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Rodrigues, D. L., Prada, M., Gaspar, R., Garrido, M. V., & Lopes, D. (2018). Lisbon Emoji and Emoticon Database (LEED): Norms for emoji and emoticons in seven evaluative dimensions. *Behavior Research Methods, 50*, 392-405. doi:10.3758/s13428-017-0878-6

Lisbon Emoji and Emoticon Database (LEED): Norms for Emoji and Emoticons in Seven Evaluative Dimensions

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Part of this research was funded by Fundação para a Ciência e Tecnologia awarded to the first (SFRH/BPD/73528/2010), the third (UID/PSI/04810/2013), and the fourth authors (PTDC/MHC-PCN/5217/2014), and by a Marie Curie fellowship (FP7-PEOPLE-2013-CIG/631673) awarded to the fourth author.
We thank Nuno Porto for his assistance in preparing the figures.

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Abstract

The use of emoticons and emoji is increasingly popular across a variety of new platforms of online communication. Moreover, they have also become popular as stimulus materials in scientific research. However, the assumption that emoji/emoticon users' interpretation always corresponds to the developers/researchers intended meaning might be misleading. This paper presents subjective norms of emoji and emoticons provided by everyday users. The Lisbon Emoji and Emoticon Database (LEED) comprises 238 stimuli: 85 emoticons and 153 emoji (iOS, Android, Facebook and Emojipedia). The sample included 505 Portuguese participants recruited online. Each participant evaluated a random subset of 20 stimuli in seven evaluative dimensions: aesthetic appeal, familiarity, visual complexity, concreteness, valence, arousal and meaningfulness. Participants were additionally asked to attribute meaning to each stimulus. The norms obtained include quantitative descriptive results (mean, standard deviation and confidence intervals), and meaning analysis per stimulus. We also examined the correlations between the dimensions, and tested for differences between emoticons and emoji, as well as between two major operating systems – Android and iOS. The LEED constitutes a readily available normative database (available at www.osf.io/nua4x) with potential applications to different research domains.

Keywords: LEED; emoticons; emoji; aesthetic appeal; familiarity; visual complexity; concreteness; valence; arousal; meaningfulness; meaning analysis; normative ratings; Android; iOS; Facebook; ICTs

Lisbon Emoji and Emoticon Database (LEED): Norms for Emoji and Emoticon in Seven Evaluative Dimensions

Human communication involves the transmission of abstract and concrete information using verbal and non-verbal symbols (for a review, see Richmond & McCroskey, 2009). Since a few decades ago, and particularly as of the beginning of the 21st century, innovations in technology have dramatically changed the way people communicate with each other. With internet usage and smartphone ownership increasing worldwide, including in emerging economies (PEW Research Center, 2016), different forms of written communication mediated by Information and Communication Technologies (ICTs) have been introduced. These include instant messaging and email applications based on ICT devices operating systems (Android, iOS) or messaging services (e.g., Gmail, Whatsapp), VoIP systems providers (e.g., Skype), social networking sites (e.g., Facebook) and social media platforms (e.g., Twitter).

Some authors suggest that these forms of communication filter out social, affective and non-verbal/visual cues, and can originate less effective communication outcomes (Walther & D'Addario, 2001; e.g., Walther, 1996). However, other studies also show that the absence of such cues does not necessarily render communications less effective. Instead they may promote the implementation of uncertainty reduction strategies to compensate for this absence (Antheunis, Valkenburg, & Peter, 2007, 2010). In particular, the use of written paralanguage cues, often used in written communicative contexts, has been identified as a strategy to overcome the absence of certain cues, because they convey meaning (e.g., Lea & Spears, 1992). These cues include typographical marks (i.e., letters and numbers) and ideograms (e.g., graphic symbols), identified as “typographic or text-based emoticons” and “graphic emoticons” respectively (e.g., Huang, Yen, & Zhang, 2008; Wang, Zhao, Qiu, & Zhu, 2014). In the late 1990s, the latter emerged as an independent strand of meaning and emotional expression through ideograms and pictographs that could be used across ICT platforms. These came to be known as emoji, created with the goal of facilitating mobile communication (Negishi, 2014; Nelson, Tossell, & Kortum, 2015).

In addition to their massive use in daily written communications, both emoticons and emoji are being increasingly used in applied domains, such as marketing and health, as well as stimulus materials in scientific research (e.g., Davidov, Tsur, & Rappoport, 2010; Hogenboom et al., 2013; Skiba, 2016; Thelwall, Buckley, & Paltoglou, 2012; Thelwall, Buckley, Paltoglou, Cai, & Kappas, 2010; Vashisht & Thakur, 2014; H. Wang & Castanon, 2015). However, their selection, coding and analysis may be somewhat biased by assuming a direct correspondence between the users’ interpretation of emoji/emoticon and their intended meaning (e.g., a sad face emoji is negative and will be perceived as such).

In this study we report evaluations of emoticons and emoji provided by ICT users. Specifically, we present the Lisbon Emoji and Emoticon Database (LEED), which includes systematic evaluations of emoji and emoticons in several evaluative dimensions, as well as results concerning the meanings attributed to the stimuli. We provide the first set of normative evaluations for 238 stimuli comprising 85 emoticons and 153 emoji, based on seven evaluative dimensions: aesthetic appeal, familiarity, visual complexity, concreteness, valence, arousal and meaningfulness. In addition, we examined the meaning attributed to each stimulus. It is our contention that the LEED contributes to the literature by proposing subjective norms for emoji and emoticons as stimuli and guaranteeing quality of the codebooks used in both research and practice in a multitude of areas (e.g., affective priming).

Emoticons and Emoji in ICT Mediated Communication

Emoticons and emoji have been considered a new medium to share daily narratives, emotions and attitudes with others through ICTs (for a review, see Gülşen, 2016). Emoticons (from emotion + icon) are symbols created by using punctuation, numbers or letters, with the intention to transmit feelings or emotional states, information in the absence of words, or to complement a written message (Dresner & Herring, 2010; Krohn, 2004; Thompson & Filik, 2016). The first known emoticons **:(** and **:)** were proposed in 1982 and are attributed to Scott E. Fahlman, a professor at the Carnegie Mellon's School of Computer Science, who created them in an attempt to differentiate serious posts from joke remarks in a bulletin board[1]. Since then, emoticons have hugely increased in number and the current list of emoticons is extensive and spans from simple symbols to highly complex ones (e.g., http://www.netlingo.com/smileys). Emoticons include representations of facial expressions, typically sideways [western style; e.g., **;)**], as well as representations of abstract concepts and emotions/feelings (e.g., **<3**). Other emoticons are represented in a right way up position [eastern style; e.g., **(*^.^*)**].

