would replicate with a different sample. One option in pursuing this goal would be to conduct a confirmatory factor analysis (CFA) in which we specify a priori a pattern and/or magnitude of item loadings identical to those we found previously. However, Hopwood and Donnellan (2010) have convincingly demonstrated that this type of rigid CFA analysis is inappropriate, because in any multi-dimensional inventory items are bound to show sources of interrelation (i.e., cross-loadings and residual correlations) that are not specified in the theoretical structure of the inventory (i.e., the primary loadings). As a result, even if the theoretical structure of a multi-dimensional inventory is valid (e.g., the factor structure passes the eyeball test and the subscales show predictive correlations), it is likely to produce extremely poor fit via conventional CFA indices.

In lieu of a strict CFA analysis, we followed three other procedures recommended by Hopwood and Donnellan (2010), based on EFA, which provide more relaxed tests of multi-dimensional factor structures than does CFA. As in Study 1, the input to our EFA was a 67 × 67 meta-analytic correlation matrix, which included correlations between each pair of positive emotion items averaged across episodes of all 17 individual positive emotions included in Study 2.

First, we tested whether a nine-factor solution, as was uncovered in Study 1, was an adequate characterization of the data in Study 2. We extracted nine factors using EFA and examined two approximate fit indices discussed by Hopwood and Donnellan (2010) which are produced in the *fa* command in the widely used *Psych* package in R (Revelle, 2019): Tucker-Lewis Index [TLI] and Root Mean Squared

Table 3 Factor loadings for higher-order meta-analytic factor analysis of state positive emotions (Study 2)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Authentic pride	I felt accomplished	**0.81**								
Authentic pride	I felt successful	**0.81**								
Authentic pride	I felt like I was achieving	**0.76**						0.10		
Authentic pride	I felt productive	**0.65**				0.13			0.14	0.11
Authentic pride	I felt confident	**0.63**			0.12			−0.11		
Authentic pride	I felt like I had self-worth	**0.58**		0.12						0.11
Authentic pride	I felt fulfilled	**0.58**		0.14	0.15					
Attachment love	I felt secure	**0.52**		0.16				−0.25		
Enthusiasm	I was on top of the world	**0.48**			0.31	−0.15	0.20		−0.12	
Contentment	I felt that all was right in the world	**0.43**		0.14	0.22	−0.20	0.17	−0.12		
Admiration	I felt motivated to work harder	0.39						0.27	0.24	0.12
Hubristic pride	I felt snobbish		**0.79**							
Hubristic pride	I felt stuck up		**0.78**							
Hubristic pride	I felt conceited		**0.77**							
Hubristic pride	I felt pompous		**0.74**							
Hubristic pride	I felt arrogant		**0.72**							
Hubristic pride	I felt egotistical		**0.71**							
Hubristic pride	I felt smug		**0.67**							
Schadenfreude	I wanted to point out someone else's shortcomings		**0.43**	−0.12		0.29				−0.12
Attachment love	I felt a close bond with someone			**0.78**						
Tenderness	I felt a strong connection with someone			**0.78**						
Tenderness	I felt warmth for someone			**0.75**		0.17				
Tenderness	I wanted to hold someone's hand			**0.73**						
Gratitude	I felt appreciative toward a specific person			**0.52**		−0.12			0.34	
Tenderness	I felt great care toward someone			**0.48**		0.10	0.23	0.21		−0.12
Attachment love	I felt a close bond with someone	0.18		**0.48**					0.21	
Nurturant love	I gave my full attention to someone			**0.43**		0.11			0.12	0.31
Nurturant love	I wanted what was best for someone		−0.13	**0.41**	0.12	**0.40**				0.13
Nurturant love	I wanted to sacrifice my own needs for someone			0.37		0.36	0.11	0.14		
Romantic love	I had a craving for someone		0.11	0.34	0.24		0.11	0.26		−0.22
Amusement	I was entertained				**0.68**					
Amusement	I laughed				**0.68**					
Contentment	I enjoyed the situation	0.23			**0.54**	−0.18		−0.17		
Amusement	Something seemed funny	−0.13	0.20		**0.54**	0.18			0.10	
Enthusiasm	I felt adventurous	0.13	0.10		**0.47**			0.20		
Romantic love	I felt giddy	0.16			**0.44**	−0.19	0.15	0.12	−0.11	
Enthusiasm	I wanted to get other people excited	0.16			**0.41**	0.13		0.10	0.17	
Contentment	I wanted to stay in the moment	0.19		0.19	0.37	−0.13	0.16			0.10
Empathy	I tried to help find a solution to someone else's problem					**0.63**			0.11	
Sympathy	I felt bad for someone		0.11		−0.19	**0.56**	0.14		−0.14	
Sympathy	I felt pity for someone		0.20		−0.18	**0.54**	0.18		−0.14	
Nurturant love	I wanted to help someone grow	0.18		0.22	0.18	**0.48**			0.12	
Nurturant love	I tried to show patience with someone			0.15		**0.44**		0.17	0.13	
Sympathy	I worried that someone would not be okay	−0.11	0.10	0.13	−0.20	**0.42**	0.18	0.22		
Schadenfreude	I thought that someone had brought something bad upon him or herself		0.29	−0.14		0.37	0.20			−0.15

Table 3 (continued)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Empathy	I tried to help find a solution to someone else's problem	−0.10		0.13	0.11	0.35			0.27	0.19
Schadenfreude	I thought someone had it coming	0.10	0.28	−0.14	0.10	0.30	0.19		0.10	−0.21
Empathy	I reflected on a time I had experienced a similar situation as someone				0.16	0.27	0.00	0.11	0.19	
Awe	I was rendered speechless						**0.66**			
Awe	I could not believe what I had seen			−0.13			**0.65**			
Awe	I felt I was in the presence of something quite out of the ordinary				0.10		**0.52**		0.12	0.15
Awe	I continued to think about something I had just seen				0.16	0.11	**0.43**		0.16	0.17
Romantic love	I felt butterflies in my stomach	0.10		0.14	0.10	−0.15	0.35	0.33		
Romantic love	I felt vulnerable	−0.17		0.13	−0.14		0.18	**0.45**		
Romantic love	I was afraid of rejection		0.23			0.00		**0.42**		−0.10
Hope	I drew on my inner strength	0.26		0.00		0.15		**0.41**		0.15
Hope	I felt challenged	0.12		−0.12		0.10		**0.41**	0.17	0.15
Hope	I tried to believe in myself	0.37						0.38	0.17	0.14
Hope	I engaged in some wishful thinking				0.19			0.34		
Admiration	I felt as if I could learn a lot from a specific person			0.17			0.12		**0.51**	0.10
Gratitude	I thought that a specific person who helped me should be acknowledged	0.14		0.20			0.15		**0.45**	−0.12
Admiration	I felt a desire to become more like a specific person						0.14	0.12	**0.43**	
Gratitude	I felt like I had benefited from a specific person's action			0.24		−0.14	0.14		**0.43**	
Interest	I paid close attention to what I saw and heard						0.23			**0.49**
Interest	I felt engaged with what I was going	0.25		0.12					−0.12	**0.47**
Interest	My attention was absorbed			0.14			0.16			**0.46**
Hope	I tried to stay positive	0.19				0.12		0.23		0.26

Emotion scale = positive emotion scale which included item. Loadings > .40 are **bolded**; loadings less than |.10| are left blank. $N = 2594$

Error of Approximation (RMSEA) as well as its 90% confidence interval. We then examined whether these indices met or exceeded traditional standards for establishing adequate model fit (i.e., TLI of .90 or above; RMSEA of .08 or below).

Second, we tested whether the emotions represented by each factor in the nine-factor solution appeared to capture similar conceptual content as the nine factors observed in Study 1. Third, we tested whether the pattern of scale items comprising the emotions represented by each factor in the nine-factor solutions was similar across Studies 1 and 2. To accomplish this goal, for each emotion factor that emerged in both Studies 1 and 2, we computed Tucker's congruence coefficient between the pattern of 67 loadings across the two studies. Congruence coefficients of .95 and above indicate good correspondence between factors, and values from .85–.94 indicate fair correspondence (Lorenzo-Seva & ten-Berge, 2006). We therefore specified in our pre-registration document that replication of any given emotion factor across studies would be indicated by a congruence coefficient of .85 or greater between the same factor from Study 1 and Study 2.

How Many State Positive Emotions Emerged as Distinct Subjective Experiences? An EFA with oblimin rotation extracting nine factors showed good fit based on the fit indices described above (TLI = .93; RMSEA = .031; 90% CI [.030 to .032]), suggesting that a nine-factor solution adequately describes the state positive emotion taxonomic space in both Studies 1 and 2. These nine factors explained 46% of the

variance in the data and individual factors explained 9, 7, 7, 5, 5, 4, 3, 3, and 2% of the variance, respectively (see Table S37 for additional fit statistics).

