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RUNNING HEAD: Digital Emotional Expression Predicts Happiness

Amount and diversity of digital emotional expression predicts happiness

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Abstract

Emotional expression in digital form has become increasingly ubiquitous via the proliferation of computers and handheld devices. Using online surveys and live chat experiments across four studies and 1325 individuals (Study 1A-B and 2A-B), and a large social media dataset spanning 4.9 billion individuals (Study 3), we examine whether digital emotion expression (emojis) predicts happiness at the individual and national levels. Our studies converge on three central findings. First, people use emojis in text-based communication to convey emotional experience. Second, the amount and diversity of emojis causally increases happiness during social interactions. Third, across 122 countries, higher total amount and greater diversity of emoji usage per capita and per user correlate with higher national happiness. Across levels of analysis, our results suggest that both the amount and diversity of digital emotion expression influences well-being.

Keywords: Emotional expression; Emoticons; Emojis; Emodiversity; Happiness

Amount and diversity of digital emotional expression predicts happiness

The relationship between emotional expression and happiness has puzzled philosophers and scientists for millennia. Aristotle offered his principle of moderation, suggesting that expressing a balance of different emotions is the path to flourishing (Ross, Aristotle, & Brown, 2009). Darwin and James offered their own speculations (Darwin, 1872; James, 1884). In empirical studies, expressing and sharing emotions has been repeatedly associated with increased psychological and physical health (Devrimci-Ozguven, Kundakci, Kumbasar, & Boyvat, 2000; Gable, Reis, Impett, & Asher, 2004; Keltner & Bonanno, 1997; Pennebaker, Zech, & Rimé, 2001; Stanton et al., 2000), and regulation strategies that dampen emotional expression – such as suppression – reduce well-being (Cutuli, 2014; Gross & John, 2003; Haga, Kraft, & Corby, 2009; Matsumoto, Yoo, & Nakagawa, 2008). More recent studies of emotional complexity suggest that reporting a large diversity of emotions is associated with decreased depression and better health (Quoidbach et al., 2014).

These literatures set the stage for our central hypotheses, that the amount and diversity of emotional expression benefits happiness. At the same time, they are limited in important ways, for example by mostly using self-report methodologies, and largely focusing on Western European samples. In addition, an emerging literature suggests that the relationship between emotion expression and happiness is not straightforward: the mere expression of negative emotion often does not bring an immediate emotional recovery (Rimé, Paez, Kanyangara, & Yzerbyt, 2011), and expressing too much happiness can be detrimental in certain contexts (Barasch, Levine, & Schweitzer, 2016; Gruber, Mauss, & Tamir, 2011). Given these ambiguities, we use a novel approach using digital emoticons and a combination of experimental (interactive chat platforms) and correlational (large cross-national datasets) approaches, to assess whether the quantity and diversity of digital emotional expression causes increased happiness and predicts increased life satisfaction.

Emotional Expression and Suppression Predict Well-Being

Our first hypothesis – that increased emotional expression predicts increased well-being – derives support from two literatures. The first is the limited body of research on the benefits of emotional expression. For example, women who coped using self-reported emotional expression following diagnoses of breast cancer showed greater levels of psychological and physical health (Stanton et al., 2000), and, separately, patients with psoriasis and low self-reported affective expression level showed more severe symptoms (Devrimci-Ozguven et al., 2000). In the context of bereavement, individuals who laughed and smiled while describing their relationship with their deceased partner showed reduced levels of anxiety and depression several years later (Keltner & Bonanno, 1997). Moreover, greater levels of self-reported emotional expression have been found to relate to better interpersonal relationship in Euro- and Asian-Americans (Kang, Shaver, Sue, Min, & Jing, 2003). These findings provide preliminary support for the hypothesis that emotional expression enhances well-being.

Studies of emotional suppression provide a second foundation for our hypothesis that increased expression will benefit well-being (e.g. Gross & John, 2003; Gross & Levenson, 1997; Matsumoto et al., 2008). Compared to individuals who, for example, reappraise negative emotions (e.g., Brooks, 2014), individuals who tend to suppress their emotions report lower levels of well-being (Cutuli, 2014; Haga et al., 2009) and interpersonal functioning (Gross & John, 2003), such as less psychological closeness to others and more distant relationships (John & Gross, 2004). At the national level, nations with higher levels of emotional suppression have been found to show lower levels of national happiness and life satisfaction (Matsumoto et al., 2008), although this does not seem to be the case among people in collectivist cultures (Butler, Lee, & Gross, 2007; Kang et al., 2003), suggesting cultural differences worthy of further exploration.

Digital Emotional Expression Predicts Happiness

An emergent literature suggests a more nuanced relationship between emotional expression and happiness. Recent research shows that people expressing too much happiness can be perceived as naïve and avoidant of negative information, which was found to be detrimental to interpersonal relationships (Barasch, Levine, & Schweitzer, 2016). Similarly, expressing high levels of happiness does not seem to be linked to psychological health and may instead be costly (see Gruber et al. (2011) for a review on the dark side of happiness). Similarly, other studies find that expressing anger (Bushman, 2002), fear (Lemay & Clark, 2008), or distress (Wolf et al., 2016) might not always be beneficial. Given such ambiguities, more studies of the relationship between emotion expression and happiness are needed.

Emotional Diversity Predicts Well-Being

Our second hypothesis – that greater diversity of emotional expression will predict increased life satisfaction – derives from recent studies of *emodiversity*, a metric which captures the number and relative frequency of emotions a person reports experiencing (Quoidbach et al., 2014). For example, imagine two individuals who each express five emotions over the course of a day: one expresses happiness five times (low emodiversity), the other expresses happiness, sadness, anger, anxiety, and excitement (high emodiversity).

Recent studies find that greater emodiversity of self-reported emotions is associated with decreased depression and more favorable objective health outcomes such as fewer visits to the doctor (Quoidbach et al., 2014), as well psychological wisdom (Grossmann, Gerlach, & Denissen, 2016a). Kang et al. (2003) found that self-reported emotional differentiation was related to strong interpersonal relationships in Asian cultures. Related research on emotional complexity shows that individuals who report expressing a wide variety of emotions are more attentive to their inner feelings, open to experience, demonstrate more empathic concern for others' feelings, and have enhanced interpersonal adaptability (Kang & Shaver, 2004; Lindquist & Barrett, 2008).

Digital Emotional Expression Predicts Happiness

Although suggestive of our central hypotheses, the literatures on emotional expression, regulation, and emodiversity are limited in important ways. First, most of the evidence is correlational in nature (although see Pennebaker's expressive paradigm (Pennebaker & Beall, 1986; Pennebaker & Chung, 2007)), documenting how one's tendency to express emotions as captured by self-report measures or behavioral coding (e.g., laughter during an interview about a deceased spouse) covary with measures of well-being and psychological functioning.