Emoji (from the Japanese e [picture] + moji [character]) are graphic symbols with a pre-defined name/ID and code (Unicode), and include not only representations of facial expressions (e.g., 😄), abstract concepts (e.g., 🤒), and emotions/feelings (e.g., ❤️), but also animals (e.g., 🐼), plants (e.g., 🌹) activities (e.g., 👯), gestures/body parts (e.g., 🙏) and objects (e.g., 🍴). Presumably, emoji were first proposed by Shegetaka Kurita during the late 1990s, who created them while working at a mobile phone operator in Japan to facilitate mobile communication (Negishi,

[1] For a first-person account of emoticon history, see http://www.cs.cmu.edu/~sef/sefSmiley.htm

2014). Currently, there are more than 2,000 emoji supported by different platforms, and they are constantly evolving and becoming more diverse (http://emojipedia.org). For instance, new Unicode releases (e.g., Unicode 11.0 released in 2016) include emoji that represent different social groups, varying for example in ethnicity (e.g., 👩🏾), and age (e.g., 👵🏻).

Ganster, Eimler, and Krämer (2012) pointed out some major general differences between emoji and emoticons. Compared to emoticons, emoji are colored, are not rotated by 90º and, in those representing facial expressions, the face is often delimited by a circle and may include multiple facial cues.

Emoticons and emoji are increasingly popular in our everyday life. They are a constant presence in the way we communicate in the virtual world (e.g., social media, email, text messages; Gülşen, 2016). Nowadays, emoji are also being included in everyday products (e.g., toys, home decoration items, or even clothes). Moreover, emoji have been integrated in the way artists communicate with their audience (e.g., Katy Perry's "Roar" music video), and in the way brands connect with consumers (for a review, see Wohl, 2016). For instance, brands have included emoji in advertising campaigns (e.g., McDonalds used people with emoji as their heads; Beltrone, 2015), and have developed new sets of brand-related emoji (e.g., Dove launched a set of curly-haired emoji; Neff, 2015). In another example of emoji popularity, the Oxford Dictionaries considered the emoji 😂 ("face with tears of joy") to be "the word of the year 2015". Just on Twitter alone, this emoji registered 6.6 billion uses in that year (@TwitterData).

Scientific research about emoticons and emoji is also increasing. Some of the studies examined naturalistic data, such as public messages posted on social media platforms (e.g., Twitter, Google forums, Facebook) to understand and characterize emoticon/emoji usage. For example, Novak, Smailović, Sluban and Mozetič (2015) proposed the Emoji Sentiment Ranking, an index of positivity based on the frequency of each emoji used in negative, neutral and positive tweets. Also, Ljubešić and Fišer (2016) used tweets as their dataset and investigated how popular emoji are on Twitter, which countries exhibited greater emoji usage, and the popularity of specific emoji. Similarly, Tossell and colleagues (2012) conducted a longitudinal study monitoring the use of emoticons in text messages. This type of descriptive analysis can also be conducted in specific domains. For example, Vidal, Ares and Jaeger (2016) examined tweets about eating situations and how people used emoticons/emoji to spontaneously express food-related emotional experiences. Other studies used similar naturalistic data to monitor a given event (e.g., public health information; Paul & Dredze, 2011) or to examine event-centered reactions, opinions, feelings, evaluations or emotions (e.g., elections; Burnap, Gibson, Sloan, Southern, & Williams, 2016). Even though these studies have typically relied on emotional word lexicons, more recently researchers have called upon the need to extend these lexicons to include emoticons and emoji (B. Liu, 2012; Pang & Lee, 2008).

Research focusing on emoticon/emoji usage and functions, suggests that these stimuli serve two key functions: to portray emotional or social intent, and to reduce potential discourse ambiguity (for a review, see Kaye, Wall, & Malone, 2016). Skovholt, Grønning and Kankaanranta (2014) showed that such stimuli also function as contextualization cues (e.g., markers of positive attitudes that facilitate message interpretation) and as organizers of social relationships in written interaction (e.g., reducing perceived interpersonal distance by decreasing impersonality/formality). As examples of these functions, Lo (2008) showed that adding emoticons to online messages improved receivers' understanding of the intensity and valence of the emotions (sad vs. happy) and attitudes (like vs. dislike) expressed by the sender. Likewise, Ganster and colleagues (2012) showed that using a smiling (vs. frowning) emoji/emoticon impacts on how the message is evaluated (i.e., more positive and humorous), how the sender is perceived (i.e., more extroverted), and how the receiver feels (i.e., more positive mood). Derks, Bos and von Grumbkow (2008) further showed that emoticons are useful to strengthen the intensity of a message (e.g., a positive message with a smile emoticon is rated more positively than the same positive message without that emoticon). Yet, in the case of incongruence between valence of the message and of the emoticon (e.g., positive message accompanied by a frown emoticon), message interpretation relies more on the text content.

Another line of research adopts experimental methodologies to examine how the presentation of emoticon/emoji influences different phenomena. For example, Wang and colleagues (2014) focused on the effects of adding positive and negative emoji to messages regarding workplace performance on recipient's acceptance of negative feedback. Likewise, Tung and Deng (2007) tested how the presentation of emoji in an e-learning environment affected children's motivation. In another example, Siegel and colleagues (2015) investigated if including emoji on food packages influenced children´s meal choice. Emoji and/or emoticons have also been used as experimental materials on studies focusing on affective processing (e.g., Han, Yoo, Kim, McMahon, & Renshaw, 2014; Kerkhof et al., 2009; Yuasa, Saito, & Mukawa, 2011). For example, positive and negative emoji have been used as primes to induce valence, influencing responses (event-related potentials) to valenced target words (e.g., Comesaña et al., 2013). Also, research has shown that novel target words primed with positive emoji are more likely to be erroneously categorized as familiar (e.g., Garcia-Marques, Mackie, Claypool, & Garcia-Marques, 2004). Finally, emoji/emoticons have also been used for research methods development, for example as anchors in rating scales assessing current emotional states (e.g., Moore, Steiner, & Conlan, 2013), emotional associations with specific stimuli (e.g., food names; Jaeger, Vidal, Kam, & Ares, 2017), well-being (Fane, MacDougall, Jovanovic, Redmond, & Gibbs, 2016) or pain (e.g., Chambers & Craig, 1998).