We next examined the pattern of factor loadings (see Table 3). The nine factors appeared to be conceptually identical to the nine factors that emerged in Study 1, and congruence coefficients between the same factors across Studies 1 and 2 supported this interpretation. Factor 1 represented *authentic pride*, and the congruence coefficient for the authentic pride factors across Studies 1 and 2 was .97. Factor 2 represented *hubristic pride*; congruence coefficient across Studies 1 and 2 was .98. Factor 3 represented *love* and, as in Study 1, included items representing attachment love and tenderness (although unlike in Study 1, this factor also included one high-loading gratitude component); congruence coefficient = .97. Factor 4 represented *amusement* (congruence coefficient = .95). Factor 5 represented *compassion* and, as in Study 1, included multiple items representing nurturant love, sympathy, and empathy (congruence coefficient = .96). Factor 6 represented *awe* (congruence coefficient = .95) and factor 7 represented *hope* (ongruence coefficient = .91). Factor 8 represented *gratitude* and, as in Study 1, included multiple items representing admiration (congruence coefficient = .94). Finally, factor 9 captured *interest* (congruence coefficient = .91).

As in Study 1, we next used network analyses to compare the structural interrelations of these nine higher-order state positive emotion experiences to the structural interrelations among all 17 emotions initially included in Study 2. Replicating Study 1, the nine higher-order positive emotional experiences were relatively well dispersed and showed moderate intercorrelations (M = .16; SD = .15, range = −.26 to .48; see Fig. 3 and Table 4), whereas several of the 17 individual emotions were tightly clustered, reflecting the fact that they are not all distinct entities (mean correlation = .29, SD = .18, range = −.31 to .64; see Tables S20-S36 and Fig. 4).

Ancillary Analyses As in Study 1, to account for the imbalance in item representation of each emotion, we again re-ran the aforementioned factor analysis while including only 3 items each for authentic pride and hubristic pride (see Table S43). As in Study 1, distinct factors again emerged for authentic and hubristic pride, and the same set of nine positive emotion factors as in the original factor analysis emerged here. Authentic pride and hubristic pride were the second and third factors in this solution, whereas they were the first and second factors in the original solution; love was the first factor in the ancillary solution (see Table 3 and Table S43). The only substantive difference between the original factor analysis and the reanalysis was that in the original analysis, the hubristic pride factor primarily captured hubristic pride, whereas in the reanalysis, it included a mix of high-loading hubristic pride and

schadenfreude items. These findings therefore suggest that the distinctness of the nine positive emotions observed in Study 2 was robust to our original decision of which items to include in the analysis.

Discussion

The consistent results across Studies 1 and 2 provide strong support for nine robust distinct subjectively experienced positive emotions at the state level, which include amusement, authentic pride, awe, compassion, gratitude, hope, hubristic pride, interest, and love.

Study 3

Studies 1 and 2 established that nine distinct subjectively experienced emotions characterize the state positive emotion space. In Studies 3 and 4, we examined the structure of subjectively experienced trait positive emotions and sought to compare the taxonomies that emerged at the state and trait level.

Method

Participants

Four hundred MTurk workers participated. Sixteen (4%) were excluded for failing a Likert-based attention check, leaving a sample of 384 (M_{age} = 40.37; SD = 13.91; 51% women; 79% Caucasian, 7% African American, 6% Hispanic/Latino, 6% East Asian, 3% other). This final sample size of 384 (for 67 variables) falls in the middle of the typical recommended range for exploratory factor analyses, both in terms of sample size and ratio of participants-to-variables (Costello & Osborne, 2005; MacCallum et al., 1999). However, there are some undesirable conditions under which larger sample sizes are warranted (e.g., weakly determined factors; Costello & Osborne, 2005; MacCallum et al., 1999). Although our data did not represent all of these undesirable conditions (e.g., several of our factors were highly determined, meaning they included many strongly loading items), we thought it prudent to ultimately conduct a pre-registered replication of study 3 in study 4, with an even larger sample size.

Procedure

Overall Approach In constructing a trait taxonomy, we adopted a theoretical approach from personality science: Personality has traditionally been conceptualized in terms of *global traits* (i.e., a person's general tendency to behave in an extraverted manner; Funder, 1991), but more recently scholars have begun to conceptualize personality as distributions of
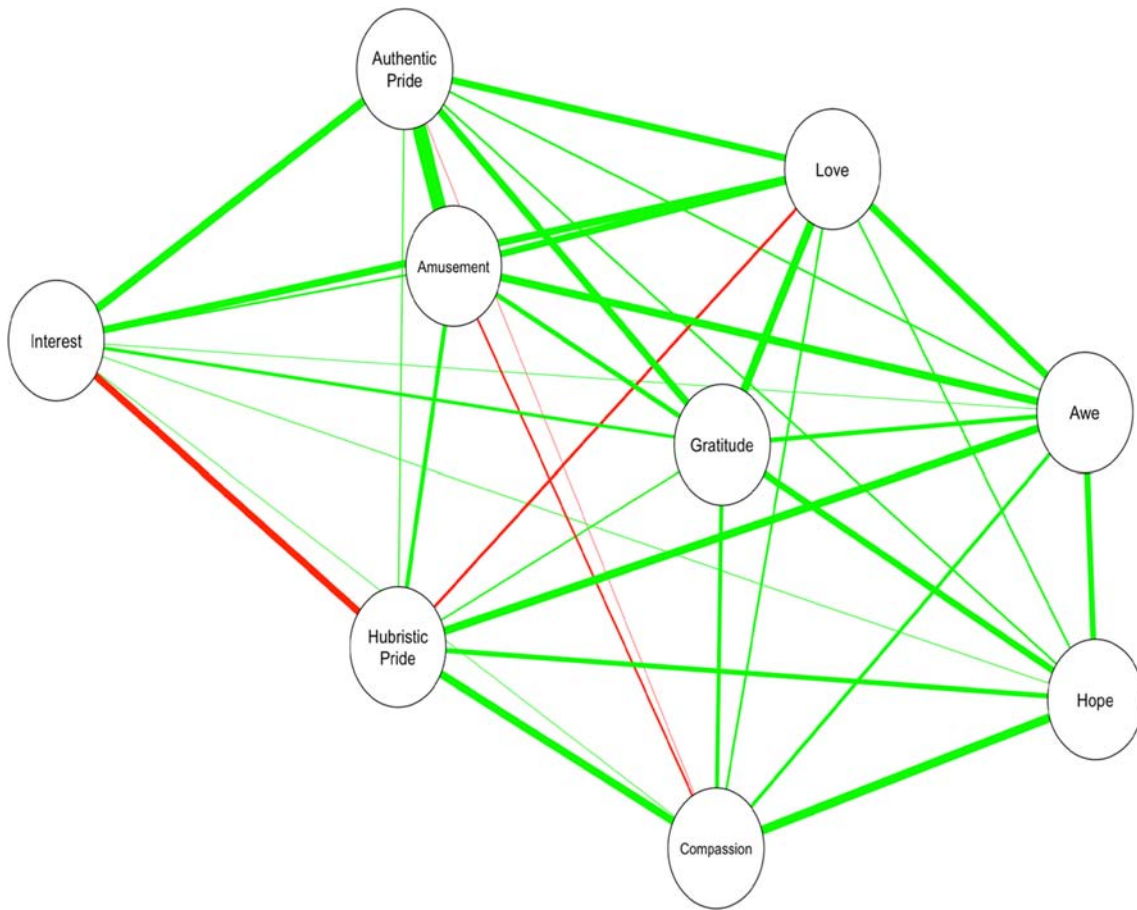
Fig. 3 Network depiction of higher-order state positive emotions (Study 2)

momentary states (i.e., a person's extraverted behavior can fluctuate from moment to moment, and the mean and standard deviation of the resultant distribution provides information about a person's general level of extraversion; Fleeson, 2001; Fleeson & Jayawickreme, 2015). For example, a person might endorse the item "I am someone who shows a lot of enthusiasm" to indicate high trait extraversion and the item "I am showing a lot of enthusiasm" to indicate high state

extraversion. Correspondingly, in Studies 3 and 4, we assumed that a person high in trait gratitude might endorse the item "I feel appreciative toward a specific person" when describing their dispositional, everyday feelings, and a person high in state gratitude might endorse the item "I felt appreciative toward a specific person" when describing their feelings during a specific past episode of gratitude, as in Studies 1 and 2.

