International Journal of Information, Control and Computer Sciences
ISSN: 2517-9942
Vol:13, No:5, 2019

The Paralinguistic Function of Emojis in Twitter Communication

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***Abstract*—**In response to the dearth of information about emoji use for different purposes in different settings, this paper investigates the paralinguistic function of emojis within Twitter communication in the United States. To conduct this investigation, the Twitter feeds from 16 population centers spread throughout the United States were collected from the Twitter public API. One hundred tweets were collected from each population center, totaling to 1,600 tweets. Tweets containing emojis were next extracted using the "emot" Python package; these were then analyzed via the IBM Watson API Natural Language Understanding module to identify the topics discussed. A manual content analysis was then conducted to ascertain the paralinguistic and emotional features of the emojis used in these tweets. We present our characterization of emoji usage in Twitter and discuss implications for the design of Twitter and other text-based communication tools.

***Keywords*—**Computer mediated communication, content analysis, paralinguistics, sociology.

I. Introduction

THE present day has seen a great increase in the popularity of social networking sites such as Facebook, Twitter, LinkedIn, and many similar sites. Indeed, hundreds of such websites are currently in use by millions of people on a daily basis. These social networking sites enable people from disparate geographic locations and walks of life to communicate in an almost instantaneous fashion and form social and emotional connections with individuals whom they would never have formed relationships with in the real world [1]. Importantly, however, many social media exchanges rely heavily on text communication, which is very different from real world face-to-face (FTF) conversation. FTF exchanges normally include not only spoken words but also contain information about voice intonation, timing as well as a wide range of body language. This nonverbal communication plays a "paralinguistic" role in communication; it operates in tandem with words, phrases and sentences to convey important emotional and social aspects of a conversation. Such information can be analyzed in an almost instantaneous fashion by the individuals taking part in the conversation in question [2] and significantly enriches the information that is exchanged.

Because simple text-based communications do not contain body language and other paralinguistic features in these increasingly popular text-based communication platforms, we propose that increasingly emojis are being recruited to play this role. *Emojis* are abstract representations of facial expressions and body language; as such they may inject such content into n text-based online communications [3]. Therefore, it can be said that the usage of emojis in text-based online communications can be seen as enhancing the emotional content and context of a conversation that is missing in text alone. Even if emotion is expressed using text (e.g., "I'm so happy"), the text itself is an abstraction of the emotional content otherwise expressed via the body language and facial expressions, which are paralinguistic in nature. In the work reported here, we examined the nature of emoji use in text-based communication, with a focus on the paralinguistic role of these small image-based characters.

A. Emojis as a Communication Medium

Emojis, which became popular during the middle of the 1990s, emerged from an earlier form of keyboard based emotional expressions known as *emoticons*, which consist of a series of keystrokes which represent a facial expression. However, unlike emoticons, which must be created from scratch by the user and may vary significantly in form from user to user, emojis are predefined and not modifiable; they are selected from an emoji keyboard just like any other character.

Current emoji keyboards contain more than emotional facial expressions, as was the case in the past. Nowadays, a myriad of objects, including everyday objects like a sun, a tree or an airplane, have also been designed as emoji characters [4]. Indeed, the scope of the content covered by emojis, as well as their corresponding use cases, is currently expanding to include much more than the traditional paralinguistic features of facial expressions and other forms of body language. Also common now are visual representations of objects which would otherwise have to be described verbally (note that in some cases the object appears both in text and as an emoji).

Use of emojis is currently increasing, with keyboards available on many electronic communication devices; these keyboards allow users to select an emoji and "type it" just as they would otherwise type text into an input field [5]. Each emoji keyboard is slightly different, depending on the operating system of the device on which it is contained and the platform within which the emoji keyboard is being used. For example, the emojis available through Apple iPhone and related devices will differ in some ways from those available through Android phones. Despite these differences, which tend to be very slight in nature, every existing emoji is tied to a single Unicode representation, which is consistent across all platforms and devices.