Methodologies and Tools for Emoticons/Emoji Analysis

The selection, coding and analysis of emoticons and emoji as direct indicators of emotional meaning conveyed by messages are either based on human (e.g., Park, Baek, & Cha, 2014; Vidal et al., 2016), or computer-based procedures (Davidov et al., 2010; Hogenboom et al., 2013; Vashisht & Thakur, 2014; H. Wang & Castanon, 2015). A computer-based procedure relies on machine-learning algorithms and semantic lexicons that apparently provide a more objective analysis of emoticons/emoji usage. Nevertheless, both human- and computer-based procedures may be prone to bias because they exclusively rely on the evaluations of, and meanings attributed by, researchers/analysts, without taking into consideration the way they are perceived by the users. One area in which this has been particularly worrisome, is the field of computer based sentiment analysis (Thelwall et al., 2012, 2010), which allows detecting and analyzing sentiment/affective reactions, based on semantic analysis of written text. Such analyses rely on codebooks developed by researchers based on the commonly accepted designations/feelings portrayed by emoticons and emoji (e.g., Emoticon Smoothed Language Models, Liu, Li, & Guo, 2012; SentiStrenght coding manual for sentiment in texts available at http://sentistrength.wlv.ac.uk/; e.g., Thelwall et al., 2012, 2010).

The Emoji Sentiment Ranking (Novak et al., 2015) constitutes an attempt to overcome some of these limitations. However, this index focuses exclusively on the valence dimension and does not take into account other relevant information such as the level of arousal elicited by a given emoji or the meaning attributed to it. Therefore, standardized procedures for the classification of emoticons/emoji are still missing.

In our view, this state of affairs may have two potential problems. First, the stimuli selection, coding and analysis may be prone to biases from researchers' own evaluations of the stimuli (e.g., analyses based on ad hoc emotionality categorization made by two coders; Park et al., 2014). Second, there may be a biased assumption that emoticon/emoji users' interpretation necessarily corresponds to the developers/researchers intended meaning. Because emoji/emoticons are not usually labeled when presented (with the exception being the Facebook emoji set), they are open to interpretations. Indeed, users can select an emoji based on superficial visual features, which can lead to misinterpretations of meaning and intent. For example, one may wish to express sadness by selecting a tearful emoji and mistakenly choose 😂 (face with tears of joy), instead of 😢 (face with tears of sadness). Additionally, the same emoticon/emoji can be used to represent a variety of meanings. For instance, a smiley face may be used to express happiness, but may also be used to express agreement with or liking something/someone, express one's physical or mental wellbeing state, express empathy, comprehension, or other meanings. Moreover, the same emoticon/emoji can also be interpreted differently according to the communication context. For example, emoticons such as **:p** and **;)** are typically described as positive, but can also be used as markers of irony (Carvalho, Sarmento, Silva, & de Oliveira, 2009), or sarcasm (Thompson & Filik, 2016). Finally, emoji with the same intended meaning may have distinct visual representations across operating systems, potentially leading to different interpretations and evaluations

(Miller et al., 2016). To sum up, as with other types of visual stimuli, emoji/emoticons are prone to subjectivity in their evaluation and interpretation, which supports the need to develop a normative database.

Normative data are abundant in the literature (for reviews, see Prada, Rodrigues, Silva, & Garrido, 2015; Proctor & Vu, 1999). These validated databases typically include stimuli such as words (e.g., Bradley & Lang, 1999a), sounds (e.g., Bradley & Lang, 1999b), or images depicting a broad range of contents (e.g., Dan-Glauser & Scherer, 2011; Lang, Bradley, & Cuthbert, 2008). Regarding the latter, some databases include for example visual materials such as simple line drawings (e.g., Bonin, Peereman, Malardier, Méot, & Chalard, 2003; Snodgrass & Vanderwart, 1980), or symbols (e.g., Mcdougall, Curry, & Bruijn, 1999; Prada et al., 2015). Other databases are theme-focused and include specific contents such as food (e.g., Blechert, Meule, Busch, & Ohla, 2014; Charbonnier, van Meer, van der Laan, Viergever, & Smeets, 2016) or human faces (e.g., Ebner, Riediger, & Lindenberger, 2010; Garrido et al., 2016; Mendonça, Garrido, & Semin, 2016).

The absence of published normative data on visual stimuli such as emoticons and emoji has two important consequences. First, it implies the additional effort of pretesting materials to meet study demands. For example, prior to their affective priming study, Comesaña and colleagues (2013) had to conduct two extensive pretests in which 180 participants evaluated the valence, arousal and meaning associated to each emoji. Second, the comparison of results between studies can be challenging because stimuli are often categorized ad hoc. For example, in their study on tweets about food, Vidal and colleagues (2016) had two coders categorizing emoji and emoticons as negative, neutral or positive by considering their intended meaning or available description. Park and colleagues (2014) also had two coders categorizing emoticons in three levels, but considered a different dimension (emotionality: sad, neutral, happy) and distinct criteria (emotion conveyed by shape of the eyes and by the shape of the mouth).

In the current paper we present the normative ratings of a set of emoticons and emoji from the two most used operating systems – Android and iOS. We also included emoji reactions from the most used social networking platform – Facebook. Each stimulus was evaluated regarding its aesthetic appeal, familiarity, visual complexity, semantic clarity, valence and arousal of the meaning conveyed, and meaningfulness. Additionally, we assessed the subjective meaning attributed by participants to each stimulus. We selected this set of seven evaluative dimensions based on previous norms with other types of visual stimuli. Specifically, we followed the methodology adopted in a recent validation study (for a detailed review of the dimensions of interest, see Prada et al., 2015), with the exception of adding the dimension of clarity, which has emerged as a relevant for the evaluation of facial expressions (for a review, see Garrido et al., 2016).

Method

Participants

A sample of 505 Portuguese individuals (71.7% women; M_{age} = 31.10, SD = 12.70) volunteered to participate in a web survey. These individuals were recruited on-line through Facebook (university institutional page and online studies advertisement page) and mailing services (students mailing lists). All participants were native Portuguese speakers or lived in Portugal for the last five years. The sample comprised mostly university students (46.7%) and active workers (43.3%), with at least a Bachelor degree (46.0%). Most participants indicated Android/Google (67.5%) or iOS (26.3%) as their operating system.

Stimulus Set

The LEED includes 238 stimuli[2]: 85 emoticons and 153 emoji (77 iOS, 63 Android, 9 Facebook and 4 Emojipedia) mostly representing facial expressions of emotions (e.g., "happy face") and/or symbolic meanings (e.g., "silence")[3].