Table 4 Factor correlations for higher-order meta-analytic factor analysis of state positive emotions (Study 2)

	Authentic pride	Hubristic pride	Love	Amusement	Compassion	Awe	Hope	Gratitude	Interest
Authentic pride	–								
Hubristic pride	.11	–							
Love	.25	− .15	–						
Amusement	.48	.20	.25	–					
Compassion	− .05	.28	.14	− .13	–				
Awe	.13	.28	.27	.27	.17	–			
Hope	.13	.20	.13	− .05	.30	.25	–		
Gratitude	.27	.12	.31	.20	.19	.19	.25	–	
Interest	.29	− .26	.26	.13	.07	.07	.08	.16	–

Factor names are based on an inspection of the highest-loading items on each factor, and mirror those presented in-text. All factor correlations are significant ($p < .05$). $N = 2594$
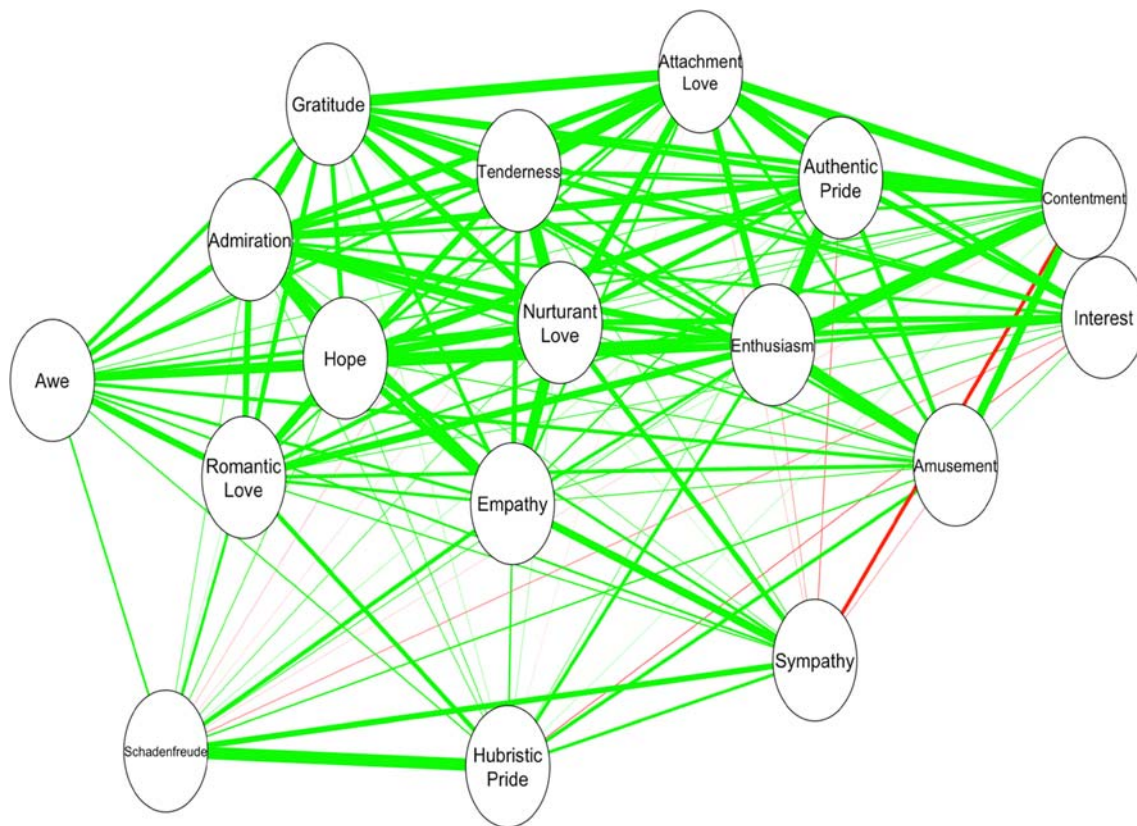
Fig. 4 Network depiction of 17 individual state positive emotions (Study 2)

Participant Tasks Following the logic outlined above, in Study 3, participants reported the extent to which each of the 67 positive emotion scale items included in Studies 1 and 2 "characterizes your everyday feelings" (1 = "not at all"; 5 = "very much"). Participants also completed several personality questionnaires that were ancillary to the present research (see online supplement).

Positive Emotion Scale Properties The specific scales for each of the 17 emotions showed adequate to good reliability (αs = .54–.93 M = .74, SD = .10; see Table S38). Of note, we focus our analyses on the short versions of the positive emotion scales described in Study 1, to increase comparability across studies. However, for exploratory purposes, we administered the full-length scales (Tracy & Robins, 2007; Weidman & Tracy, in press); intercorrelations among all full-length positive emotion scales are presented in Table S38 alongside intercorrelations among the short scales.

Results

Analyses As in Studies 1 and 2, we computed a correlation matrix among all 67 items used to measure each trait positive emotion and used this correlation matrix as input into an EFA. As in Study 1, to determine the optimal number of factors, we

again used MAP to uncover a lower bound and then examined each solution from this lower bound up to a 17-factor solution.

How Many Trait Positive Emotions Emerged as Distinct Subjective Dispositions? MAP recommended extracting six factors. Following the procedure outlined in Study 1, we examined the six-factor, seven-factor, eight-factor solutions, and so on, until we reached a solution that did not yield an additional theoretically interpretable factor on which three items loaded above .40. Each factor in the six-factor solution was interpretable as an emotion and had several items with primary loadings over .40. The seven-factor solution included an additional factor on which all three items representing *schadenfreude* loaded at or above .43. The eight-factor solution included an additional factor on which three of the four *awe* items loaded at or above .49. In contrast, the nine-factor solution included an additional factor on which no items loaded above .40. We therefore determined that an eight-factor solution best characterized the data. We extracted eight factors using EFA with maximum likelihood estimation and oblimin rotation. These eight factors explained 52% of the variance in the data and individual factors explained 11, 10, 7, 7, 6, 4, 4, and 3% of the variance (see Table S39 for additional fit statistics).

These factors appeared to capture eight distinct positive emotional dispositions (see Table 5). Factor 1 captured *authentic pride* and factor 2 captured a blend of attachment love,

tenderness, and gratitude; we labeled this factor *love*, as in Studies 1 and 2. Factor 3 captured *hubristic pride* and factor 4 captured a blend of empathy and nurturant love; we labeled this factor *compassion*, as it was conceptually similar to the compassion factor identified in Studies 1 and 2 (however, in Studies 1 and 2, this factor also included high-loading items representing sympathy, whereas in Study 3, this was not the case). Factor 5 captured *amusement*, factor 6 captured *awe*, factor 7 captured *hope* but also included components of interest, and factor 8 captured *schadenfreude*.

As in Studies 1 and 2, we used network analyses to compare the structural interrelations among these eight higher-order trait positive emotions and the structural interrelations among all 17 trait positive emotions initially included in Study 3. The eight higher-order positive emotional dispositions were relatively well dispersed, reflecting traits with low intercorrelations ($M = .19$; SD = .18, range = $-.16$ to .53; see Table 6 and Fig. 5). In contrast, many of the 17 individual trait positive emotions were tightly clustered, reflecting the fact that these 17 emotions are not all distinct entities, and therefore often show strong intercorrelations (e.g., attachment love and tenderness were correlated .76; mean correlation = .36, SD = .22, range = $-.14$ to .79; Table S38 and Fig. 6). As in Studies 1 and 2, our methodology thus allowed us to parse a large group of overlapping trait positive emotions into a smaller group of largely distinct emotional dispositions.

Ancillary Analyses As in Studies 1 and 2, we again re-ran the aforementioned factor analysis while including only 3 items each for authentic pride and hubristic pride (see Table S44). As in Studies 1–2, distinct factors emerged for authentic and hubristic pride in this reanalysis and the same set of eight positive emotion factors emerged as in the original factor analysis. Authentic pride and hubristic pride were the second and sixth factors in this solution, whereas they were the first and third factors in the original solution; love was the second factor in the ancillary solution, and compassion, amusement, and hope represented factors 3–5 (see Table 5 and Table S44). These findings again suggest that the distinctness of the eight positive emotions observed in Study 3 was robust to our original decision of which items to include in the analyses.

Discussion

Study 3 provides initial evidence that the subjectively experienced trait positive emotional space is characterized by eight dimensions: amusement, awe, compassion, authentic pride, hope, hubristic pride, love, and schadenfreude. They also suggest that many frequently studied positive emotions—including admiration, attachment love, contentment, enthusiasm, empathy, gratitude, interest, nurturant love, romantic love, sympathy, and tenderness—are, at the trait level, best conceptualized as comprising other positive emotion dispositions, in that they largely or entirely share subjective components with these other dispositions.

Study 4

Study 4 was a pre-registered attempt to directly replicate Study 3. Based on the results of Study 3, we pre-registered the prediction that eight distinct subjectively experienced trait positive emotions would emerge, and that the content of these eight factors would correspond to the content of the factors uncovered in Study 3 (see https://osf.io/8h6gc/).

Method

Participants Four hundred fifty-four MTurk workers participated. Forty-eight (10%) were excluded for failing a Likert-based attention check, leaving a final sample of 406 (M_{age} = 35.21; SD = 12.33; 44% women; 74% Caucasian, 9% African American, 5% East Asian, 12% other). This final sample size of 406 (for 67 variables) falls in the middle of the typical recommended range for exploratory factor analyses, in terms of sample size and ratio of participants-to-variables (Costello & Osborne, 2005; MacCallum et al., 1999). However, as noted above, there are some conditions under which larger sample sizes are warranted for these analyses (Costello & Osborne, 2005; MacCallum et al., 1999). For this reason, our conclusions regarding how many, and which, positive emotional traits emerged as distinct were based on a wholistic evaluation of the combined results of Studies 3–4, across which the combined sample sizes and ratio of participants-to-variables exceed the typical recommended ranges.

Procedure Participants reported whether each of the 67 positive emotion items used in Study 3 "characterizes your everyday feelings" (1 = "not at all"; 5 = "very much"). The specific scales for each of the 17 positive emotions tended to show adequate to good reliability (αs = .46–.93 M = .69, SD = .12; see Table S40). Only one scale showed an internal consistency below .50 (admiration: .46); aside from one motivational admiration item loading on the hope factor ("I felt motivated to work harder"), the admiration items did not load strongly on any factors. Note that we also observed this pattern of results in Study 3, suggesting that admiration may not be well-defined as a distinct experience at the trait level.