Second, the majority of studies rely on self-report measures of past emotional expression rather than studying actual expressive behavior (such as emoticon usage). And finally, most of the evidence is limited to Western samples, often college students (although see Kang et al. (2003) and Matsumoto et al. (2008)), posing problems of generalization (Henrich, Heine, & Norenzayan, 2010). In particular, recent research on emodiversity suggests that there might be important cultural differences in the complexity and range of emotions people experience (Grossmann, Huynh, & Ellsworth, 2016b). Guided by these past studies but cognizant of their limitations, in the current research, we use emoticons as a proxy for emotional expression: emoticon use. In this way, we can test the hypothesis that expression of a more diverse array of emotions will predict increased life satisfaction and happiness, in both controlled experiments and field data across 122 nations.

Digital Emotional Expression

People express emotions in myriad ways, including nonverbal expressions of emotion such as facial expressions and body gestures (e.g., frowning, smiling, hunching) and verbal expressions such as vocal effects and emotional labeling (e.g., pitch and timbre of voice, spoken words such as "I am sad" or "I feel excited"). Over time, technological development has led to increased human interaction, including the emotional expression, through digital channels—email, text messaging, online chat and message boards, social media websites, and

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on and on. For example, the number of registered users on Facebook—a data source we explore in our studies—has more than doubled in the last five years, from 1 billion active users in 2012 to over 2.2 billion users by the end of 2017 (Statista, 2017). People express their emotions in many ways on these digital channels.

The aspects and consequences of digital communication have been explored in previous research. Work on computer-mediated and virtual communication suggests that digital communication is consequential. For example, relationships cultivated online have the capacity to reduce loneliness and depression (Shaw & Gant, 2002), enhance social bonds (Burke, Marlow, & Lento, 2010), and spread emotional contagion (Kramer, 2012).

Though when people are very familiar with a particular mode of communication and very familiar with a particular communication partner, mode of communication matters less (Channel Expansion Theory, Carlson & Zmud, 1999), the mode of communication people use to interact (e.g., email versus phone versus face to face) matters profoundly. Modes differ in *richness*, the variety of cues the mode of communication transmits (Media Richness Theory, Daft & Lengel, 1986), and *synchronicity*, the extent to which the partners are communicating at the same time (Media Synchronicity Theory, Dennis, Fuller & Valacich, 2008).

Compared to in-person communication, email and text-based communication make people less attentive to their audience (Sproull & Kiesler, 1986), more likely to express views that challenge others (Bishop & Levine, 1999; Ho & McLeod, 2008; Siegel, Dubrovsky, Kiesler & McGuire, 1986), more likely to use tough (versus soft) negotiation tactics (Galini, Gross, & Gosalker, 2007), more likely to express hostility (Stuhlmacher & Citera, 2005), more likely to be influenced by stereotypes (Epley & Kruger, 2005), less satisfied with their team (Baltes, Dickson, Sherman, Bauer & LaGanke, 2002), appear less competent (Schroeder & Epley, 2015), feel more equivalent in status to their communication partner (Dubrovsky,

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Kiesler & Sethna, 1991; McLeod, 1992; Siegel, Dubrovsky, Kiesler & McGuire, 1986), and more task focused (McLeod, 1992).

Though individuals express their emotions digitally in many ways—such as by sending emotionally expressive whole-body avatars, by sharing photos, videos, gifs, and memes that represent their feelings, or by expressing feelings with written text—one of the most pervasive forms of digital emotional expression are emoticons, graphic representations of human emotional expressions, most commonly facial expressions. Prior work suggests that emoticons assist communication by signaling social information nonverbally (Lo, 2008; Walther & D’Addario, 2001), and they are universally recognized among computer-mediated communication users: they are used by 92% of the online population ("2015 Emoji Report," 2015).

In face-to-face interactions, facial expressions are used as non-verbal cues to provide information, regulate interaction, and express intimacy (Ekman & Friesen Wallace, 1969; Harrison, 1973; Keltner & Haidt, 1999; Keltner & Kring, 1998; van Kleef, 2016). Likewise, evidence suggests that emoticons regulate digital social media interactions in similar ways (Derk, Bos, & von Grumbkow, 2008; Gajadhar & Green, 2005; Lo, 2008; Park, Barash, Fink, & Cha, 2013), particularly with regard to expressing emotions and emotional states (Derk et al., 2008; Riva, 2002). In a recent neuroimaging study (Churches, Nicholls, Thiessen, Kohler, & Keage, 2014), seeing emoticons and real human faces activated similar brain regions, suggesting that emoticons are used as non-verbal facial cues in written communication, just as real facial expressions are used in face-to-face communication.

Taken together, due to their frequent usage among diverse age groups and around the world ("2015 Emoji Report," 2015), we suspect and suggest that emoticons can serve as a novel and ubiquitous means for investigating the psychology of emotional expression at scale.

Overview of Current Research

In the current work, we examine emoticon usage to pursue three questions: (a) Are emoticons used to express emotional experiences in digital interactions? (b) How does the *total amount* of emotional expression via emoticons relate to happiness? (c) How does the *diversity* of emotional expressions via emoticons relate to happiness?

First, we investigate how people use emoticons in two short surveys in a US sample (Studies 1A-1B) to validate the usage of digital emoticons as a proxy for emotional expression. Next, we explore how the amount and diversity of emotional expression influences happiness in two experiments in which US participants engage in synchronous online chats (Studies 2A-B). Finally, we extend these findings to the macro-national level by analyzing de-identified country-level aggregate counts of emoticon use on Facebook, linking this data to national happiness metrics (Study 3). Across all studies, we use a multimodal mix of both micro-individual data and macro cross-national data to provide robust evidence that digital emotional expression (via emoticons) meaningfully relates to human happiness.

Studies 1A-B: Establishing a Link Between Emotions and Emoticons

To gauge the alignment between emotional experience and emoticon use, we conducted two studies to examine whether—and how easily—people can match emoticons with different emotional experiences.

Some prior work has suggested that due to the asynchronous and remote nature of text-based communication, emoticons might not reflect the authentic experience of an emotion but instead various strategic intentions (e.g., to express sarcasm, to entertain, to express hypothetical but unfelt emotion) (Derk et al., 2008). Though we suspect individuals use emoticons to misrepresent their emotions, we predict that people more commonly—and easily and intuitively—use emoticons to represent authentic emotions. Therefore, in Studies 1A-B, we investigate the connection between emotional experience (i.e., the way people feel)

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and digital emotion expression (i.e., the way people express their feelings via emojis), with the prediction that most people use positively-valenced emojis in positive emotional scenarios and use negatively-valenced emojis in negative emotional scenarios with the goal of expressing their authentic moods, feelings, and emotions.

Study 1A

This study investigates whether the emoticons people use align with the emotions that they people feel. The results of this study were used to inform the materials we use in Study 1B.