The emoticon set was developed based on the list of emoticons presented in the "Twitter emotion coding instructions"[4] for the SentiStrenght™ tool (Thelwall et al., 2010; adapted from Wiebe, Wilson, & Cardie, 2005), used for sentiment detection in short texts. This list included 63 Western style emoticons (e.g., Emot07, see Figure 1) and 23 Eastern style emoticons (e.g., Emot56a, see Figure 1). One symbol was removed due to unavailability in mobile phone text packages (**:Þ**).

Because a given emoticon can sometimes vary in its presentation, variations of the same stimulus were included. For example, Emot01 ("laughing, big grin") has three variations identified in the database from Emot01a to Emot01c. Each emoticon was generated in black 28-point Arial font on a white background and saved as a single image file (72x68 px, 72 dpi, RGB, PNG format).

According to the information available at the Unicode foundation (http://unicode.org/emoji/charts/full-emoji-list.html), we selected emoji with an intended meaning similar to emoticons. Figure 1 depicts examples of emoticons and emoji for "laughing" and "crying". As in the case of emoticons, variations of the same emoji were included. The 153 emoji set was extracted from the Emojipedia database (http://emojipedia.org/) and included stimuli from the two most used and available operating systems at the time the study was performed: Apple iOS 9.3 (used in

[2] The full set of stimuli is available as online supplemental material, and at www.osf.io/nua4x. This includes the corresponding Unicode references (http://unicode.org/emoji/charts/full-emoji-list.html) and intended meanings for each emoticon/emoji proposed by the Unicode foundation.
[3] For identifying the stimuli in our database, we used the prefixes: Emot = Emoticon; Emj = Emoji; Ap = Apple iOS; An = Google Android; Fb = Facebook; Pe = Emojipedia.
[4] Available at http://sentistrength.wlv.ac.uk/documentation/TwitterVersionOfSentimentCodeBook.doc

iPhone, iPad, iMac, Apple Watch, Apple TV) and Google Android 6.0.1 (Android devices, Gmail Web Interface, Google Hangouts, and Google Chrome internet browser).

Emoji were matched across operating systems according to their Unicode reference. Of the 153 emoji set, 63 stimuli were represented in both operating systems (all 63 Android emoji had a corresponding iOS emoji), 14 were only represented in the iOS operating system (e.g., EmjAp51) and eight were represented in both operating systems and in the Facebook reactions set (see Figure 1)[5]. This latter subset included nine emoji: the like/dislike buttons (EmjFb76 and EmjFb77, respectively), the recently added "Facebook Reactions" (five faces expressing emotions, EmjFb07 to EmjFb67; one heart symbol, EmjFb71), and the new like button (EmjFb78). Lastly, four Emojipedia images (EmjPe86 to EmjPe89) were also included in the final set. These Unicode 9.0 emoji were not available in Android or iOS operating systems at the time of the study (e.g., EmjPe89), but were included in order to represent potentially future official emoji not currently available. Each emoji was saved as a single image file (72x72 px, 72 dpi, RGB, PNG format).

The vast majority of the emoji set represents facial expressions (88.89%), the exceptions being popular symbols (3.27%; e.g., heart, EmjAn71; heartbreak, EmjAn72) and hand gestures (7.84%; e.g., hand palm, EmjAp75).

[5] Except for the new "like" emoji which had no correspondence, given that the old "like" button was the one used as a correspondent to similar emoji in iOS and Android. Moreover, a non-existent emoji in Facebook, the "dislike" emoji (representing the "like" emoji in an inverted position), was also included in the stimuli set given that when the study materials were created there were news stating that Facebook would include this option in their platform, which proved later on not to be the case.

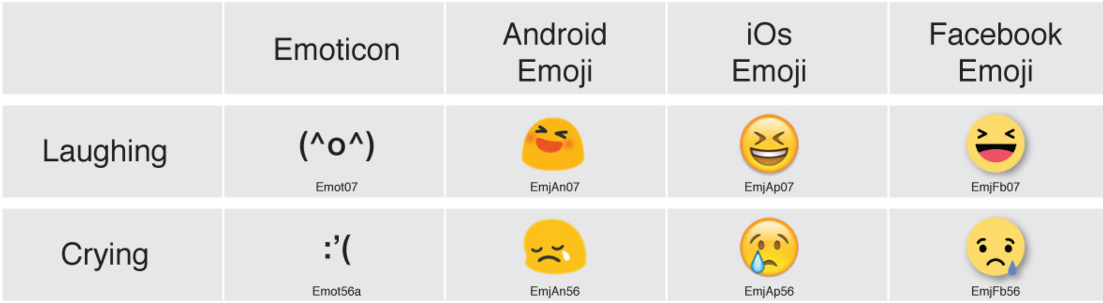

Figure 1. Sample emoticons and emoji across operating systems for "laughing" and "crying" (stimuli codes are included).

Procedure and Measures

The study was conducted using Qualtrics® software. Participants were invited to collaborate on a web survey about the perception and evaluation of emoticons and emoji. After clicking on the hyperlink, participants were directed to a secure webpage and were informed about the goals of the study and its expected duration (approximately 20 minutes). Initial instructions provided the definition of emoji and emoticons and examples of each type of stimulus were presented (emoticon: :) :| :(and emoji: ☺ 😐 ☹). To avoid overlap, these examples were different from the stimuli used in the evaluation task. Participants were also informed that all the data collected would be treated anonymously and that they could abandon the study at any point by closing the browser, without their responses being considered for analysis.

After providing their informed consent to collaborate in the study (by checking the "*I agree*" option), participants were asked to provide information regarding their age, sex, educational level, current occupation, and their operating system. Following this, they were given specific instructions to evaluate each stimulus in seven evaluative dimensions, namely: aesthetic appeal, familiarity (subjective frequency), visual complexity, clarity, valence, arousal, and meaningfulness (all dimensions rated using 7-points Likert-type scales; detailed instructions for each scale are presented in Table 1; see also Garrido et al., 2016; Prada et al., 2015). These dimensions were randomly presented per trial in the evaluation task. Finally, participants were requested to write the first meaning or emotion that came to their mind for each stimulus in an open-ended response format, or alternatively select the option "*I do not know*" if they were not able to provide a specific meaning or emotion. Instructions also emphasized that responses would have to be fast and spontaneous and that there were no right or wrong answers.