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B. Twitter as a Text-Based Communication Channel

The Twitter messaging tool was launched in October, 2006; it was designed to be a microblogging platform. *Microblogging* can be defined as a manner by which one quickly updates one's friends and online followers in real time with regards to the mundane activities which one is currently engaging in. This method of communication must be short and succinct so as to fulfill its purpose of rapid social engagement. As a result, the Twitter platform places a length limit for each microblog, or tweet, to 140 characters. Twitter use has grown exponentially from the time of its founding; by April 2007 (i.e., in just over six months), Twitter users numbered 94,000 [6]. At the time of writing, the number of users of this social networking site is 326 million [7].

The topics discussed on the Twitter social networking site are diverse in scope and in content. However, in general, Twitter users discuss the same topics that are circulating within the news media at the time that these tweets are created by individual Twitter users [8]. That is, on any given day, the subject matter of the majority of tweets created on that day are related to newsworthy events occurring on that very same day. For this reason, Twitter is seen as an effective way to quickly sample "what is happening" in the world, or at least in the world defined by the users a Twitter reader chooses to follow.

C. Paralinguistic Content in Text-Based Communication

As a result of the inherent abstractness and lack of imagery in purely text-based conversation, it is impossible to convey the wide range of paralinguistic functions that body language and facial expressions bring to FTF exchanges. The paralinguistic features of spoken language are primarily auditory and visual in nature, and verbal text is neither auditory nor visual. The auditory paralinguistic features of language include such aspects as fluctuations in vocal pitch and energy fluctuations in the voice of the speaker [9]. The visual paralinguistic features of language include such aspects as raising or lowering one's eyebrows, or the nodding of one's head, or other body gestures such as moving one's hands [10]. Because the conversations that occur on social networking sites such as Twitter are textual in nature and contain no form of real-time viewing of the individuals conversing, these traditional paralinguistic functions will be absent during the course of such a conversation, leading to potential ambiguity or misunderstanding of the emotional content and context of the conversation in question.

Even though the paralinguistic potential of text-based communications is miniscule in size, there may be some minor expressions of paralinguistic information that the writer embeds in the text conversation. For example, to emphasize excitement, a writer may include an exclamation mark; to mark a statement as a question, one can write a question mark [11]; and so on. Using punctuation marks such as this, the writer is able to clarify the language action intent of a statement that otherwise might be ambiguous as to whether it is an exclamation or a question.

Despite the paralinguistic challenges of text-based communication, users of modern social networking sites such as Twitter are able to mitigate these challenges to some extent by using an appropriate tone in the language they choose to convey their ideas and opinions. That is, in contrast to formal written texts, which are used to provide general information to the general public, the messages written by users of social networking sites are conversational in nature. As a result of their conversational tone, a greater degree of emotion is present even in the text characters making up these messages (conversational speech often contains much more emotional content than formal speech [12]). However, despite the greater emotional content in a social networking message, the reader of such a message may not grasp the specific emotion conveyed by a message; emotion conveyed by words is simply more ambiguous than emotion conveyed by body language. This is true because the range of facial expressions which can convey emotions is much larger and more nuanced that the number and variety of words that can be used to convey emotions [13]. Therefore, there is much more specificity in terms of emotional content when a facial expression is used to convey an emotion as opposed to a word or series of words.

D. The Paralinguistic Potential of Emojis

In addition to the inclusion of emotional and paralinguistic factors into an otherwise emotion-sparse text-based conversation, emojis can also be used to add a visual element to an otherwise imageless text-based conversation [14]. Some emojis are popular during specific times of the day and year because they evoke or reinforce certain aspects of the time in question. For example, emojis that present a picture of Santa Claus are popular during the winter holiday times; emojis that present a picture of a beach are popular during the summer. Interestingly, there is a correlation between these time specific emojis and the usage of emojis which are more general in nature, such as emojis which pertain to emotions and opinions [15]. Users tend to insert these types of emojis in conjunction with each other, perhaps because the seasonal content is partly responsible for an emotion that the user wants to express (e.g., being at a beach in the sunshine makes you feel happy!).

There is a sound *a priori* case for the claim that emojis are used as a substitute for the body language inherently present in face-to-face conversation, at least partly because usage of these emotional abstractions is currently increasing to a dramatic degree among internet users [16]. Despite the novelty of emojis and their usage, this is not the first time in the history of the English language that new symbols have been invented to convey emotion. Indeed, the now mundane question mark and other punctuation symbols were added to the English language in the 15th century in an attempt to increase and clarify the emotional context of written speech [11].