Study 1A: Method

Participants and procedure. We recruited 202 participants from Amazon’s Mechanical Turk (www.MTurk.com) and obtained usable data from 198 participants. Sample size was chosen *a priori*. We lost four participants due to technical problems. The mean age of the participants was 33.6 years ($SD = 8.8$ years) and 61.1% of the sample was male (121 males, 77 women). All participants were U.S. residents and native English speakers. Participants were paid \$.50 for their participation.

Materials. Participants completed three questionnaires. In the first, we asked participants to read sixteen scenarios and choose emoticons they would use to express their feelings in each of the scenarios. Guided by past studies (e.g., Keltner & Cordaro, 2015), the scenarios were written to reflect simple, readily-understood situations (e.g., a friend writing about his dog that died; see supplementary information for all sixteen scenarios). For each scenario, participants chose one of sixteen emoticons in the standard “emoji” package to represent how they would feel (see Figure 1). Taken together, this first questionnaire assessed whether people choose specific emoticons to convey their feelings in a predictable and authentic way—that is, do most people choose positive emojis to match a positive scenario, and negative emojis to match a negative scenario? Agreement across participants in the

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valence of the emojis selected would represent shared, aggregate understanding (consensus) that emoticons convey meaningful emotional expression—at least at the level of positive/negative valence for a specific scenario.

In the second questionnaire, participants listed their motives for using emoticons in their real lives (open-ended response), which were then coded for different intentions.

In the third questionnaire, participants matched emojis from the panel depicted in Figure 1 to emotions they might feel from a list of 11 specific positive and negative emotions: happy, hilarious, sad, confused, angry, in love, cool, surprised, cheeky, neutral, embarrassed, and none.



Figure 1. Emoji panel displayed to participants in Studies 1A and 1B

Study 1A: Results

Emoticon Selection. 86% of participants selected emojis that matched the scenarios on emotional valence (i.e., they selected positive emojis to accompany positive scenarios, and negative emojis for negative scenarios), suggesting that, at least at the level of valence, emoji use tends to match the emotional context. Out of the sixteen scenarios, thirteen scenarios achieved at least 93% agreement between participants on emoji valence (positive/negative).

We used these thirteen high-agreement scenarios in Study 1B. The three remaining scenarios were not kept for further analysis in Study 1B because participant selections for those scenarios were split between positive and negative emojis, as in the following scenario: “I did not expect to take an exam this morning.” We suspect this lower agreement was because these three scenarios were emotionally ambiguous and people were likely to respond

to the situation in different ways (e.g., by using a sad emoji for failing the exam or a shocked emoji representing their surprise).

Motives for emoticon use. Our second questionnaire assessed the motives underlying emoticon use. Participants provided an average of 3.2 motives for using emoticons, with some participants listing up to five motives. Based on a review of the 632 total motives reported, we created a coding scheme with eight categories (see Table 1) emerging from an original word search. Two coders (LV and RS) independently coded each motive into the eight categories and achieved sufficient agreement with a Cohen’s Kappa of .958, $p < .001$. Each motive was coded into one category only. In ten cases, the motives clearly matched two categories. For example, when participants said “to quickly show feelings,” these motives consequently were coded as both “to express feelings, moods and emotions” and “to save time or space in text.” The motive was coded as “other” when the sentence did not make sense, or when the motive was only cited once.

We use these eight categories in a ranking task in Study 1B. Importantly, the most common category was “To express feelings, moods, and emotions,” offering evidence that people use emojis in digital communication to express their emotions.

Table 1. The Most Common Reasons People Use Emojis

Reason for using emojis	Percentage of times cited
To express feelings, moods, and emotions	30
To give context or meaning to the text	16
Because emojis are fun to use	12
To save time or space in text	14
To add colors or visual effect to the text	6
By habit or because everyone is using them	3
To show someone they are appreciated	2
Other	17

Matching emoticons to discrete emotion labels. Our third questionnaire assessed whether participants would match specific emojis (e.g., an emoji representing anger) to the discrete emotion label (e.g., “anger”). Emojis were consistently classified according to valence (positive/negative) with 90% accuracy for positive emojis (emojis with a smile up, corresponding to happy, hilarious, in love, cool and cheeky), 87% accuracy for negative emojis (emojis with mouth upside down, corresponding to sad, confused, angry and surprised), and 60% accuracy for neutral emojis (emoji with flat smile, corresponding to neutral and embarrassed).

In addition, eight of the sixteen emojis were labeled by participants with the target emotion over 80% of the time (these eight emojis were linked to happiness (1 emoji), anger (1 emoji), love (1 emoji), sadness (2 emojis), and being cool (1 emoji). Other emojis were not clearly linked to one specific emotion, such as the grin emoji, which was rated as happy by 24% of participants, as anger by 21% of participants, and as embarrassment by 20% of participants. Overall, these results demonstrate that, at least with respect to this set of emojis, there is consensus among people about which emotions are expressed by specific emojis. These findings help to demonstrate consensus among users and recipients that emoticons convey predictable, understandable emotional expressions.

Study 1A: Discussion

Relying on prior research about emotional expression (Keltner, Tracy, Sauter, Cordaro, & McNeil, 2016), we examined lay perceptions and use of 16 emojis that we will use in testing our primary hypotheses, as well as people’s motives for emoji usage. We identified a set of emojis that unambiguously convey positive versus negative emotional expression (Questionnaire 1) and a specific emotion label (Questionnaire 3). We also found support for our contention that people primarily use emojis to express their feelings, moods, and emotions (Questionnaire 2).

Study 1B

In Study 1A, we found initial evidence for a link between the emotions people experience and the emojis they select to send to others. In Study 1B, we further investigate the relationship between emotional experience and digital emotion expression.

Study 1B: Methods

Participants and procedure. We recruited 779 participants from Amazon's Mechanical Turk (sample size was chosen *a priori*). We excluded 118 participants from the analysis who said they had never used emojis or did not answer that question. The mean age of the 661 remaining participants was 35.2 years ($SD = 10.9$ years), 47.2% of the sample was male and 52.4% female (227 men, 252 women, 1 transgender and 1 other, 180 NA). All participants were U.S. residents and native English speakers. Participants completed two questionnaires and were paid \$1 for their participation.

Materials. Participants completed two questionnaires. In Questionnaire 1, we asked participants to indicate their preference—to send messages with words only, to send messages with words and an emoji, or to send an emoji only (Figure 2)—for each of the thirteen scenarios pilot-tested in Study 1A (see supplementary information). We created percentage scores indicating the percentage of times the participants chose each option. For example, a percentage score of 70% for the “emoji only” condition indicated that 70% of the time (about 9 out of 13 scenarios), the participant selected the emoji-only choice. We then conducted within-person *t*-tests to compare these three means. In Questionnaire 2, we asked participants to rank their reasons for using emojis by order of importance (from the list of seven motives compiled in Study 1A).