Table 1

Instructions and Scale Anchors for each Dimension

Dimension	Instructions	Scale
1. Aesthetic appeal	In your opinion, considering the visual characteristics of the symbol, and not the object or concept it may depict, how visually appealing is the stimulus?	1 = *Visually unpleasant/unappealing;* 7 = *Visually very pleasant/appealing*
2. Familiarity	How frequently do you encounter or see this stimulus in your daily routine? More frequently encountered stimuli are more familiar.	1 = *Not familiar;* 7 = *Very Familiar*
3. Visual complexity	Considering the complexity of the visual characteristics of the stimulus, and not those of the concept that can be related to it, how much visual detail and complexity does this stimulus contain? The more details the stimulus contains, the more complex it is.	1 = *Very simple;* 7 = *Very complex*
4. Clarity	How clear or ambiguous is this stimulus? Stimuli that, in your opinion, clearly convey an emotion/meaning should be considered clear. Otherwise, they should be considered more ambiguous.	1 = *Totally ambiguous;* 7 = *Totally clear*
5. Valence	To what extent do you consider this stimulus refers to something positive/pleasant or negative/unpleasant.	1 = *Very negative;* 7 = *Very positive*
6. Arousal	To what extent do you consider this stimulus refers to something arousing/exciting or passive/calm?	1 = *Very passive/calm;* 7 = *Very arousing/exciting*
7. Meaningfulness	Please indicate to what extent this stimulus conveys a meaning/emotion.	1 = *Conveys no meaning/emotion at all*; 7 = *Conveys a lot of meaning/emotion*

Participants then proceeded to the main task. In order to prevent fatigue and demotivation, each participant only saw a sub-set of 20 randomly selected stimuli from the available pool of 238 stimuli. Each stimulus was presented in a single page of the web survey. We used the force response option, such that participants were required to answer each question in order to progress in the survey. The number of participants evaluating each stimulus varied between 40 and 49. The stimuli were always presented on the top left corner of the page, with all evaluative dimensions presented below. Upon completing the task, participants were thanked and debriefed.

Results

The norms for the full set of stimuli are provided as supplementary material. In the following sections we present: a) the preliminary analysis regarding outlier detection; b) the analysis of the differences by gender and operating system; c) the subjective rating norms for each dimension; d) the correlations between evaluative dimensions; and e) the analysis of attributed meaning/emotion.

Preliminary Analysis

Because only completed surveys were included in the analysis, there were no missing cases. Outliers were determined considering the criterion of 2.5 standard deviations above or below the mean evaluation of each stimulus in a given dimension. This analysis yielded a small percentage (1.32%) of outlier ratings. Moreover, none of the participants responded systematically in the same way (i.e., using the same value of the scale). Therefore, no participants were excluded.

Emoticons and Emoji Evaluations

Comparing the evaluations of emoticons and emoji on each dimension for the total sample (see Table 2), overall results show that emoji (vs. emoticons) were rated as aesthetically more appealing, $t(498) = -24.82$, $p < .001$, $d = 1.11$, more familiar,

$t(498) = -23.73$, $p < .001$, $d = 1.06$, clearer, $t(497) = -31.45$, $p < .001$, $d = 1.41$, more positive, $t(498) = -2.50$, $p = .013$, $d = 0.11$, more arousing, $t(498) = -21.51$, $p < .001$, $d = 0.96$, and more meaningful, $t(498) = -31.00$, $p < .001$, $d = 1.39$.

Table 2

Evaluations (Mean and Standard Deviation) for Emoticons and Emoji in each Dimension for the Total Sample, Men and Women and Mean Difference Tests

	Total Sample (N = 505)		Men (n = 143)		Women (n = 362)		Difference test for gender	
Stimulus/Dimension	*M*	*SD*	*M*	*SD*	*M*	*SD*	*t*	*p*
Emoticons								
Aesthetic appeal	3.01_a	1.13	3.09_a	1.19	2.89_a	1.11	0.91	.373
Familiarity	3.38_a	1.30	3.29_a	1.31	3.42_a	1.30	-1.03	.306
Visual complexity	3.39_a	1.25	3.35_a	1.20	3.41_a	1.27	-0.50	.612
Clarity	3.52_a	1.20	3.48_a	1.17	3.54_a	1.21	-0.49	.622
Valence	3.96_a	0.82	3.96_a	0.83	3.95_a	0.82	0.08	.941
Arousal	3.90_a	0.81	3.95_a	0.80	3.88_a	0.81	0.88	.379
Meaningfulness	3.69_a	1.22	3.62_a	1.22	3.70_a	1.23	-0.39	.699
Emoji								
Aesthetic appeal	4.65_{b***}	1.04	4.55_{b***}	0.99	4.69_{b***}	1.05	-1.42	.141
Familiarity	4.86_{b***}	1.18	4.55_{b***}	1.14	4.99_{b***}	1.17	.3.85	< .001
Visual complexity	3.52_a	1.24	3.52_a	1.14	3.53_a	1.27	0.05	.965
Clarity	5.33_{b***}	0.93	5.15_{b***}	0.91	5.41_{b***}	0.93	-2.87	.003
Valence	4.08_{b*}	0.85	4.01_a	0.80	4.11_{b*}	0.87	-1.20	.204
Arousal	4.84_{b***}	0.86	4.73_{b***}	0.84	4.88_{b***}	0.87	-1.73	.079
Meaningfulness	5.43_{b***}	0.85	5.29_{b***}	0.81	5.49_{b***}	0.86	-2.43	.015

Note. Subscripts indicate 5,000 bootstrap samples paired sample *t* tests comparing emoticons and emoji on each evaluative dimension, by column. Different subscripts indicate significant differences: *** $p < .001$, * $p < .050$. *p* values for gender differences correspond to 5,000 bootstrap samples paired samples *t*-tests.

Gender differences. The general results of the comparison between emoticons and emoji were also observed in both women and men subsamples. However, men provided equivalent valence ratings for emoticons and emoji. We also tested for gender differences in the evaluation of emoticons and emoji on each dimension. As shown in Table 2, no gender differences emerged in the ratings of emoticons.

Replicating this analysis for emoji, results showed that women evaluated emoji as more familiar, clear and meaningful than men, all $p < .015$. This pattern of results remained the same after controlling for the main operating system used by participants, all $p < .019$.

Operating system differences. Emoji evaluations were compared between Android and iOS operating systems (Table 3). Results show that iOS emoji were evaluated as more aesthetically appealing, familiar, clearer and meaningful, all 5,000 samples bootstrapped $p < .006$. In contrast, no differences between operating systems were found for visual complexity, valence and arousal, both 5,000 samples bootstrapped $p > .059$.