Results

Analyses Similar to Study 2, we used a pre-registered analysis plan to determine the extent to which the eight-factor trait positive emotion disposition taxonomy that emerged in Study 3 replicated in Study 4 (see also Hopwood &

Table 5 Factor loadings for higher-order meta-analytic factor analysis of trait positive emotions (Study 3)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Authentic pride	I feel successful	**0.79**		0.11	0.10				
Authentic pride	I feel fulfilled	**0.69**	0.16			0.13			
Authentic pride	I feel accomplished	**0.68**	0.14				0.12	0.12	0.12
Authentic pride	I feel confident	**0.65**						0.26	
Authentic pride	I feel productive	**0.64**			0.13			0.22	
Attachment love	I feel secure	**0.64**	0.16		0.13	0.14	−0.16		
Authentic pride	I feel like I am achieving	**0.63**	0.10		−0.12	0.12	0.15	0.21	
Enthusiasm	I am on top of the world	**0.57**	0.12	0.14	−0.11	0.26	0.17		
Authentic pride	I feel like I have self-worth	**0.56**		−0.12	0.10			0.30	0.10
Contentment	I feel that all is right in the world	**0.54**				0.23	0.14	−0.20	
Romantic love	I feel vulnerable	−0.50			0.11		0.32		0.10
Romantic love	I am afraid of rejection	−0.49	−0.11		0.15	0.21	0.14		0.16
Sympathy	I worry that someone will not be okay	−0.48	0.18		0.20		0.18		0.18
Sympathy	I feel bad for someone	−0.37	0.13		0.11		0.30	0.14	0.11
Attachment love	I feel a close bond with someone		**0.94**						
Attachment love	I feel accepted by someone		**0.85**	−0.11					
Tenderness	I feel a strong connection with someone		**0.84**						
Gratitude	I feel appreciative toward a specific person		**0.69**		0.15				
Tenderness	I feel warmth for someone		**0.66**		0.28				
Tenderness	I feel great care toward someone		**0.58**	−0.10	0.34				
Gratitude	I feel like I have benefited from a specific person's action		**0.49**		0.25		0.12		
Gratitude	I think that a specific person who helps me should be acknowledged	−0.12	**0.42**		0.28	0.12			
Nurturant love	I give my full attention to someone	0.17	**0.41**	−0.13	0.15	0.11	0.11		
Admiration	I feel as if I could learn a lot from a specific person		0.38			0.14	0.28	0.11	−0.12
Romantic love	I have a craving for someone		0.28	0.14	0.15	0.24		−0.17	
Hubristic pride	I feel snobbish		0.00	**0.81**					
Hubristic pride	I feel egotistical			**0.77**			−0.11	0.10	
Hubristic pride	I feel conceited			**0.76**					−0.10
Hubristic pride	I feel pompous	0.10	0.00	**0.74**				−0.10	
Hubristic pride	I feel stuck up	−0.10		**0.70**					0.11
Hubristic pride	I feel smug			**0.68**					0.16
Hubristic pride	I feel arrogant			**0.66**	−0.12				
Nurturant love	I try to show patience with someone				**0.59**			0.19	
Nurturant love	I want to help someone grow	0.14	0.14	−0.10	**0.58**		0.11		
Empathy	I try to help find a solution to someone else's problem				**0.53**			0.13	0.12
Nurturant love	I want to help someone grow		0.13		**0.52**		0.16	−0.19	
Nurturant love	I want to sacrifice my own needs for someone		0.36	−0.10	**0.51**			0.11	
Empathy	I try to relate to someone else's experience	−0.11	0.16		**0.47**	0.17		0.15	
Tenderness	I want to hold someone's hand		0.24		0.37	0.23		−0.25	0.17
Interest	I pay close attention to what I see and hear	0.16			0.31			0.29	
Amusement	I am entertained	0.18	0.10			**0.62**		0.10	
Amusement	I laugh	0.17		−0.12		**0.55**		0.11	
Enthusiasm	I want to get other people excited	0.11		0.10	0.28	**0.50**	0.13	−0.10	
Amusement	Something seems funny	−0.13				**0.49**	−0.11	0.13	
Contentment	I enjoy the situation	0.45				**0.45**			
Romantic love	I feel giddy	0.17		0.19	0.10	**0.43**	0.17	−0.14	

Table 5 (continued)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Hope	I engage in some wishful thinking	− 0.30	0.13	− 0.12		0.37	0.13		0.17
Enthusiasm	I feel adventurous	0.27		0.15		0.36	0.20		
Contentment	I want to stay in the moment				0.14	0.34		0.11	
Empathy	I reflect on a time I have experienced a similar situation as someone	− 0.19	0.11		0.20	0.32	0.13	0.16	0.16
Awe	I continue to think about something I have just seen	− 0.24	0.16			0.31	0.27	0.14	
Admiration	I feel a desire to become more like a specific person		0.14			0.28	0.11	− 0.11	0.25
Awe	I cannot believe what I have just seen						**0.54**	0.10	0.14
Awe	I feel I am in the presence of something quite out of the ordinary	0.33			0.10		**0.54**		0.13
Awe	I am rendered speechless				0.16		**0.49**		
Romantic love	I feel butterflies in my stomach				0.26		0.19	0.36	− 0.17
Sympathy	I feel pity for someone	− 0.16	0.11		0.14		0.35		0.20
Hope	I draw on my inner strength	0.24	0.18			0.11	0.14	**0.49**	0.13
Interest	I feel engaged with what I am doing	0.23			0.14	0.12	0.13	**0.44**	− 0.13
Hope	I try to believe in myself	0.29			0.20	0.18	− 0.12	**0.43**	
Hope	I feel challenged			0.10		0.12	0.27	0.35	
Interest	My attention is absorbed			0.18	0.23			0.34	
Hope	I try to stay positive	0.31		− 0.15	0.20	0.15		0.34	
Admiration	I am motivated to work harder	0.29		− 0.12	0.17		0.24	0.33	− 0.10
Schadenfreude	I think that someone has brought something bad upon him or herself								**0.73**
Schadenfreude	I think that someone has it coming				0.12				**0.65**
Schadenfreude	I want to point out someone else's shortcomings		− 0.10	0.36	0.15				**0.43**

Emotion scale = Positive emotion scale which included an item. Loadings > .40 are bolded; loadings less than |.10| are left blank. $N = 384$

Donnellan, 2010). As in Studies 1–3, our analyses were based on an EFA which had as input a correlation matrix among all 67 positive emotion items. As in Study 2, we used this approach to determine (a) whether eight emotional dispositions provide an adequate and robust characterization of the trait positive emotion domain; (b) whether the emotions represent- ed in this eight-factor solution captured conceptually similar content to the eight factors that emerged in Study 3; and (c) whether the patterns of item loadings within these eight factors were highly similar to the patterns of item loadings observed in each of the eight factors that emerged in Study 3, based on high congruence coefficients across Studies 3 and 4.

Table 6 Factor correlations for higher-order meta-analytic factor analysis of trait positive emotions (Study 3)

	Authentic pride	Love	Hubristic pride	Compassion	Amusement	Awe	Hope	Schadenfreude
Authentic pride	–							
Love	.29	–						
Hubristic pride	− .01	− .10	–					
Compassion	.12	.53	− .09	–				
Amusement	.44	.42	.10	.35	–			
Awe	.10	.29	.22	.28	.36	–		
Hope	.34	.26	− .16	.24	.28	.14	–	
Schadenfreude	− .07	.09	.32	.13	.19	.30	.03	–