Figure 2. Screenshot of one of the 16 scenarios presented with three possible response options: words only, emoji only, and words and emojis.

Study 1B: Results

Preferences for emoticon use. Participants preferred using both words and emojis (on average 49% of the time) compared to only words (37%), $t(582) = 6.6, p < .001, 95\% \text{ CI } [1.11, 2.06]$, and only emojis (24%), $t(582) = -26.7, p < .001, 95\% \text{ CI } [-4.90, -4.23]$. That is, when given the choice to express authentic emotions using just words, just emojis, or words and emojis, people preferred to express their feelings using a combination of emojis and words.

Ranking motives for emoticon usage. We depict the results of this study in Table 2. As in Study 1A, participants report using emojis primarily to express feelings, mood, and emotions.

Table 2. Participant Ranking of the Reasons They Use Emoticons

Motives for using emojis	Mean (sd)	Rank
To express feelings, mood, and emotions	1.88 (1.23)	1
To give context or meaning to the text	2.46 (1.27)	2
Because emojis are fun to use	3.33 (1.53)	3
To save time or space in text	4.45 (1.56)	5
To add colors or visual effect to the text	4.19 (1.40)	4
By habit or because everyone is using	6.53 (1.15)	7
To show someone they are appreciated	5.50 (1.30)	6
Other	7.65 (1.25)	8

Study 1B: Discussion

When imagining being in different emotional contexts, participants indicated that they would prefer sending emojis to express their emotions, rather than just sending words.

Participants also indicated that their main reason for using emojis was to express emotions and feelings. Taken together, the findings from Study 1A and 1B align with previous work, which suggests that emojis often convey authentic emotions (Derk et al., 2008; Lo, 2008; Walther & D’Addario, 2001) and supports the face validity of our methodology in Studies 2 and 3, in which we use emojis as an indicator of meaningful emotional expression.

Studies 2A-B: Emoticon Use in Live Chat

In Studies 2A-B, we test (causally) whether emoticon use during a live, online social interaction influences happiness, testing our primary hypotheses that sending a higher *total amount* of emoticons increases feelings of happiness (Study 2A), as does sending a higher *diversity* of emoticons (Study 2B).

Study 2A

Prior work demonstrates that greater emotional expression predicts increased happiness, and, similarly, increased experience of positive emotions predicts increased life satisfaction (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Kuppens, Realo, & Diener, 2008; Lyubomirsky, King, & Diener, 2005) while suppressing emotions (i.e., concealing the emotions that one truly feels) reduces well-being (Cutuli, 2014; Gross & John, 2003; Haga et al., 2009). In Study 2A, we confirm and extend these findings to digital communication, testing the hypothesis that higher emoji use increases feelings of happiness.

Study 2A: Methods

Participants and procedure. We recruited 195 participants from Amazon’s Mechanical Turk, and obtained usable data from 189 participants. Attrition (6 participants)

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was due to their poor Internet connectivity. The mean age of the remaining participants was 33.41 years ($SD = 10.79$ years) and 55.56% of the sample was male (105 males, 84 women).

We recruited our samples to obtain 100 participants per condition, and sample size was chosen *a priori*. For both studies 2A and 2B, all participants were US residents and native English speakers. Studies 2A and 2B were mutually exclusive, such that participants could only participate in one study. For both studies, Participants were paid \$3 for participating, relatively high pay to ensure a timely recruitment rate, and thus successful participant matching on the chat platform. We used Chatplat, an online software application researchers use to design chat windows with customized features to be embedded in surveys (www.chatplat.com). Chatplat has been validated in previous research (e.g., Brooks & Schweitzer, 2011; Huang et al., 2017). In each chat dyad, participants viewed the same number and type of emojis because it would be confusing to receive emojis from a chat partner that you cannot send yourself. That is, our experimental treatment varying the use of emoji display was administered at the dyad level.

We told participants that they would be paired with another participant to chat for seven minutes, and that they should try to get to know each other. Upon arriving at the chat window, participants were matched with another active participant to create chat dyads. While they chatted, they viewed the 16 emojis from Studies 1A-B (Figure 1). This panel of emojis was displayed continuously in the chat window throughout the seven-minute conversation.

We experimentally manipulated emoji use. To systematically vary the number of emojis used by participants, we explicitly instructed half of the participants to use the emojis (High Emoji Use). For control participants, we provided no instructions about whether or not to use the emojis (Low Emoji Use condition).

Measures. We gathered two measures of happiness immediately following the chat portion of the study. First, participants rated the extent they felt happy on a 7-point Likert scale: *To what extent did your conversation make you feel happy?* Second, participants reported their general life satisfaction on a single 7-point Likert scale: *Taken together, I am satisfied with my life as a whole these days.* (We use the same life satisfaction measure in Study 2B and Study 3).

Study 2A: Results

Our experimental manipulation intended to vary emoticon usage was successful: participants in the High Emoji Use condition sent more emojis during their conversations ($M = 3.70$, $SD = 3.62$) than did participants in the Low Emoji Use condition ($M = 1.25$, $SD = 1.64$), $t(189) = 6.12$, $p < .001$, 95% CI [1.65, 3.23].

Participants in the High Emoji Use condition reported feeling happier after their chat ($M_{HighAmount} = 5.61$, $SD = 1.24$) than did participants in the Low Emoji Use condition ($M_{LowAmount} = 5.10$, $SD = 1.43$), $t(189) = 2.57$, $p = .01$, 95% CI [.117, .892]. There was a marginal effect for experimental condition on generalized life satisfaction such that participants in the High Emoji Use condition reported marginally higher life satisfaction after their chat ($M_{HighAmount} = 5.80$, $SD = 1.11$) than did participants in the Low Emoji Use condition ($M_{LowAmount} = 5.51$, $SD = 1.13$), $t(189) = 1.82$, $p = .06$, 95% CI [-.024, .621].

Study 2B

Study 2A provides evidence that using a higher *amount* of emoticons increases happiness. In Study 2B, we extend correlational findings on emodiversity (Quoidbach et al., 2014) to test the hypothesis that using a greater *diversity* of emoticons increases happiness and life satisfaction.

Study 2B: Methods

Participants and procedure. We recruited 396 participants using Amazon’s Mechanical Turk, and obtained usable data from 361 participants. As in Study 2A, attrition (35 participants) was due to their poor Internet connectivity among those participants. The mean age of the remaining participants was 33.08 years ($SD = 10.50$ years) and 59.56% of the sample was male (215 males, 146 women). We recruited our samples to obtain 100 participants per condition, and sample size was chosen *a priori*.

As in Study 2A, participants learned that they would chat with another active participant, and that they should try to get to know each other during the seven minute chat. The instructions provided were identical to Study 2A. We induced two different levels of emotional diversity (Low v. High) by randomly assigning participants to view one of four panels of emojis while they chatted (Figure 5). They viewed three of the same positive emoji (Low Diversity-Positive), three of the same negative emoji (Low Diversity-Negative), three of the same neutral emoji (Low Diversity-Neutral), or three different emojis (High Diversity). These conditions allowed us to hold the amount of emojis presented constant, while varying the available diversity.