As the use of emojis has increased, the presence of emoticons (a series of keystrokes arranged to visually convey a facial expression) has decreased [17]. This finding suggests that the paralinguistic role offered by emojis is superior to that of other forms of digitally-represented paralinguistic cues, such as emoticons. This finding is corroborated by the fact that the standardization of emojis has given rise to a more exact

conveyance of emotional content than the unstandardized nature of emoticons, which may be interpreted in a myriad of ways by individuals.

Another factor that points to the paralinguistic nature of emojis is that, when used within a series of words, emojis are more correctly interpreted with regards to the emotion which they convey than when they are used independently; without words surrounding them for context [18]. Therefore, emojis can be seen as an aspect of communication that is intricately associated with language; they are most accurately understood when they are used in conjunction.

Previous research has revealed that, in a general sense, emojis are used to convey emotions and simple body language in text-based conversations, however, most of these studies were conducted to ascertain usage differences across different national and gender groups. Thus, the research described in the current paper is an extension of previous research on differences in body language and gesture usage in real-world, in-person conversations, and by individuals of different nationalities. That earlier research revealed that different national groups retain their distinct tendencies towards using particular gestures and body language even generations after emigrating from their countries of origin to the United States of America [19].

With regards to gender differences in the usage of emojis, one study that investigated these differences found that females are more likely to use emojis to make sure that the emotional intent of a message is not misinterpreted; in contrast, males are more likely to use emojis to insert humor into a text-based conversation [20]. Another study in this domain revealed that males and females use different emojis to different degrees; that is, the most popular emojis used by male users are different than the most popular emojis used by female users [21] Also, females tend to use more emojis in their online communications on social networking sites than males [22].

Another study, which investigated how emojis are used differently by Spaniards vs. Chinese individuals, revealed that Spaniards use fewer emojis than Chinese individuals, except in the case of emojis which represent anger, which were used to an equal degree among individuals of both nationalities [23]. It has also been found, through brain imaging techniques, that individuals may perceive an emoji as being ironic if one's neural response to an emoji is opposite that which is predicted by the apparent emotion represented in the emoji; whereas individuals may perceive that the same emoji is unironic if one's neural response to that emoji is in line with the emotion which is being clearly presented in the emoji in question [24].

The populations of different countries use emojis on the Twitter platform to differing degrees. The country with the highest percentage of tweets containing emojis is Indonesia, whose Twitter users insert emojis in 46.5% of their tweets. Paraguay holds the second place in terms of tweets containing emojis, with 37.6% of tweets from that country containing emojis, followed by the Philippines with 34.6% of tweets emerging from that country containing emojis. Algeria and Qatar rank fourth and fifth, with 33.5% and 32.6% of tweets emerging from those two countries, respectively, containing emojis. Latvia, whose users employ emojis in 24.4% of their tweets, is the leader of emoji usage in Europe, closely followed by Spain, with 24.1% of tweets emerging from that country containing emojis. It is very interesting to note that Japan, the country that invented emojis, is very low in terms of its usage of emojis, with only 7% of tweets emerging from that country containing emojis. The United States, which is the focus of the analysis of this research study, lags far behind Southeast Asia, South America, North Africa, and the Middle East in terms of its emoji usage — only 10% of tweets emerging from the United States contain emojis [25].

We turn now to our empirical investigation of the paralinguistic role played by emojis in the United States; first describing how we sampled and analyzed the Twitter messages, followed by presentation of our findings and their implications.

II. Research Methods

A. Data Collection

We chose eight major urban centers of the United States to sample with respect to the Twitter messages emanating from people who live there. The eight centers were carefully chosen to represent multiple regions with in the United States (North and South; East, Middle and West) as well as to include both an urban metropolitan area and a rural town located just outside the urban city's border. This sampling method was chosen so as to increase the generalizability of this study.