Factor names are based on an inspection of the highest-loading items on each factor and mirror those presented in-text. Factor intercorrelations greater than |.10| are significant ($p < .05$). $N = 384$
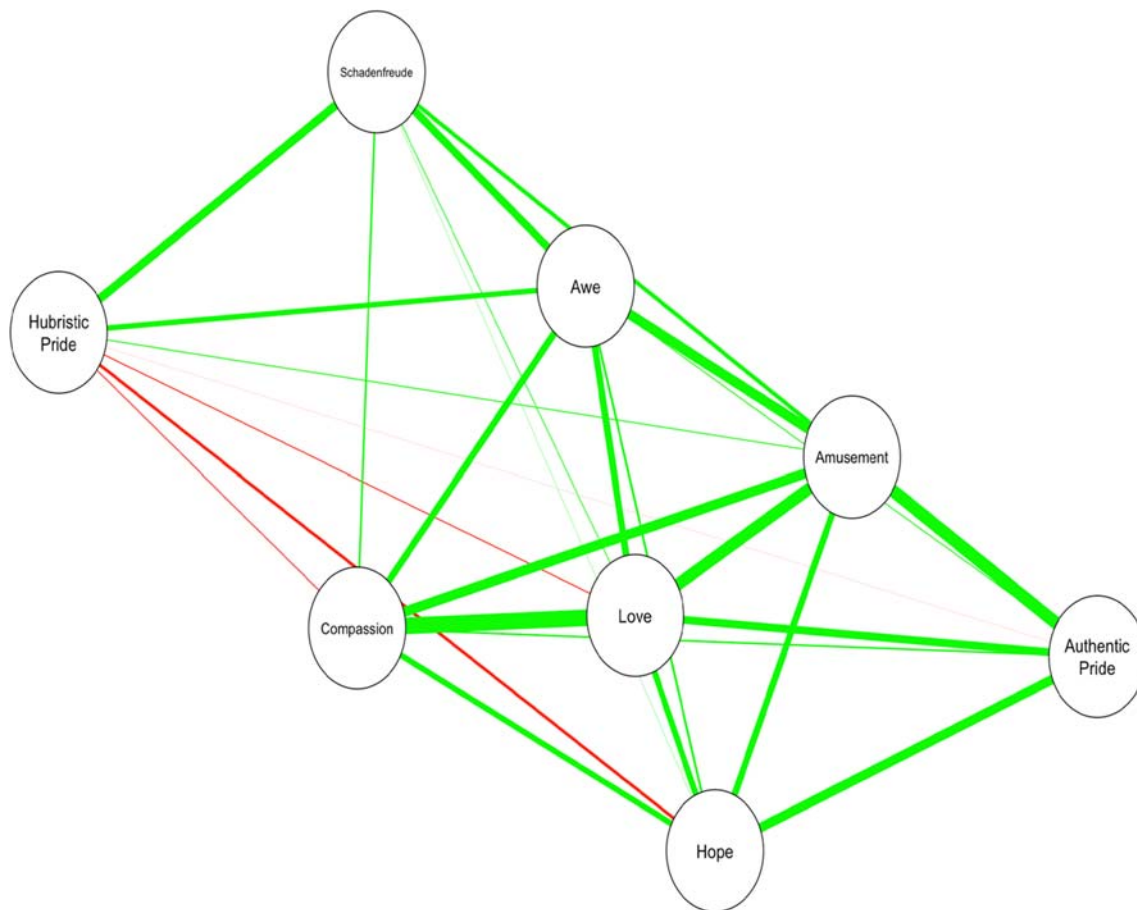
Fig. 5 Network depiction of higher-order trait positive emotional dispositions (Study 3)

How Many Trait Positive Emotions Emerged as Distinct Subjective Dispositions? Following the same procedure as was used in Study 2, we conducted EFA with oblimin rotation to extract eight factors. This solution showed good fit based on the fit indices described above (TLI = .94; RMSEA = .034 with 90% CI of [.027 to .041]). This result suggests that an eight-factor solution adequately describes the trait positive emotion space, as was found in Study 3. These eight factors explained 48% of the variance in the data and individual factors explained 9, 8, 7, 6, 5, 5, 4, and 3% of the variance, respectively (see Table S41 for additional fit statistics).

We next examined the pattern of factor loadings (see Table 7). Five of the eight factors appeared to be conceptually similar to those identified in Study 3, and congruence coefficients supported this interpretation. Factor 1 represented *hubristic pride*, and the congruence coefficient comparing the hubristic pride factors between Studies 3 and 4 was .90. Factor 2 represented *love* and, as in Study 3, included multiple items representing attachment love, tenderness, and gratitude; the congruence coefficient across Studies 3 and 4 was .92. Factor 3 represented *hope*, and although this factor showed some congruence across Studies 3 and 4 (congruence coefficient = .80), in Study 3, it primarily represented a blend of hope and one item

representing interest, whereas in Study 4 it primarily represented a blend of hope, authentic pride (three items), one item capturing a particularly motivational subjective component of admiration ("I feel motivated to work harder"), and again one item representing interest. Factor 4 represented *authentic pride* (congruence coefficient = .86) and factor 7 represented *amusement* (congruence coefficient = .83).

Two of the eight factors, however, seemed conceptually related to those identified in Study 3 but showed substantial differences in their loading patterns. First, factor 6 was conceptually recognizable as *compassion*, but whereas in Study 4, this factor primarily represented sympathy (the three sympathy items were the highest-loading, whereas only one nurturant love item and zero empathy items loaded above .40), in Study 3, this factor primarily represented a blend of nurturant love and empathy (the six highest-loading items captured these two emotions), and no sympathy items loaded above .40. This conceptual difference was reflected by a low congruence coefficient of .55. Second, factor 8 seemed conceptually similar to the *schadenfreude* factor in Study 3, but in Study 4 this factor was very poorly defined, with the three schadenfreude items showing loadings between .35 and .46 (compared with loadings
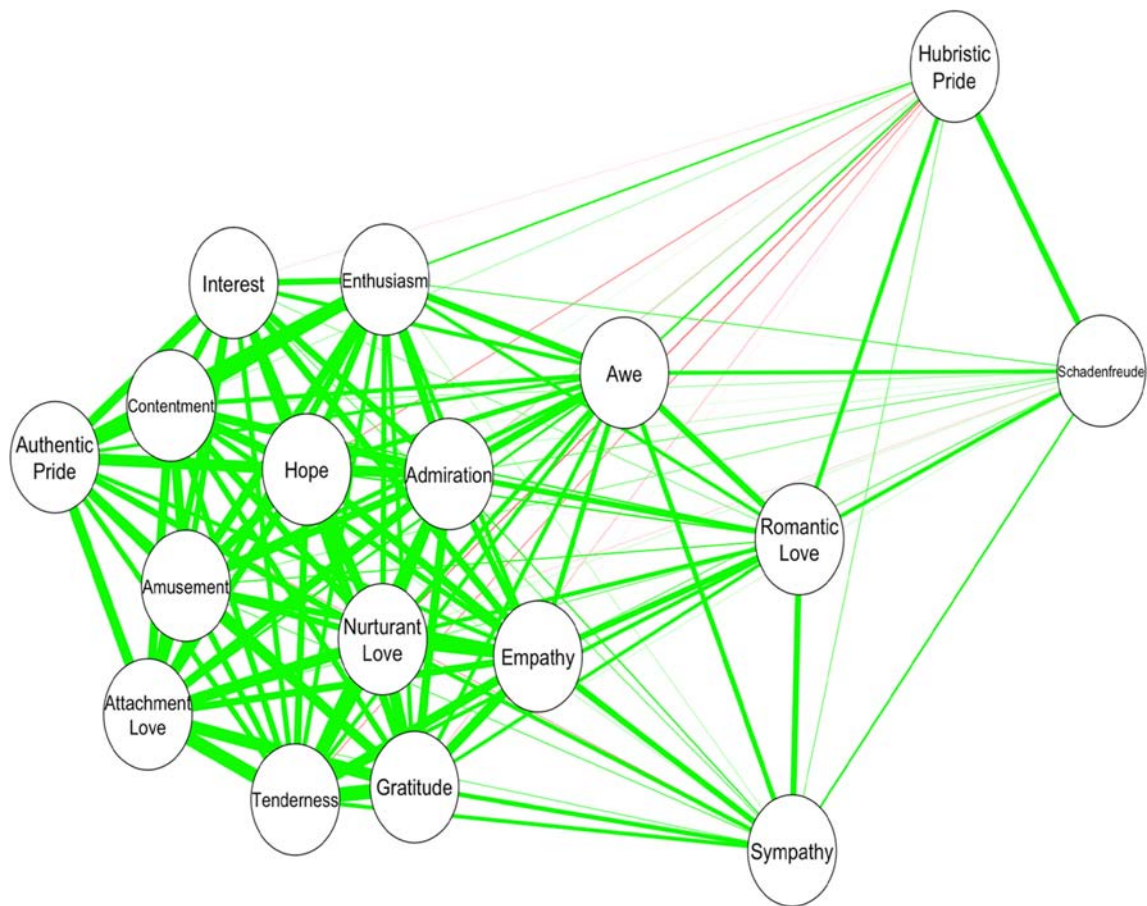
Fig. 6 Network depiction of 17 individual trait positive emotions (Study 3)

of .43–.73 in Study 3). Again, the factors had a low congruence coefficient of .58 across studies.

Finally, factor 5 in the eight-factor solution did not appear to be conceptually similar to any factor that emerged in Study 3. This factor seemed to represent desire for a romantic partner: The items loading over .40 included two romantic love items (i.e., "I feel giddy" and "I have a craving for someone"), one tenderness item ("I want to hold someone's hand"), two enthusiasm items ("I feel adventurous" and "I want to get other people excited"), and one awe item ("I feel I am in the presence of something quite out of the ordinary"). In contrast, factor 6 in Study 3 represented awe (this is the only factor that emerged in Study 3 and did not have a clear comparison factor in Study 4): Three awe items loaded between .49 and .54 and no other items loaded above .40. Of note, the congruence coefficient between the romantic desire factor in Study 4 and the awe factor in Study 3 was .60, likely reflecting some similarities in the pattern of loadings among the two factors.

As in Study 3, we used network analyses to examine the structural interrelations of these eight higher-order positive emotion dispositions and compared them to the structural interrelations among all 17 state positive emotion dispositions

initially included in Study 4. As in Study 3, the eight higher-order positive emotional experiences were relatively well dispersed and showed moderate intercorrelations ($M = .17$; $SD = .20$, range $= -.33$ to $.47$; see Fig. 7 and Table 8), whereas several of the 17 individual positive emotion dispositions were tightly clustered, reflecting the fact that they are not all distinct entities (mean correlation $= .33$, $SD = .21$, range $= -.12$ to $.73$; see Table S40 and Fig. 8).