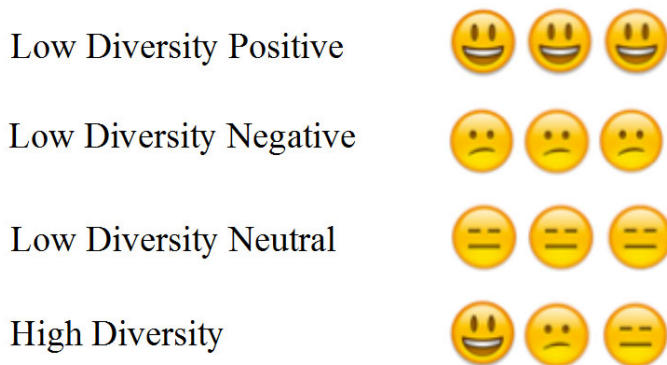


Figure 5. Four panels of emojis presented between dyads that vary in terms of emodiversity.

Measures. Immediately following the chat portion of the study, participants reported two measures of happiness. First, participants rated the extent they agreed with four positive emotions associated with happiness, each using a 7-point Likert scales: *To what extent do you*

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feel [joyful, content, pleased, happy], $\alpha = .89$. Second, participants reported on their general life satisfaction using the same scale as in Study 2A.

Study 2B: Results

There was a significant effect of experimental condition on feelings of happiness, $F(3, 357) = 5.11, p < .01$ (see Figure 3). Participants in the High Diversity condition reported higher levels of happiness ($M_{HighDiversity} = 5.29, SD = 1.03$) at the end of their seven minute interaction, compared to all three Low Diversity conditions ($M_{LowDiversity} = 4.75, SD = 1.35$), $ps < .02$, 95% CI [0.20, 1.15]. Comparing High Diversity with Low Diversity Neutral (95% CI [0.07, 0.89]), High Diversity with Low Diversity Negative (95% CI [0.42, 1.39]); and High Diversity with Low Diversity Positive (95% CI [0.07 1.01]) yielded similar results.

Interestingly, we did not observe any differences in happiness between the three Low Diversity conditions ($ps > .17$), which contained the same number of emojis. That is, participants using negative emojis had similar levels of happiness as participants using positive or neutral emojis. This suggests that the opportunity to express a diversity of emotions, regardless of their valence, might be beneficial for well-being (see Figure 3, which depicts means by condition).

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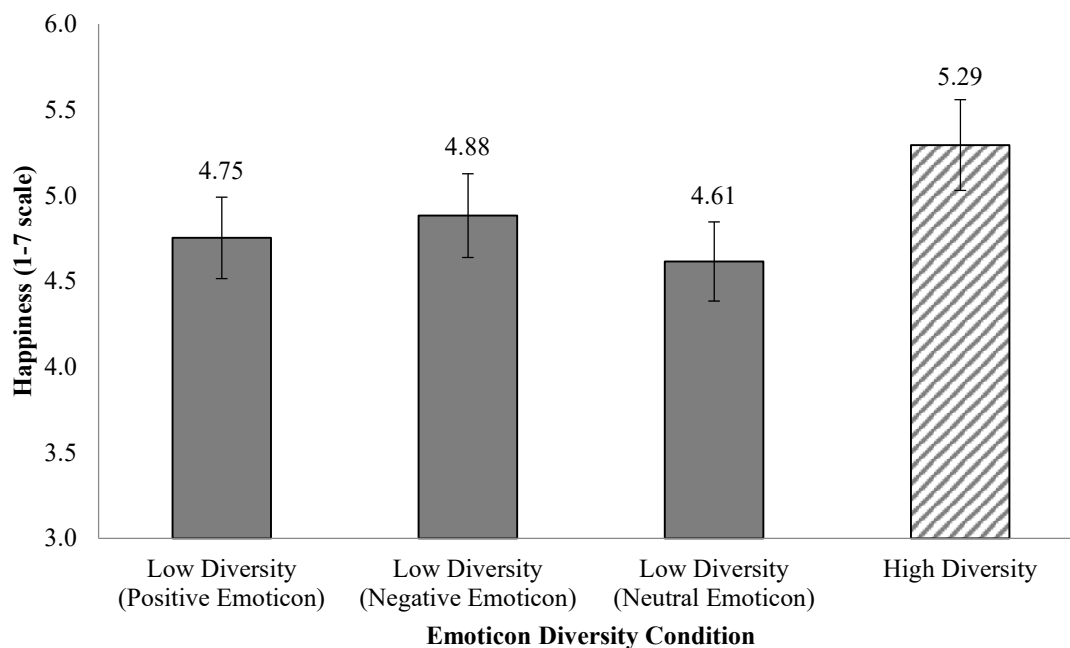


Figure 3. The effect of emoji diversity on happiness. The hashed bar (high diversity) was significantly different from each of the three other conditions. Participants in the high diversity condition reported greater feelings of happiness. Error bars depict standard deviation.

There was also a significant effect of the emotional diversity condition on generalized life satisfaction, $F(3,357) = 23.49, p < .001$ (Figure 4). Participants in the High Diversity condition reported higher life satisfaction ($M_{HighDiversity} = 5.92, SD = 0.99$) compared to all three Low Diversity conditions ($M_{LowDiversity} = 4.92, SD = 1.34$), $ps < .001$, 95% CI [0.61 1.58]. In addition, the effect remained when comparing High Diversity with just Low Diversity Neutral, 95% CI [0.42 1.39]; just Low Diversity Negative, 95% CI [0.54 1.48]; and, just low Diversity Positive. Again, there were no significant differences in life satisfaction between the three Low Diversity conditions ($ps > .33$).