Data collection took place on January 14, 2019, between the hours of 11:45 a.m. and 3:55 p.m. During this time, the "gettweets.py" program was run on the 16 population centers in the following order; the specific time that tweets began to be collected from the population centers are indicated in parentheses next to the population center in question: New York City (11:45 a.m.); Somers, NY (11:47 a.m.); Miami (12:03 p.m.); Southwest Ranches, FL (12:07 p.m.); Chicago (12:13 p.m.); Channahon, IL (12:24 p.m.); Houston (12:48 p.m.); Kenefick, TX (12:51 p.m.); Denver (12:58 p.m.); Watkins, CO (1:07 p.m.); Phoenix (1:51 p.m.); Superior, AZ (1:58 p.m.); San Francisco (2:34 p.m.); Diablo, CA (2:38 p.m.); Seattle (2:51 p.m.); and Index, WA (2:58 p.m.). The ordering from East to West was intended to adjust informally for time zone differences.

B. Data Analysis Methods

After data collection, the dataset was analyzed and processed with the help of custom Python scripts. These scripts allowed us to count the total number of tweets; the total number of tweets containing emojis (these tweets were extracted for further processing); the total number of emojis; the ratio of the tweets containing emojis to the total number of tweets; and the average number of emojis per tweet.

Once the raw tweets had been counted and characterized with respect to the presence of emojis, we began to conduct a content analysis on the data. Content analysis is a method wherein the overall subject matter or other characteristics of a

text is ascertained via a coding scheme, which can be either manual or computational in nature. In the present day, because much data are usually included in datasets which need to be analyzed via this method, it is becoming popular to use computational content analysis.

Our general content analysis approach was multi-phased. We first sought to analyze the context in which an emoji (or multiple emojis) were used. Because this study seeks to determine the paralinguistic usage of emojis in tweets, we first needed to gain a sense of what the main goal of a message was so as to then assess the possible paralinguistic role of the emoji. For example, tweets with overlapping topics can then be grouped together on the basis of their subject matter and emotional content. The emojis used for each subject matter can then be grouped alongside these subject matter and emotional content groups. These groupings will allow one to determine which emojis are used the most alongside which subject matter groups, which will enable one to observe whether emojis are used to add an emotional substratum to a text-based conversation to clarify a potentially ambiguous issue, etc. We used the IBM Watson API Natural Language Understanding module to classify each emoji-bearing tweet by topic. This module draws from a set of 23 categories. After the classification process was complete, we randomly selected 5% of the classified tweets and checked them manually to ensure that this first phase of content analysis was sensible.

After classifying the tweet topics to provide context, two more phases of content analysis were conducted. First we assessed the paralinguistic function of the emojis used in a tweet. We used a coding scheme from an earlier research paper investigating the use of emojis in tweets [26, p. 138]. These categories were: topic, attitude, gesture, and unknown. We used these assignment rules: If an emoji was used to clarify the topic of the tweet in which it appears, it was coded into the topic category. If an emoji was used to display the attitude of the writer with respect to the content of the tweet, it was coded into the attitude category. If an emoji was used to convey a gesture that the writer might otherwise have expressed using nonverbal communication, it was coded into the gesture category. Finally, if the paralinguistic role of the emoji was unclear, the emoji was placed into unclear category [26].

After this manual coding of the paralinguistic function of emojis, a secondary content analysis was conducted to examine the specific emotion conveyed by the emojis that had been classified as either an attitude or gesture. The coding scheme we applied was again taken from a previous research paper focused on the use of emojis for emotional purposes. This coding scheme consists of 11 categories: joy, surprise, praise, pride, love, anger, confusion, anxiety, disapproval, boredom, and playfulness [27, p. 2].

III. Results

Overall, the 1,600 tweets included 269 tweets that had at least one emoji (16.8%). There was a total of 628 emojis in this sample, for an average of 2.33 emojis per tweet. The maximum number of emojis seen in a single tweet was 14; and most tweets containing emojis only contained one emoji. That is, the range of this dataset is 13, and the mode of this dataset is 1.