Ancillary Analyses As in Studies 1–3, we re-ran the aforementioned factor analysis while including only 3 items each for authentic pride and hubristic pride (see Table S45). As in Studies 1–3, distinct factors again emerged for authentic and hubristic pride in this reanalysis. The same set of eight positive emotion factors as in the original factor analysis emerged here, including the five factors that emerged as distinct across both Studies 3–4 (authentic pride, hubristic pride, love, hope, and amusement). Authentic and hubristic pride were the third and second factors in this solution, whereas they were the fourth and first factors in the original solution; love was the first factor in the ancillary solution (see Table 7 and Table S45). As was observed in Study 2, however, in the original analysis, the hubristic pride factor primarily captured hubristic pride,

Table 7 Factor loadings for higher-order meta-analytic factor analysis of trait positive emotions (Study 4)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Hubristic pride	I feel snobbish	**0.89**							
Hubristic pride	I feel arrogant	**0.85**							
Hubristic pride	I feel stuck up	**0.78**							
Hubristic pride	I feel egotistical	**0.75**	−0.10						
Hubristic pride	I feel smug	**0.70**							0.14
Hubristic pride	I feel pompous	**0.63**							0.22
Hubristic pride	I feel conceited	**0.62**			0.11				0.15
Admiration	I feel a desire to become more like a specific person	0.37			−0.24			0.22	
Schadenfreude	I want to point out someone else's shortcomings	0.35					0.18		0.35
Attachment love	I feel a close bond with someone		**0.81**		0.12				
Tenderness	I feel great care toward someone		**0.75**				0.12	−0.10	
Tenderness	I feel a strong connection with someone		**0.74**					0.12	
Gratitude	I feel appreciative toward a specific person		**0.68**	0.16	−0.11				
Tenderness	I feel warmth for someone	−0.14	**0.58**	0.12			0.11		
Attachment love	I feel accepted by someone		**0.54**		0.19		−0.22	0.21	
Nurturant love	I want what was best for someone	−0.23	**0.48**	0.20	−0.10	0.17	0.15		
Gratitude	I think that a specific person who helps me should be acknowledged		**0.40**	0.19	−0.15	0.17			
Nurturant love	I want to sacrifice my own needs for someone		0.36			0.32	0.21		
Gratitude	I feel like I have benefited from a specific person's action	0.24	0.35	0.11	−0.14	0.10		0.24	−0.17
Nurturant love	I give my full attention to someone		0.29			0.20		0.23	−0.13
Hope	I try to believe in myself			**0.74**					
Hope	I draw on my inner strength			**0.53**			0.11	0.12	
Hope	I try to stay positive	−0.10		**0.53**	0.10				
Admiration	I feel motivated to work harder			**0.53**					
Authentic pride	I feel productive			**0.47**	0.24			0.16	
Authentic pride	I feel confident	0.10	0.15	**0.45**	0.30		−0.24		0.20
Interest	I feel engaged with what I am doing		−0.19		0.44	0.13		0.20	0.20
Authentic pride	I feel like I have self-worth		0.11	**0.41**	0.33		−0.15		
Hope	I feel challenged	0.12		0.34			0.23	0.16	
Interest	My attention is absorbed	0.10		0.26		−0.10	0.23	0.17	
Authentic pride	I feel fulfilled	0.10			**0.73**			0.21	−0.13
Attachment love	I feel secure		0.22	0.11	**0.57**		−0.13		0.18
Authentic pride	I feel accomplished	0.15		0.31	**0.54**				
Authentic pride	I feel successful	0.15		0.23	**0.53**	0.12	−0.11		
Contentment	I feel that all is right in the world	0.28			**0.50**				
Authentic pride	I feel like I am achieving	0.12	0.14	0.39	**0.43**	0.10			
Enthusiasm	I am on top of the world	0.11	0.11		0.38	0.33	−0.24		0.16
Romantic love	I have a craving for someone		0.12		−0.12	**0.52**			
Enthusiasm	I want to get other people excited	0.12		0.11		**0.47**		0.16	−0.14
Enthusiasm	I feel adventurous			0.30		**0.46**	−0.19	0.16	0.14
Tenderness	I want to hold someone's hand		0.37			**0.44**			
Awe	I feel I am in the presence of something quite out of the ordinary	0.10				**0.43**	0.17		0.25
Romantic love	I feel giddy				0.26	**0.41**		0.17	
Nurturant love	I want to help someone grow		0.29	0.24		0.35	0.24		−0.10
Romantic love	I feel butterflies in my stomach	0.30		−0.10		0.34	0.16		
Awe	I am rendered speechless	0.26	−0.14			0.32	0.25		0.24

Table 7 (continued)

Emotion scale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Admiration	I feel as if I can learn a lot from a specific person		0.22	0.19		0.24		0.16	
Empathy	I try to relate to someone else's experience		0.19	0.17	−0.12	0.21	0.17	0.19	−0.11
Sympathy	I feel bad for someone						**0.54**		0.10
Sympathy	I feel pity for someone	0.11				0.12	**0.51**		0.18
Sympathy	I worry that someone will not be okay	0.18	0.17	−0.14	−0.15		**0.50**		
Nurturant love	I try to show patience for someone	−0.15	0.22	0.16	0.18		**0.41**		−0.11
Romantic love	I am afraid of rejection	0.16	0.11	−0.19	−0.32		0.34	0.10	
Awe	I cannot believe what I have just seen	0.18	−0.11			0.23	0.33		0.28
Romantic love	I feel vulnerable	0.30			−0.29		0.32		−0.12
Interest	I pay close attention to what I see and hear	−0.22		0.29		−0.11	0.32	0.23	
Empathy	I try to help find a solution to someone else's problem		0.18	0.21		0.13	0.21	0.12	
Amusement	I am entertained				0.18		**0.61**		
Amusement	I laugh	−0.10	0.23		0.10		**0.50**		
Awe	I continue to think about something I have just seen			−0.12	−0.15		0.16	**0.47**	0.20
Contentment	I enjoy the situation		0.14	0.14	0.25		−0.15	**0.45**	
Empathy	I reflect on a time I have experienced a similar situation as someone	0.15		0.15				**0.40**	
Amusement	Something seems funny			−0.23		0.20		**0.40**	
Contentment	I want to stay in the moment			0.12	0.12	0.11		0.37	
Hope	I engage in some wishful thinking			0.24	−0.27		0.12	0.29	
Schadenfreude	I think someone has it coming	0.30			−0.23			0.14	**0.46**
Schadenfreude	I think that someone has brought something bad upon him or herself	0.34	0.13		−0.23				**0.40**

Emotion scale = positive emotion scale which included an item. Loadings > .40 are bolded; loadings less than |.10| are left blank. $N = 406$

whereas in the reanalysis, it included a mix of high-loading hubristic pride and schadenfreude items. More broadly, however, these findings again suggest that the distinctness of the positive emotions observed in Study 4—as well as the set of five positive emotions that emerged as distinct in Studies 3 and 4—were robust to our original decision of which items to include in the analysis.

Discussion

Studies 3 and 4 suggest that five robust subjectively experienced dispositions comprise the trait positive emotion domain: amusement, authentic pride, hope, hubristic pride, and love. However, several other dispositions—awe, interest, compassion, and gratitude—did not clearly or consistently emerge across Studies 3 and 4, calling their robustness into question.

General Discussion

The present research uncovered a provisional taxonomy of subjectively experienced positive emotions based on a rigorous, data-driven analysis of the language used to describe the thoughts, feelings, and behavioral action tendencies that typically go along with these emotions. At the state level, nine distinct subjectively experienced positive emotions emerged from episodes recalled by individuals from two populations, including amusement, authentic pride, awe, compassion (which blended components of empathy, sympathy, and nurturant love), gratitude (which included components of admiration), hope, hubristic pride, interest, and love (which blended components of tenderness and attachment love). In contrast, at the trait level only, five subjectively experienced positive emotional dispositions emerged as robust, distinct entities: amusement, authentic pride, hope, hubristic pride, and love (each of these five emotional traits also emerged as distinct at the state level). At both levels, several frequently studied positive emotions were found to in fact comprise one or more broader subjective experiences, but did not emerge as distinct experiential entities: admiration, attachment love, contentment, empathy, enthusiasm, nurturant love, romantic love, sympathy, and tenderness.