Table 3

Evaluations (Mean and Standard Deviation) for Android and iOS *Emoji in each Dimension for the Total Sample and Mean Difference Tests*

	Android		iOS		Difference test	
Stimulus/Dimension	*M*	*SD*	*M*	*SD*	*t* (504)	*p*
Aesthetic appeal	4.45	1.22	4.77	1.11	6.38	<.001
Familiarity	4.43	1.53	5.05	1.22	10.40	<.001
Visual complexity	3.59	1.32	3.55	1.27	-0.89	.370
Clarity	5.12	1.12	5.30	0.99	3.70	<.001
Valence	3.85	1.01	3.95	0.91	1.89	.059
Arousal	4.74	0.98	4.77	0.95	0.69	.494
Meaningfulness	5.31	1.04	5.42	0.92	2.72	.006

Note. 5,000 bootstrap samples paired sample *t* tests comparing Android and iOS emoji on each evaluative dimension.

Subjective Rating Norms

In order to define subjective rating norms, data was further coded and analyzed by stimulus. For each stimulus, we calculated frequencies, means, standard deviations and confidence intervals (CI) in each dimension (see Appendix 1). Based on these results, stimuli were categorized as Low, Moderate or High in each dimension (for a similar procedure see Prada et al., 2015). When the CI included the response scale midpoint (i.e., 4) stimuli were considered as “Moderate” in a given dimension. Stimuli were categorized as “Low” when the upper bound of the CI was below the scale midpoint and as “High” when the lower bound of the CI was above the scale midpoint. In the case of valence, Low means Negative, Moderate means Neutral, and High means Positive. Figures 2 and 3 presents a summary of this analysis for emoticons and emoji separately.

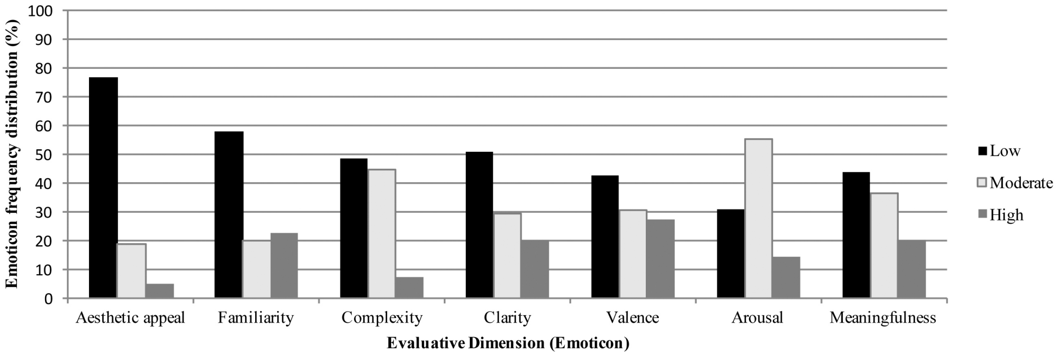

Figure 2. Emoticon frequency distributions in each dimension level. *Note.* For valence: Low = Negative, Moderate = Neutral, High = Positive.

As shown in Figure 2, the majority of emoticons were categorized as low in aesthetic appeal (76.47%), familiarity (57.65%), and clarity (50.59%), and as moderately arousing (55.29%). Moreover, results show that most emoticons were categorized as low (48.24%) or moderate (44.71%) in complexity, and as low (43.53%) or moderate (36.47%) in meaningfulness. Regarding valence, emoticons were distributed across the three levels: low (42.35%), moderate (30.59%), and high (27.06%).

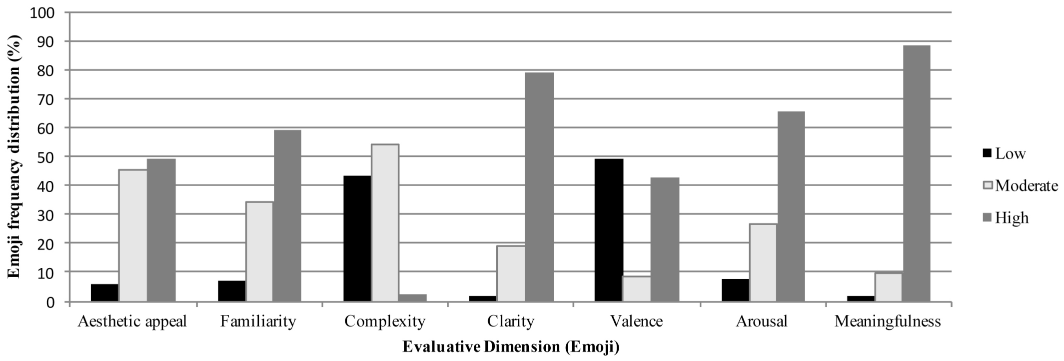

Figure 3. Emoji frequency distributions in each dimension level. *Note.* For valence: Low = Negative, Moderate = Neutral, High = Positive.

Figure 3 shows that the majority of emoji were categorized as highly familiar (58.82%), clear (79.08%), arousing (65.36%) and meaningful (88.24%). Results further show that emoji were categorized as high (49.02%) or moderate (45.10%) in aesthetic appeal, and moderate (54.25%) or low (43.10%) in complexity. Of notice, emoji were somewhat polarized in their valence, being mostly categorized as low (49.02%) and high (42.48%) in this dimension. Figure 4 depicts examples of emoticons and emoji for each level per evaluative dimension.