Table I lists the names of the emojis observed in this sample of tweets, along with their corresponding images and the percent of the total number of emojis represented by each one; tweets with fewer than five occurrences were not included. As can be seen in the ordered list, the top 10 emojis used by this sample of users were: the face-with-tears-of-joy emoji (70 instances of use); the loudly-crying-face emoji (39 instances of use); the rolling-on-the-floor-laughing emoji (22 instances of use); the red-heart emoji (21 instances of use); the medium-dark-skin-tone emoji (20 instances of use); the smiling-face-with-heart-eyes emoji (20 instances of use); the medium-light-skin-tone emoji (19 instances of use); the female-sign emoji (17 instances of use); the fire emoji (14 instances of use); and the face-blowing-a-kiss emoji (11 instances of use). All other emojis in this dataset were used 10 times or less.

TABLE I
List of Emojis with Corresponding Image and Percentage

Text	Emoji	Percentage of Overall Tweets
face-with-tears-of-joy	😂	11.1%
loudly-crying-face	😭	6.2%
rolling-on-the-floor-laughing	🤣	3.5%
red-heart	♡	3.3%
medium-dark-skin-tone	🏾	3.2%
smiling-face-with-heart-eyes	😍	3.2%
medium-light-skin-tone	🏼	3.0%
female-sign	♀	2.7%
fire	🔥	2.2%
face-blowing-a-kiss	😘	1.8%
kiss-mark	💋	1.6%
person-facepalming	🤦	1.4%
weary-face	😩	1.4%
thinking-face	🤔	1.6%
clapping-hands	👏	1.3%
dark-skin-tone	🏿	1.3%
male-sign	♂	1.3%
woman-dancing	💃	1.3%
raising-hands	🙌	1.3%
person-shrugging	🤷	1.1%
purple-heart	💜	1.1%
face-with-rolling-eyes	🙄	1.0%
light-skin-tone	🏻	1.0%
drooling-face	🤤	0.8%
sparkles	✨	0.8%
waving-hand	👋	0.8%

A. Topic Analysis

The most common Tweet topic was society, accounting for 99 tweets (see Fig. 1). Technology and Computing was the second most common topic (78 tweets). Art and entertainment and sports were the topic in 71 tweets each. Following are the remaining topics observed in this sample, with the number of tweets pertaining to each topic in parenthesis next to the topic in question: Law, government, and politics (40); business and Industrial (32); education (14); family and parenting (27); food and drink (23); health and fitness (20); finance (15);

education (14); pets (11); automotive and vehicles (10); travel (9); careers (8); religion and spirituality (7); real estate (6); science (3); news (3); style and fashion (2); shopping (2). Forty-three tweets had a topic which was unknown.

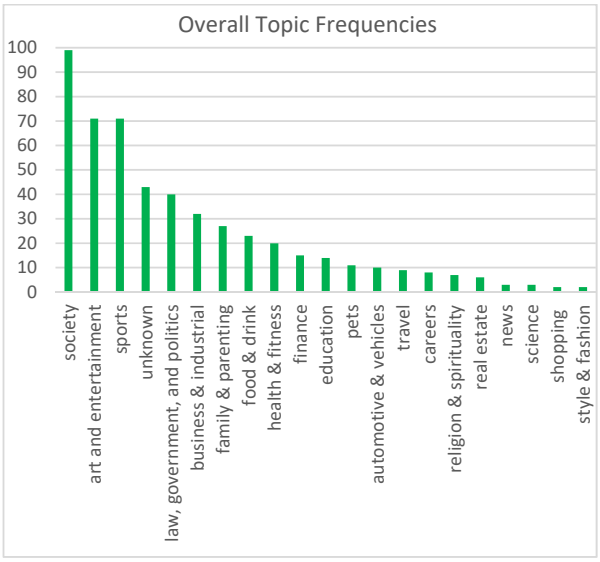

Fig. 1 Topics Discussed in Tweets

B. Paralinguistic Analysis

The tweets we analyzed contained three paralinguistic features: attitude, gesture, and topic. Note that in this phase of our content analysis, we coded each emoji for its function in cases where a tweet had multiple emojis. We found that 274 emoji-bearing tweets (43.6%) had the paralinguistic feature of attitude; 247 tweets (39.3%) had the paralinguistic feature of gesture; and 102 tweets (16.2%) had the paralinguistic feature of topic. These general findings suggest that the primary communication purpose of emojis is to convey nonverbal information such as emotion or attitude.