Several differences emerged between the set of subjectively experienced state and trait positive emotions. In particular, whereas gratitude emerged as largely distinct at the state level,
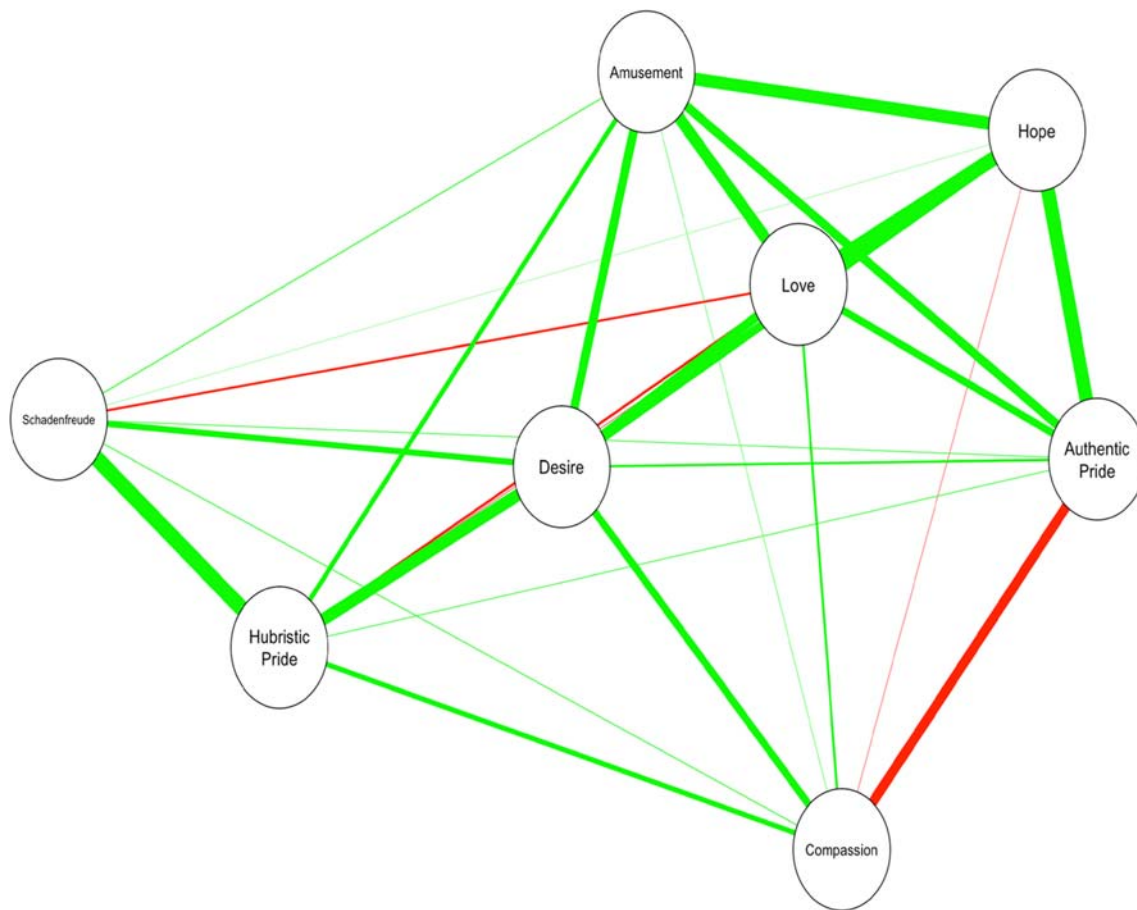
Fig. 7 Network depiction of higher-order trait positive emotional dispositions (Study 4)

at the trait level, gratitude blended with attachment love and tenderness as part of a broad *love* disposition. Additionally, although compassion emerged as subjectively distinct at the state level—comprising empathy, nurturant love, and sympathy—at the trait level, the structure of compassion was not well defined: In Study 3 we uncovered a disposition blending empathy and nurturant love, whereas in Study 4 we found a disposition

primarily capturing sympathy. Similarly, whereas awe and interest emerged as distinct subjective experiences at the state level, these two emotions were not clearly defined at the trait level. Schadenfreude showed the opposite pattern, emerging as subjectively distinct at the trait level in Study 3 (though less so in Study 4) but showing no such distinctiveness at the state level in Studies 1–2. We discuss the implications of these differences below.

Table 8 Factor correlations for higher-order meta-analytic factor analysis of trait positive emotions (Study 4)

	Hubristic pride	Love	Hope	Authentic pride	Desire	Compassion	Amusement	Schadenfreude
Hubristic pride	–							
Love	−.14	–						
Hope	−.06	.43	–					
Authentic pride	.07	.26	.46	–				
Desire	.38	.31	.29	.13	–			
Compassion	.20	.14	−.05	−.33	.27	–		
Amusement	.20	.38	.38	.30	.32	.05	–	
Schadenfreude	.47	−.13	.03	.07	.22	.08	.09	–

Factor names are based on an inspection of the highest-loading items on each factor, and mirror those presented in-text. Factor intercorrelations greater than |.10| are significant ($p < .05$). $N = 406$

Fig. 8 Network depiction of 17 individual trait positive emotions (Study 4)

Theoretical Implications

State Positive Emotions The results of Studies 1–2 point to a set of nine state positive emotions which are distinct at the subjective, experiential level, in that they are typically associated with a largely unique set of thoughts, feelings, and behavioral action tendencies. Furthermore, in Studies 1–2, each single positive emotion factor accounted for at most 9% of the variance in the entire solution. These results imply that, at least in the case of subjective experience, there is validity to theoretical models which treat positive emotions as functional, discrete entities (e.g., Keltner & Haidt, 1999; Tracy, 2014; Shiota et al., 2017). In contrast, dimensional models of emotion would predict that the vast majority of positive emotion experience could be captured by variability on core feelings of pleasantness, activation, and other appraisal-based themes or dimensions (e.g., level of controllability; Roseman & Smith, 2001; Russell & Barrett, 1999; Watson & Tellegen, 1985). Studies supporting dimensional models of emotion typically observe dominant factors representing pleasantness and arousal that account for a much larger percent of the variance in a factor solution than the factors we observed in this work (e.g., over 50% in Feldman, 1995a, 1995b). Furthermore, dimensional theories would not have predicted the emergence of factors that correspond so closely to positive emotions previously theorized to be distinct, such as gratitude, amusement, and interest. At the same time, the present work does not speak

to the functional discreteness of positive emotions at any level beyond subjective experience. Although some of the positive emotions that emerged as distinct here have been shown to have distinct biological or behavioral features (e.g., pride; Tracy & Robins, 2004), more work is needed to test the correspondence between positive emotions that are distinct at the subjective level and those that are distinct in terms of biological indicators or nonverbal expression. As noted in the introduction, such work would inform debates over which positive emotions are discrete, "basic" entities (Ekman, 1992).

The present findings also strongly suggest that the number of positive emotions that are in fact distinct subjective experiences is far smaller than the number of positive emotions that are typically treated as such: Nine state positive emotions emerged as distinct here, compared with the over 30 positive emotions that have been treated as distinct in the empirical literature, based on a review of studies published from 2001 to 2011 (Weidman et al., 2017). That said, the particular set of nine state emotions that emerged in the present work may not emerge as distinct in every analysis of subjective experience, in light of potential differences in methods and subjective components used to assess emotion; future studies using an approach somewhat different from ours might uncover additional subjectively distinct positive emotions. Yet, given the breadth of emotions with which we began this work, we find it difficult to imagine a scenario in which a bottom-up lexical analysis yields a set of subjectively distinct positive emotions

that is 2–3 times as large as the set that emerged here—as would be suggested by the prior literature. As a result, the present findings imply that the breadth of constructs regularly operationalized and studied by positive emotion scientists has expanded to a potentially problematic extent, and a smaller set of subjectively distinct constructs likely drive the bulk of momentary positive emotion experience.

Against this backdrop, it is worth underscoring several points of convergence between the positive emotions that emerged here and those that have been proposed by other scholars. Most notably, Shiota and colleagues (2017, 2014) have proposed a total of 10 distinct positive emotion states across two comprehensive reviews rooted in functionality and biology, including amusement, attachment love, awe, contentment, enthusiasm, gratitude, liking/pleasure, nurturant love, pride, and sexual desire. The majority of positive emotions included in Shiota and colleagues' taxonomies are also represented in our state-level taxonomy across Studies 1–2 (i.e., amusement, attachment love [which we label "love"], awe, gratitude, nurturant love [which we label "compassion"], and pride [for which we include two emotions, "authentic pride" and "hubristic pride"]). It is also promising to note the convergence between the number of state positive emotions identified in our work and that of Shiota and colleagues (i.e., 9 and 10, respectively). Furthermore, four of the five trait positive emotions that emerged as distinct in Studies 3–4 were included in Shiota and colleagues' reviews (i.e., amusement, authentic and hubristic pride, and love). Although there are some points of divergence (e.g., we identified hope and interest as distinct state positive emotions, but neither was included in Shiota and colleagues' reviews), we view the broad similarities as a promising indication that the field might eventually integrate multiple forms of evidence to identify a common core of distinct positive emotions.

Trait Positive Emotions The results of Studies 3–4 point to only five positive emotional dispositions that emerged as distinct at the subjective level. Dispositional positive emotions therefore may not be experienced with a level of fine-grained distinctiveness that matches the level of distinctiveness with which people experience state emotions, nor the manner in which positive emotions are conceptualized in the literature. These results imply that theories of functional, discrete positive emotions may have less validity at the trait level compared with the state level, as discussed above (e.g., Keltner & Haidt, 1999; Tracy, 2014; Shiota et al., 2017). Dimensional models, which specify a smaller number of factors in explaining the positive emotion space compared with discrete models, may have more validity in the case of trait positive emotion (e.g., Roseman & Smith, 2001; Russell & Barrett, 1999; Watson & Tellegen, 1985). Yet it is noteworthy that each trait positive emotion factor that emerged in Studies 3–4 accounted for no more than 11% of the total variance in each factor solution, far less than would be

expected from the dominant factors that typically emerge in studies supporting dimensionalist accounts (e.g., Feldman, 1995a, 1995b). More work is therefore needed to test these two competing theoretical models in lexical data meant to represent a wide range of positive emotion experience.