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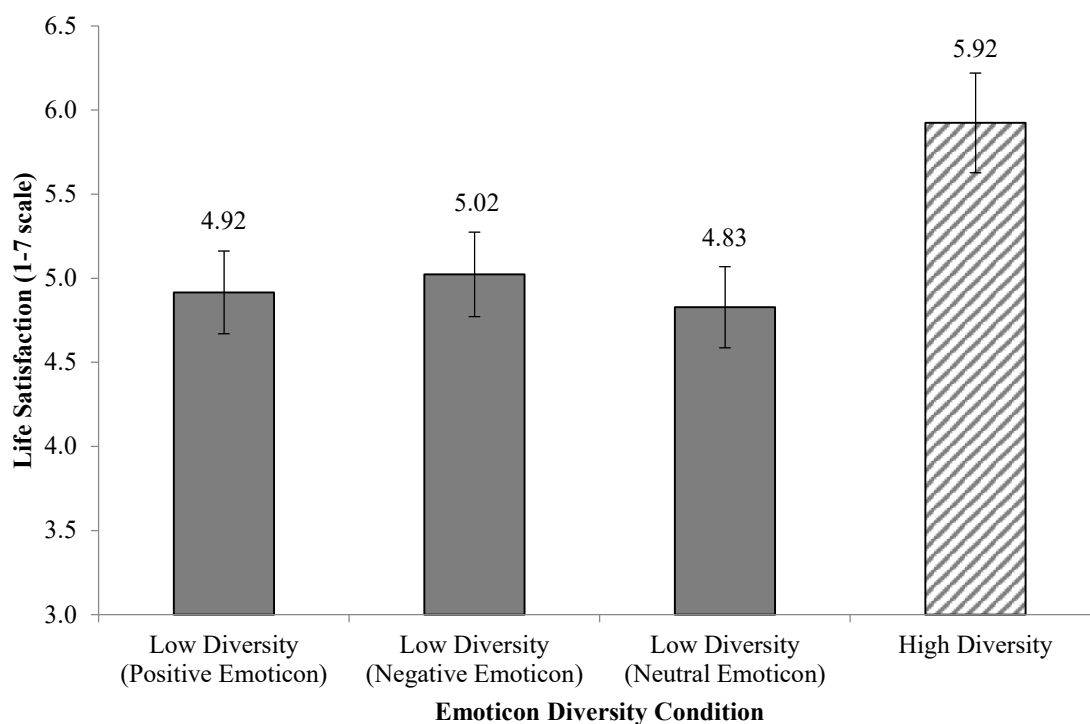


Figure 4. The effect of emoji diversity on ratings of life satisfaction. The hashed bar (high diversity) was significantly different from each of the three other conditions. The participants in the high diversity condition reported greater life satisfaction.

Study 2A-B: Discussion

Findings from Studies 2A-B suggest that using a higher *amount* and *diversity* of emoticons increases happiness and life satisfaction in a controlled, experimental setting. Though these findings suggest causality, the experiments had some limitations. For example, we used brief conversations between anonymous strangers, limited emoticon panels, and simple measures of happiness. Though these experimental design elements allowed for clean manipulation and measurement, we expand our investigation in Study 3 by using naturalistic field data from Facebook paired with large happiness survey data.

Study 3: Emoticon Use on Facebook

Studies 2A-B provide experimental evidence that using a greater amount and diversity of emojis increases feelings of happiness and life satisfaction during informal interactions with anonymous strangers. Study 3 examines whether the benefits of the amount and diversity of emoji usage extend across cultures, using the nation as the unit of analysis. This extension is critical in light of recent studies documenting cultural variations in emotional expression and emodiversity, and their associations with psychological well-being (Grossmann et al., 2016b; Matsumoto et al., 2008). In Study 3, we predicted that nations that show higher total amount and diversity of emoji usage would also show higher levels of happiness.

Study 3: Methods

In this study, we used a new package of emojis—digital facial expressions of emotions—named “Finch,” which were created for Facebook in collaboration with a Pixar Illustrator (Matt Jones) and a coauthor of this article (DK) (Figure 7; Ferro (2013)). The Finch package of emojis was designed according to the latest scientific advances in emotional expression that have mapped displays of a wide array of emotions (e.g. Keltner & Cordaro, 2015; Keltner et al., 2016) to represent 16 different emotions. The finch package is now available for all users on Facebook and has been used by individuals throughout the world, wherever there is access to Facebook. We recorded every usage of a finch emoji in the world during a four-week period from August to September 2013. All data was de-identified and researchers only had access to country-level aggregate counts of Finch emojis.

We restricted our analyses to the nations for which complete data was available for all key predictors, outcomes, and our set of economic, social, political, and environmental controls. Thus, we retained 122 out of the 196 total nations in the world. The total population across these 122 nations exceeded 4.9 billion, and comprised more than 930 million Facebook users, and a total of 143,736,186 Finch emoji occurrences during our four-week

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sampling period. We quantified happiness using life satisfaction data from the World Database of Happiness (Veenhoven, 2012), and the latest available data for economic, social, political and environmental data from the World Bank ("The World Bank Databank," 2012) and Freedom House ("Freedom in the World," 2012) as controls. Using these data, we examined the total amount and the diversity of emotional expression across the 122 countries. The total amount of emotional expression was quantified as the average number of emojis (positive and negative together) used per capita and per Facebook user in each nation over the four-week study period. To measure the diversity of emotional expression, we used a previously-validated measure of emodiversity derived from the Shannon's entropy index (Quoidbach et al., 2014), with the formula: $\mathbf{Emodiversity} = \sum_{i=1}^s (p_i * \ln p_i)$, where s equals the total number of emotions experienced (richness) and p_i equals the proportions of s made up of the i th emotions.



Figure 7. Finch package of emojis

We depict global patterns of total amount and diversity of emotional expression across the world in Figure 6. In particular, Figure 6A and 6B depict the total amount of emojis used in each country, standardized by either the total population (Figure 6A) or the

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estimated Facebook user base (Figure 6B). Figure 6C depicts the level of diversity in the emojis used, with nations higher in emodiversity (more red) using a greater mixture of emojis, and nations lower in emodiversity (more yellow) using a lesser mixture of emojis.

Study 3: Results

Although there was a strong correlation between the total amount of emotional expression per capita and the total amount of emotional expression per Facebook user ($r = .80, p = .01$), there were only weak-to-moderate correlations between the total amount of emotional expression and emotional diversity per capita ($r = .25, p < .01$) and between the total amount of emotional expression and emotional diversity per user ($r = .11, p = .16$). This suggests that the total *amount* and *diversity* of emotion expressed represent two distinct aspects of emotional expression.

As depicted in Figure 6, there were significant regional differences in both the total amount and diversity of emotional expression. For example, Latin American and North African nations were relatively high in the total amount of expression, whereas sub-Saharan African nations were relatively low. Overall, the United States, Canada, UK, Australia, and several Latin American and North African/Middle Eastern Nations were particularly high in emotional diversity, whereas Eastern European and South African nations were low.