Within the emojis classified as attitude or gesture, we classified the emotion reflected by the emoji. Overall, we observed the occurrence of 11 emotional features: playfulness, praise, confusion, boredom, surprise, joy, pride, disapproval, anger, love, and unknown. The most common emotional feature was that of joy and the least common emotional feature was that of praise.

The frequency of occurrence of the 11 emotional features is graphed in Fig. 2. The top feature of a joy-expressing emoji appeared in 186 tweets; other common emotional attributes were love (71), playfulness (63), surprise (58), disapproval (43), anger (40), pride (28) and confusion (19).

IV. Discussion

With regards to the future usages and evolution of the Twitter social networking platform, it can be said that, since the topic of society was discussed by the majority of those sampled, it may be that the Twitter platform is evolving from one within which users discuss current events in a succinct manner to one where users "hold forth" on current societal issues. The platform providers might consider ways to focus on and elaborate discussions relating to society as well as to the also popular topics of art and entertainment, and sports. Note however that these findings are restricted to users in the United States, and we have no international analysis of tweet topics for comparison.

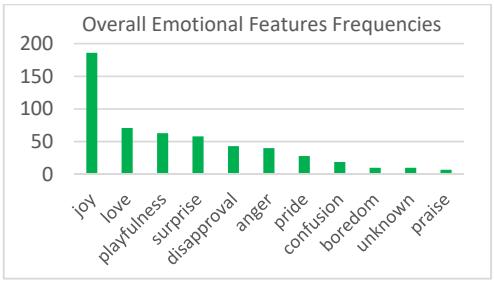

Fig. 2 Emotional Features Found in Tweets

With regards to paralinguistic uses of emojis, we found a prevalence for expression of topic attitudes or the injection of a gesture to complement a tweet topic. This may suggest emojis used to convey facial expressions should be more realistic, so as to emulate the nonverbal behavior of FTF conversation even more closely.

As an example, consider the example of the smiling-face-with-heart-eyes emoji. This emoji was used to convey a positive attitude on the part of the user with regards to the tweet topic. The specific emotional message of this emoji was typically that of love or joy, interpretable based on the text surrounding the emoji. However, in the real world, it is impossible for an individual to smile and have their eyes transform into hearts. Perhaps it would be better if this emoji was revised to be a smile with tender eyes; or a smiling face with a blush, which is a more realistic image of the emotions of love and joy [28]. At the same time, we can make an argument for keeping the smiling-face-with-heart-eyes. Previous research has revealed that familiarity of icons is more conducive to optimal performance in a computer setting than the concreteness of the icon itself [29]. Therefore, since Twitter users are already familiar with the smiling-face-with-heart-eyes emoji as it is currently, it may not be wise to change it to be more realistic.

The American population has been shown to use emojis to convey positive affect. This is the case since both populations use emojis for the emotional feature of joy for the most part.

In conclusion, it can be said that there is definitely a paralinguistic substratum within the usage of emojis on text-based online communication platforms, most notably Twitter. This is the case since most tweets which contained emojis used the them to convey the user's attitude towards the topic of the tweet or to supplement the text of the tweet with an artificial gesture. Emotionally expressive emojis, such as the face-with-tears-of-joy and the loudly-crying-face emojis are used widely by Twitter users located in the United States. The topics of technology and computing, along with society and sports, are the most commonly discussed topics among this

population.

The findings reported here must be qualified by the restricted sampling that we carried out. We collected just 1600 tweets, because we planned to do significant manual coding of the content. We carefully sampled different sorts of residential contexts in the United States hoping to give the sample reasonable generalization. Nonetheless, we recommend that further research be conducted on a larger dataset which contains Twitter users from different parts of the world, or even simply larger sample from within the United States. The IBM Watson API can be easily used to ascertain the topics of the tweets, making a larger dataset more feasible. However, the manual coding scheme used in this study to ascertain the paralinguistic and emotional intent of the users would be impossible to conduct on such a large dataset. In the future, it could be the case that sentiment analysis, still in its infancy in the present day, would become more advanced and reliable, which would lead to its potential successful usage for such an analysis [30].

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