Regardless of which theoretical position is supported, the same conclusion noted above with respect to state positive emotions may apply to an even greater extent in the case of trait positive emotions: fewer positive emotional traits are experienced as distinct than are studied as distinct in the literature, even though the set of five that emerged here may not be the only or final set of positive emotional traits. It therefore may be questionable to assess a person's tendency to subjectively experience a single positive emotion disposition (e.g., gratitude) under the assumption that it represents a construct distinct from other positive emotion dispositions (e.g., attachment love) or from broad positive affect, aside from the five dispositions that emerged robustly in Studies 3 and 4.

Practical Implications

The present findings reveal a set of nine subjectively experienced distinct positive emotions that should garner the bulk of empirical attention in the near future, more so than the large number of positive emotions that are currently studied but that did not emerge as distinct in this research. This refocusing could take two forms. First, and most simply, affective scientists could examine the causal antecedents and/or functional consequences of feeling these nine positive emotions, in light of the present evidence that they are each associated with at least some distinctive subjective content. For example, in light of our findings, empirical efforts to understand the functional consequences of state gratitude and trait amusement rest on solid construct validation ground. In contrast, empirical studies of state love are more ambiguous (i.e., should we attribute subsequent findings to romantic, nurturant, or attachment love components?), as are empirical studies of trait awe, given that we did not observe a coherent set of subjective components representing this emotion. More broadly, concentrating the field's empirical efforts on a smaller set of positive emotions which are known to be relatively distinct at the subjective level would increase our depth of knowledge regarding these emotions, while reigning in the apparent clutter of positive emotions that are currently studied in the literature (Weidman et al., 2017).

Second, and equally important, affective scientists could further examine distinctiveness of the set of positive emotions that emerged here, in an effort to refine and/or add to the present taxonomy. Echoing sentiments expressed above, it may be that these nine state positive emotions and five trait positive emotions *do not* represent a definitive or final taxonomy but *do* represent a convenient and empirically justified starting point for future work seeking to gain more insight into

the relative distinctiveness of positive emotions. For example, an affective scientist might hypothesize that a state positive emotion such as relief or elevation (neither of which were included in this research) or a trait positive emotion such as gratitude (which did not emerge as distinct here) is in fact a distinct experience. These hypotheses could be tested and supported with studies that use methods somewhat different than those used here (e.g., different emotion elicitation procedure, different initial set of items) and doing so would deepen our knowledge of the positive emotion landscape. In light of the present findings, however, such future studies should empirically test these and related hypotheses using similar taxonomic analyses as those employed here in order to determine where these additional positive emotions in fact fit within the taxonomic space identified here. This course of action is preferable to simply assuming that, for example, state elevation, state relief, or trait gratitude is subjectively distinct and subsequently studying them as such. We hope that our work inspires additional taxonomic efforts and/or revisions of this sort.

Limitations

The present research has several limitations which should be addressed in future work. First, our research relied on a single source of evidence regarding positive emotion experience: the words people use to describe thoughts, feelings, and behavioral action tendencies that they recall via the relived emotion task. On one hand, these subjective components are consensually viewed as foundational to the experience of positive emotions (e.g., Russell & Barrett, 1999; Frijda, 1988; Izard, 2010; Smith & Ellsworth, 1985). Yet on the other hand, our investigation omitted many foundational and well-studied elements of emotion that are more objective and often biological or behavioral in nature (e.g., non-verbal vocalizations, facial and bodily displays, and touch and autonomic profiles; Cordaro, Keltner, Tshering, Wangchuck, & Flynn, 2016; Hertenstein, Holmes, McCullough, & Keltner, 2009; Sauter, Eisner, Ekman, & Scott, 2010; Shiota et al., 2017; Tracy & Robins, 2004). We acknowledge that how many, and which, positive emotions are considered distinct may vary based on the source of evidence used to answer this question. An integration of multiple modalities, including subjective experience and biological and behavioral components, is needed to arrive at a more comprehensive understanding of which positive emotions are distinct at a more ultimate, basic level.

Second, we based our taxonomic analysis on a set of 67 items representing the subjective components that constitute 17 of the most frequently studied positive emotions in the empirical literature. This approach allowed us to provide comprehensive coverage of the vast majority of the positive emotion landscape, therefore increasing the likelihood that our resulting taxonomy proved robust. Yet, it is possible that some

of the emotions we omitted but which are occasionally studied in the empirical literature (e.g., desire, inspiration, relief) may contain distinct subjective content that was not captured by the present taxonomy. Furthermore, even among those emotions we did include, there may be other thoughts, feelings, and behavioral action tendencies that often comprise these experiences but were not included in this analysis. For example, we primarily assessed gratitude toward a specific target, but gratitude can also be felt more broadly toward no specific entity (Lambert, Graham, & Fincham, 2009). Although we predict that this latter form of gratitude would be most similar to general pleasant affect, it is possible that it could represent a distinct positive emotion subjective experience. Regardless of these considerations, we drew a line at including 17 positive emotions and 67 items measuring them for pragmatic reasons, so that participants could feasibly report their feelings across all of these emotions in a single study. Nonetheless, in light of the issues discussed here, the taxonomic structure we uncovered must be considered *provisional*, in that future work could conceivably uncover additional positive emotion subjective content or a different structure among the subjective content examined in this research. We hope our work is generative in inspiring exactly these kinds of additional efforts.

Third, we relied on retrospective designs—in which participants recalled emotion experiences—rather than assessing emotion experience in vivo. This decision was largely a pragmatic one given the limitations associated with alternative methods. For example, had we wished to use experience-sampling methods, we could not have expected participants to report their feelings on a long list of 67 subjective elements as they were going about their daily lives. Likewise, it would have been difficult to identify and validate a set of film clips that uniquely elicited all 17 of the positive emotions with which we began this project. In contrast to these approaches, the recall method we employed allowed us to target specific episodes of each distinct positive emotion using a homogeneous procedure across a wide range of positive emotions that differed in content. This type of recall methodology is widely used and has been shown to reliably elicit distinct emotion experiences (e.g., Ekman et al., 1983; Gonzaga, Turner, Keltner, Campos, & Altemus, 2006; Siedlecka & Denson, 2019). Of course, because we used a recall methodology, the subjective elements we uncovered may in part reflect participants' *understanding* (vs. actual experience) of positive emotions. Given the ultimate aim of understanding positive emotion subjective experience purely in-vivo, future work would do well to assess the subjective experience of positive emotions in more targeted, real-life scenarios. An additional fruitful future direction would be to develop stimuli such as film clips that reliably induce feelings of the 17 positive emotions examined here. As noted above, these potential avenues are consistent with our hope that this research marks an initial step

in a larger and more comprehensive, field-wide examination of the positive emotion subjective experiential taxonomy.

Fourth, all samples in this report were comprised of WEIRD participants (Henrich, Heine, & Norenzayan, 2010), leaving future work to examine whether the structures of subjectively experienced state and trait positive emotions uncovered here emerge among individuals from different cultural backgrounds. Similarly, we did not examine whether other demographic factors such as age and gender moderated the subjective components that comprise distinct positive emotions, because we did not have specific hypotheses regarding these potential moderators. Yet several recent articles have documented age and gender differences in the *experience* of certain distinct positive emotions (e.g., Allemand & Hill, 2016; Else-Quest, Higgins, Allison, & Morton, 2012; Orth, Robins, & Soto, 2010; Ward & King, 2018), raising the possibility that these demographic factors also influence lay people's understanding of the *structure* of positive emotions. This would be another interesting avenue for future research.

Finally, future research might to examine the links between the five distinct positive emotional traits found to robustly emerge in Studies 3–4 and the Big Five personality traits (John et al., 2008). Our speculation is that, despite the obvious parallel in the number of dimensions in each taxonomy, few strong links between individual traits would emerge. Dispositional authentic and hubristic pride, as well as amusement, typically show moderate but not overly strong links to some Big Five traits (e.g., authentic pride correlates .30–.40 with conscientiousness; Shiota, Keltner, & John, 2006; Tracy & Robins, 2007). Furthermore, although one might expect that love would relate positively to agreeableness, the former is defined by forming close interpersonal bonds with specific people (e.g., an attachment figure; see Tables 5 and 7), whereas the latter includes a range of polite and thoughtful responses toward all people (e.g., DeYoung et al., 2007). We are not aware of any work directly linking dispositional hope to the Big Five, although trait optimism (a conceptually similar construct to hope) has been shown to negatively correlate with neuroticism (Scheier, Carver, & Bridges, 1994). In light of these mixed findings, future work is needed to examine all of these links in a systematic fashion.

Conclusion

The science of distinct positive emotions has expanded greatly in recent years, yet based on the present work, the empirical literature appears to include far more ostensibly distinct positive emotion constructs than are subjectively experienced as distinct entities. The present research provides strong evidence for the subjective experiential distinctness of nine state positive emotions and an even smaller number of distinct trait positive emotions. We hope these findings have the immediate effect of highlighting a concise set of distinct positive

emotions that can be examined with confidence in research on subjective positive emotion experience. In the longer term, we hope that this work inspires affective scientists to continually examine and revise the taxonomic structure of positive emotions—while comparing this structure to the taxonomic structure that emerges at other, more biological and behavioral levels of analysis—in an effort to pin down which positive emotions are distinct, basic components of the human experience.

Additional Information

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