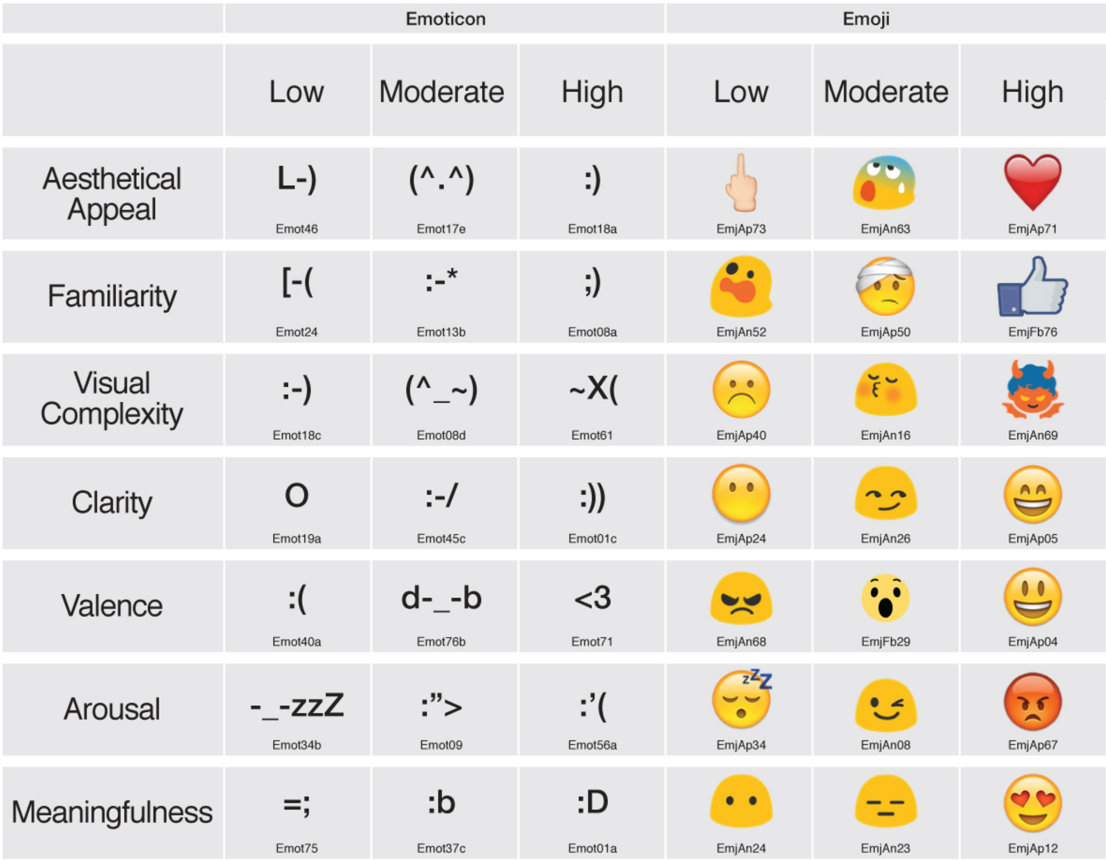

Figure 4. Sample emoticons and emoji in each level across dimensions (LEED stimuli codes are included). *Note.* For valence: Low = Negative, Moderate = Neutral, High = Positive.

Correlations Between Dimensions

Overall, results show significant correlations between dimensions (see Table 4). For example, meaningfulness was strongly correlated with aesthetic appeal (r = .547), familiarity (r = .648), clarity (r = .743) and arousal (r = .506). Also, clarity was strongly associated with aesthetic appeal (r = .538) and familiarity (r = .704). Aesthetic appeal was also strongly associated with familiarity (r = .556).

Table 4

Pearson's Correlations Between the Dimensions

Dimensions	1	2	3	4	5	6
1. Aesthetic appeal	-					
2. Familiarity	.556***	-				

3. Visual complexity	-.038***	-.188***	-			
4. Clarity	.538***	.704***	-.175***	-		
5. Valence	.403***	.250***	-.032***	.176***	-	
6. Arousal	.266***	.314***	.106***	.398***	-.005	-
7. Meaningfulness	.547***	.648***	-.062***	.743***	.123***	.506***

*** Correlation is significant at the .001 level (2-tailed).

Analysis of Attributed Meaning/Emotion

In addition to meaningfulness ratings, participants were also asked to indicate the meaning or emotion attributed to each stimulus. Percentage of responses was computed considering the sample size that evaluated a given stimulus. Two independent judges coded the meaning/emotion attributed by the participants to each symbol (for a similar strategy see, for example, Prada et al., 2015). Synonyms (e.g., “don't speak” and “silence”, EmjAp31) and singular/plural forms (e.g., “smiles” and “smile”, Emot1c) were included in the same category. The meaning of 15 emoticons was not categorized due to a low percentage of responses (i.e., < 25%). For example, from the 42 participants that evaluated Emot32, only eight indicated meaning, from which two were categorized as “smile”, two as “ignore”, and the remaining were uncategorized. Note that the sum of percentages of both categories does not necessarily equals 100. For example, 48.4% of the valid responses for EmjAp47 were categorized as “glad”, 25.8% as “upside down”, whereas the remaining responses (n = 8) were heterogeneous and therefore uncategorized (e.g., “normality”; “sarcasm”).

The percentage of meaning responses varied between 4.3% (Emot75) and 95.0% (Emot01a) for emoticons (M = 49.9%, SD = 24.1), between 46.9% (EmjAn24) and 100% (e.g., EmjAn71) for Android emoji (M = 84.6%, SD = 11.9), and between 48.8% (EmjAp24) and 100% (e.g., EmjAp57) for iOS emoji (M = 86.9%, SD = 11.3). Moreover, the percentage varied between 90.7% (EmjFb17) and 100% (e.g., EmjFb76) for Facebook emoji (M = 95.7%, SD = 2.9), and between 74.4% (EmjPe86) and 97.8% (e.g., EmjPe88) for Emojipedia emoji (*M* = 82.9%, *SD* = 10.8). Within each operating system, results regarding the first category showed that, on average participants agreed on the meaning of both Android (64.95%) and iOS (66.78%) emoji.

A detailed discussion of the meaning or emotion attributed to each stimulus would be too extensive. The complete meaning analysis is presented in Appendix 2 alongside the Unicode intended meaning for comparison purposes. In some cases, the meaning categorization converged with the Unicode intended meaning. For instance, participants attributed a congruent meaning to the "winking face" stimulus in its different formats. For emoticon (Emot08a) the most frequent meanings were "wink" (40.5%) and "agree" (21.6%), for the iOS emoji (EmjAp08) these were "agree/compliance" (40.0%) and "wink" (28.6%), and for the Android emoji (EmjAn08) these were "wink" (40.6%) and "compliance" (25.0%).

In other cases, there was only partial convergence. For example, the emoji "face savoring delicious food" was interpreted as "cheeky/fun" (63.2%) and "tasty" (18.4%) in the iOS emoji (EmjAp10), and as "wink/cheeky" (59.4%) and "tasty" (12.5%) in the Android emoji (EmjAn10). In another example, the emoji "imp" was attributed the meanings "evil" (60.0%) and "mischief/prank" (30.0%) in the iOS emoji (EmjAp70), and "evil/mischief" (62.5%) and "rage" (22.5%) in the Android emoji (EmjAn70).

In addition, for other stimuli the attributed meaning differed across operating systems and from the Unicode intended meaning. For example, the emoji "dizzy face" was attributed the meaning "shocked" (66.7%) in the iOS emoji (EmjAp66), and "confusion" (46.5%) and "hypnotized" (18.6%) in the Android emoji (EmjAn66). These examples clearly illustrate that the meaning participants assign to emoji is not always convergent with their Unicode intended meaning and also varies across operating systems.