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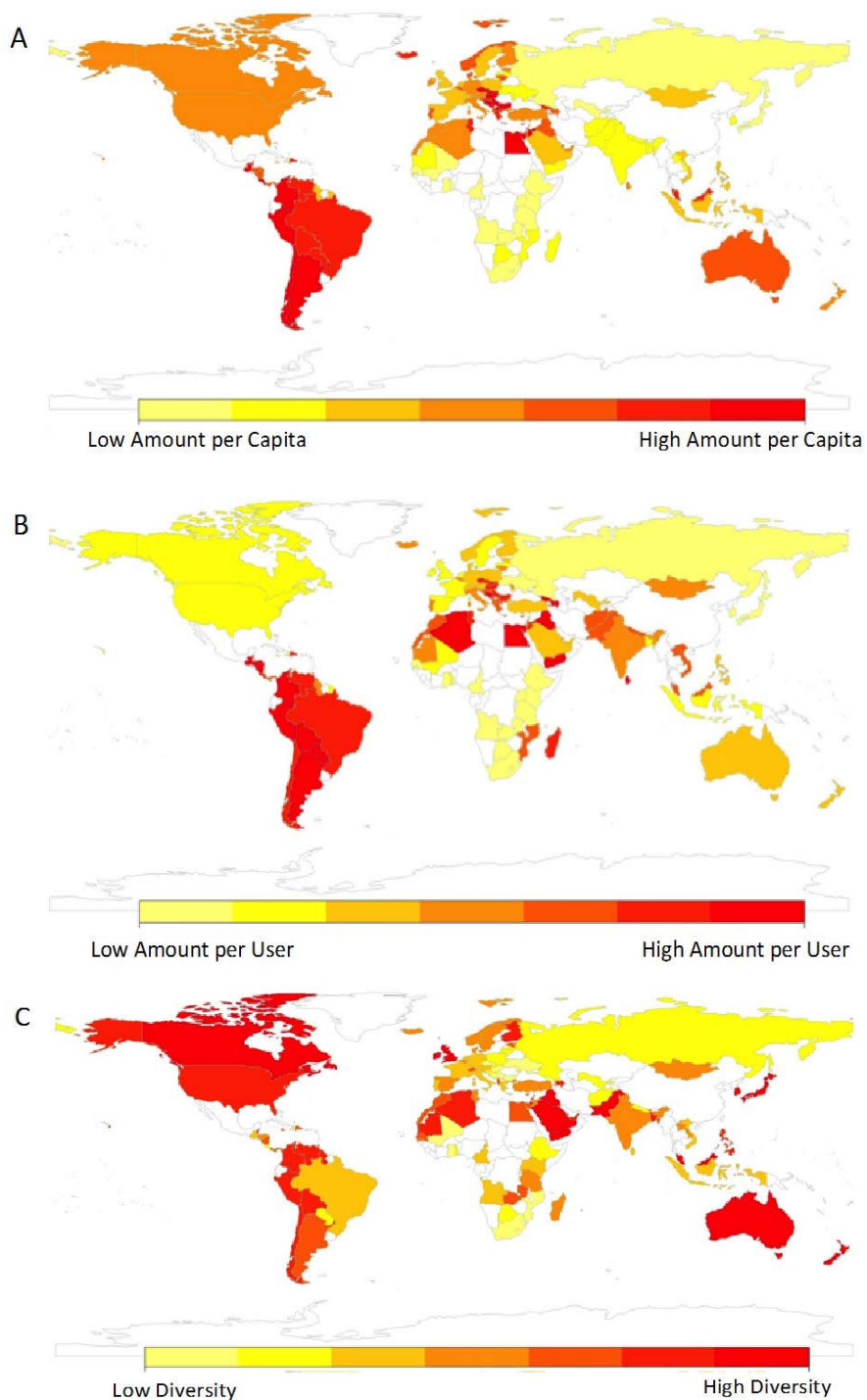


Figure 6. Total amount and diversity of emotional expression across the world. 6A: Total amount of emojis used per resident in each country; 6B: Total amount of emojis used per Facebook user in each country; 6C: Emoji diversity by country.

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We predicted that both the total amount and diversity of emotional expression would be positively related to national happiness. To this end, we first conducted simple correlational analyses. Consistent with our predictions, national happiness level was positively correlated with the total amount of emotional expression per capita, $r = .58$, 95% CI [.45, .69], $t(119) = 7.8$, $p < .01$, the total amount per user, $r = .23$, 95% CI [.05, .39], $t(119) = 2.59$, $p = .01$, and the diversity of emotional expression, $r = .33$, 95% CI [.16, .48], $t(119) = 3.83$, $p < .01$.

This effect was not driven exclusively by either the total amount of positive emoji used, or negative emojis used, because both were also positively correlated with national happiness ($r = .58$, 95% CI [.45, .69], $t(119) = 7.76$, $p < .01$ for positive emotional expression per capita, $r = .23$, 95% CI [.05, .39], $t(119) = 2.54$, $p = .01$ for positive emotional expression per user, and $r = .59$, 95% CI [.46, .69], $t(119) = 7.89$, $p < .01$ for negative emotional expression per capita, $r = .25$, 95% CI [.07, .41], $t(119) = 2.79$, $p < .01$). Further, we also found that the amount of positive and negative emotion expression were strongly correlated ($r = .99$ per capita and $r = .98$ per user, $p < .01$), showing that the total amount of emotional expression matters, not just expressing positive or negative emotions.

In addition, positive emodiversity (using a variety of positive emojis) did not correlate with national happiness, $r = .05$, 95% CI [-.13, .22], $t(119) = 0.49$, $p = .63$, whereas negative emodiversity (using a variety of negative emojis) showed a small positive correlation with national happiness, $r = .18$, 95% CI [.01, .35], $t(119) = 2.11$, $p = .04$. The correlation between national happiness and total emodiversity was higher than the correlation between either positive or negative emodiversity alone. This suggests that regardless of valence, expressing a wide diversity of emojis is most important for national happiness.

Of course, numerous economic, political, social, and environmental factors are likely to play a role in both national happiness and emotional expression. In our second set of

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models, we controlled several factors known to predict national well-being, including log GDP per capita, CO₂ emissions per capita, number of physicians per 1000 citizens, age dependency ratio, civil liberties, log intentional homicides, log literacy rate, and percentage of population with internet access. We constructed two models with these controls: the first with amount per capita and diversity as the key predictors; and the second with amount per user and diversity as key predictors. This approach also isolates the independent effects of emotional expression amount and emotional diversity.

Supporting our hypotheses, both the total amount of emotional expression per capita, $b = .12$, 95% CI [.02, .23], $r_{\text{partial}} = .21$, $t(110) = 2.27$, $p = .025$, and the total amount per user, $b = .19$, 95% CI [.04, .34], $r_{\text{partial}} = .24$, $t(110) = 2.56$, $p = .01$, predicted greater national happiness. Using a large total number of positive emojis also predicted greater national happiness after controlling for the impact of demographic, economic and political variables (amount per capita, $b = .12$, 95% CI [.01, .23], $r_{\text{partial}} = .21$, $t(110) = 2.21$, $p = .029$, and amount per user, $b = .19$, 95% CI [.04, .33], $r_{\text{partial}} = .23$, $t(110) = 2.48$, $p = .015$, respectively). The same was also true for negative emojis (amount per capita, $b = .13$, 95% CI [.02, .23], $r_{\text{partial}} = .22$, $t(110) = 2.39$, $p = .018$, and amount per user, $b = .19$, 95% CI [.05, .34], $r_{\text{partial}} = .25$, $t(110) = 2.74$, $p = .007$, respectively).