Discussion

In this paper we present the LEED, which includes 238 emoticons and emoji, evaluated across seven evaluative dimensions: aesthetic appeal, familiarity, visual complexity, clarity, valence, arousal, and meaningfulness. Additionally, participants attributed meaning to each stimulus. To our knowledge, this is the first available emoticon/emoji normative database.

First of all, results showed that, in comparison to emoticons, emoji are perceived as more aesthetically appealing and familiar, clearer and more meaningful. Most emoticons were categorized as low in aesthetic appeal, familiarity, clarity, valence and meaningfulness, whereas most emoji were categorized as high in familiarity, clarity, arousal and meaningfulness. This may be associated with an increasing popularity and use of emoji. Indeed, recent evidence shows that as emoji usage increases the usage of emoticons decreases (Pavalanathan & Eisenstein, 2015). Also, in the case of stimuli depicting facial cues, the graphical representation of emoji may be more appealing because they are better proxies to human facial expressions (e.g., Ganster et al., 2012).

Second, results showed no gender differences regarding the evaluation of emoticons. Emoji, however, were evaluated as more familiar, clear and meaningful by women. This finding converges with empirical evidence showing that women were more likely than men to use emoji (e.g., Fullwood, Orchard, & Floyd, 2013). Third, recent literature suggests the need to take into account possible differences in emoji evaluation across operating systems (Miller et al., 2016). Indeed, our results show that iOS emoji were evaluated as more aesthetically appealing, familiar, clear and meaningful than Android emoji. Fourth, overall we found significant correlations between the evaluative dimensions (e.g., stimuli that were perceived as more meaningful were also perceived as more aesthetically appealing, familiar, clear and arousing). This pattern replicates findings from databases of other visual stimuli using the same evaluative dimensions (Garrido et al., 2016; Prada et al., 2015).

Fifth, in addition to presenting normative ratings across dimensions, our database includes participants' interpretation of the meaning of each stimulus. Participants were more likely to attribute meaning to emoji than to emoticons irrespectively of the operating system (iOS vs. Android). It is important to note that even though participants described the meaning in terms of what the stimulus directly represents (e.g., wink), they were also likely to go beyond this mere description and infer about its intent (e.g., being cheeky). This is particularly relevant because it allows researchers to assess the extent to which the intended meaning overlaps with the meaning attributed by users, and more importantly because our findings show this is not always the case. However, as in previous research, our coding system for the meaning has shortcomings that render this overlap subjective (see limitations below).

Emoticons and emoji are often analyzed in the absence of information about the context in which they are communicated (Gaspar, Pedro, Panagiotopoulos, & Seibt, 2016). This was also the case of the current research in which ratings were obtained by presenting the stimuli in isolation. This can constitute a limitation, because the interpretation of visual stimuli is often context-dependent (e.g., Wolff & Wogalter, 1998). Emoticons/emoji are typically incorporated in a message and research has already shown that they can influence how the message is interpreted (e.g., Derks et al., 2008; Fullwood et al., 2013). Moreover, the reverse may also occur, such that the content of the message can influence the interpretation of emoticons/emoji (e.g., Miller et al., 2016). For instance, a winking emoji can be interpreted differently when accompanied by “Let’s go to the movies **;)**” versus “Let’s watch a movie at my place **;)**”. Furthermore, emoticons/emoji interpretation can also depend on how the sender’s goals are perceived (Gaspar, Barnett, & Seibt, 2015; Gaspar et al., 2016). For instance, winking emoji accompanying a sarcastic remark can be differently interpreted when the sender is a close friend or when the sender is one’s boss.

Another limitation to the present study concerns the specific cultural context where this dataset was developed. Culture has emerged as a factor that influences emoticon and emoji usage in online communication (Park et al., 2014). Our normative dataset was obtained with Portuguese participants and, according to recent data (Ljubešić & Fišer, 2016), Portugal ranks fourth in Europe for emoji usage on Twitter. Nevertheless, as with other normative databases, generalizations to other populations should be made with caution and cross-validation is recommended. Therefore, future studies may explore extending this study and resulting database to other countries/cultures to assess cross-cultural differences and similarities. It should also be noted that differences may arise between studies that analyze how emoticon and emoji are evaluated in isolation from the context in which they are often used, and those focusing on how users actually contextualize them in communication. For example, in our study participants perceived emoji as negative or positive, whereas the work by Novak and colleagues (2015) showed that users mostly use positive emoji in their tweets.

Finally, the results from the meaning analysis indicated that intended meaning and users’ interpretation of that meaning do not always overlap. Two independent coders analyzed and categorized the responses given by participants to each stimulus.

Although this procedure is not exempt from bias, the lack of overlap constitutes an important indicator that the selection of emoji and emoticons to use in research or practice should be carefully conducted, based on more objective normative data such as reported in the LEED. Other procedures could be used to determine users' interpretation of meaning. For instance, researchers could use forced choice tasks (i.e., decide which emotion/meaning is expressed by the stimuli; Vaiman, Wagner, Caicedo, & Pereno, 2015).

The LEED mostly includes stimuli depicting graphical representations of faces. Research has shown that this type of emoji is processed similarly to other human nonverbal information (e.g., voice and facial expression; Yuasa et al., 2011) and that emoji can be used to prime social presence (Tung & Deng, 2007). Therefore, our stimuli can be used in studies concerning affective processing and be used as experimental primes in this regard. Future studies could also seek to expand our normative ratings to other emoji representing humans (e.g., bodily postures and activities). Considering that recently new emoji varying in age group and skin tone were added to the available set in different platforms, it would be interesting to examine whether they are suitable as stimulus materials in research designed to examine topics such as person perception, intergroup relations, and social influence.

The LEED is a useful tool for researchers and practitioners (e.g., public health officials) interested in conducting research with naturalistic data (e.g., user-generated messages shared on social media platforms). It can also be used in a variety of experimental paradigms, particularly when the control of stimuli characteristics is required. Instead of relying their selection, coding and analysis of emoticons and emoji on ad hoc categorization and intended meaning, researchers and analysts can rely on the systematic normative ratings offered by the LEED.

This type of database has also the potential to be used in more applied contexts comprising ICTs mediated written communication, such as in marketing, education and professional contexts (e.g., Skiba, 2016; Skovholt et al, 2014). Particularly promising is the field of health informatics (see, for instance, Eysenbach, 2011). Both human based and computer based evaluations of ICT users reactions to health related events have been used for a variety of public health issues monitoring and surveillance (e.g., influenza like diseases and dengue; Milinovich, Williams, Clements, & Hu, 2014). In such monitoring, machine learning algorithms and semantic lexicons often use computer based techniques. These techniques would benefit if based on normative ratings as offered by the LEED.

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