Finally, emotional diversity also predicted greater national happiness in models controlling for demographic, economic and political variables, as well as total amount per capita, $b = 5.69$, 95% CI [1.20, 10.19], $r_{\text{partial}} = .23$, $t(110) = 2.51$, $p = .01$, and total amount per user, $b = 5.70$, 95% CI [1.20, 10.20], $r_{\text{partial}} = .23$, $t(110) = 2.51$, $p = .01$. Positive emodiversity alone predicted higher national happiness in models controlling for demographic, economic and political variables, as well as total amount per user, $b = .16$, 95% CI [.15, .31], $r_{\text{partial}} = .20$, $t(110) = 2.18$, $p = .031$, but only marginally for total amount per

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capita, $b = .10$, 95% CI $[-.01, .21]$, $r_{\text{partial}} = .17$, $t(110) = 1.76$, $p = .082$. Negative emotion diversity alone did not predict higher national happiness after controlling for these same variables.

Study 3: Discussion

The results of Study 3 suggest that both the *amount* of emotional expression and emotional *diversity* independently predict greater happiness in countries around the world, controlling for relevant economic, political, and social and environmental factors. Using a very large dataset of emoji usage on Facebook, we found that people who send more emojis—and a greater diversity of them—have higher life satisfaction at the macro-national level of analysis.

Importantly, these effects were not driven by the valence of emojis, showing that it is expressing a large total amount and diversity that predicts higher life satisfaction, rather than just positive or negative emotions. These results align with literature on the social sharing of emotion, which has been shown to strengthen social bonds, foster dyadic connections, and lead to enhanced social integration (see Rimé et al. (2011) for review). Note that our results conflict with Kang et al. (2003), where emotion expression (using the Emotional Expressiveness Questionnaire) was linked to greater relationship quality in Euro- and Asian-American samples, whilst emotional differentiation predicted greater relationship and life satisfaction in Asian cultures only. While further research is needed, the discrepancy may be due to distinct methodologies: whereas Kang et al. (2003) used self-report questionnaires capturing people's knowledge of emotions, we used actual emotional expression as assessed by emoji usage.

General Discussion

The present investigation was inspired by an enduring question: how does the expression of emotion relate to human flourishing? But we have translated this question into today's new social media and the expression of emotion through digital emoticons. Studies

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1A-B demonstrated that digital emotion expression is used to express meaningful emotional experiences, and there is shared understanding about the meaning of emoticons.

We then turned to the central hypotheses. In Studies 2A-B, we found that using both a higher amount and greater diversity of emojis (positive and negative) increased happiness during online, dyadic interactions. In Study 3, we complemented these experimental results with big data from 122 cultures and over 100 million emoji shared. There, we found that nations characterized by high amounts and high diversity of digital emotional expression had higher life satisfaction, relative to nations with low amounts and low diversity of emotional expression. These effects held controlling for a broad range of economic, social, political, and environmental factors.

Our results make several contributions to the literature on emotional expression. First, building on research on the role of positive emotions in human flourishing (Fredrickson, 2001), we focus on the possible benefits of expressing both positive and negative emotions. In fact, at the national level, we find that the core difference in national life satisfaction is predicted by the *total* amount of digital emotional expression—not positive or negative emotions per se. Indeed, we found a near one-to-one relationship between the amount of positive and negative emotion expression at the national level. Thus, our findings highlight the promise of investigating emotional expression generally, rather than just positive or negative emotions, as is often done in the empirical literature. This result is also in accordance with the emerging literature on the dark side of being too happy (Barasch et al., 2016; Gruber et al., 2011): a balance between positive and negative emotions seems to be a better predictor of happiness than positive emotions alone.

Second, our findings highlight the value of understanding patterns of emotional expression, rather than focusing on the sheer amount or intensity of expression. We demonstrate that digital emotional diversity independently predicts national life satisfaction

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around the world—above and beyond the impact of amount of expression alone. These findings, demonstrating a causal role for diversity on happiness, augment recent research on emodiversity (Quoidbach et al., 2014) and emotional complexity (Kang & Shaver, 2004). Future research on emotional expression should continue to focus on such understudied aspects of emotional expression, such as diversity, stability, granularity, the relative impact of emotional valence (positive-negative) versus emotional arousal (high-low), intensity, uncertainty, and other dimensions of emotional expression (Barrett, Lewis, & Haviland-Jones, 2016; Barrett & Russell, 2014).

The results of the present investigation should be interpreted with several limitations in mind. First, the experimental studies were conducted in the U.S., a country that favors free speech and the free expression of emotion. Given cultural differences in emotion expression and suppression (Butler et al., 2007), our experimental results might differ in collectivist cultures such as in Japan. Further, the underlying mechanisms driving relationships between emoji use and happiness at the individual and national level might differ. That is, psychological processes might drive the relationship between the amount and diversity of emojis and happiness at the individual level, while cultural and societal processes might drive these same relationships at the national level. In addition, cultural differences in emoticon usage (Markman & Oshima, 2007; Park et al., 2013) suggest that different cultures may use emojis for different reasons, or place less overall importance on them compared to our U.S. samples. However, to challenge this later point, Markman and Oshima (2007) compared English and Japanese emoticons and found that Japanese emoticons were also used to represent actions and emotions that text alone could not capture, in line with our results.

Second, although we demonstrated the link between digital and actual emotion expression in Studies 1A and 1B, the two differ in critical ways. For instance, while emojis are almost always voluntarily expressed, facial expressions can often be involuntary

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(Kendon, 1987; Marvin, 1995). Although our results converge with findings on the positive associations between verbal emotion expression, and happiness and life satisfaction (Gross & John, 2003; Matsumoto et al., 2008; Stanton et al., 2000), further experimental work examining facial and behavioral emotion expression is needed.

To researchers and the general public, emoticons might seem a trivial afterthought because they require just the tap of a finger. However, we show that they may be a critical component of overall emotion expression. Not only do people use emoticons to highlight the emotions they intend to convey, but they also serve as predictors – and causes – of happiness and well-being. Given the ongoing march towards ubiquitous digital interaction, understanding the psychology of emoticon usage is essential for understanding the psychology of emotion experience and interpersonal emotional expression at-large.

Author contributions:

LV, AWB, MIN, JQ, JG, and DK developed the study concept. LV, AWB and MJS performed the data analysis. LV and AWB created the figures. Data collection was facilitated by LV, RS, EST, PP, SF, AWB, PF, CG, and DK. All authors drafted the manuscript. AWB, MIN, JQ, JG and DK provided critical revisions. All authors approved the final version of the manuscript for submission.

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Data availability:

The datasets generated during Studies 1 and 2 are available from the corresponding author on reasonable request.

The data that support the findings of Study 3 is available from Facebook but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

Code availability:

The custom codes are available from the corresponding author on reasonable request.

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