The Influence of Texting on Perceived Warmth: The Role of Punctuation and Emoji

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Abstract

Technology Mediated Communication (TMC) has become an essential part of interpersonal communication. Punctuation and emoji are major vessels of nonverbal communication in texting. The impact of punctuation and emoji use on perceptions of warmth was tested with 291 residential undergraduate students at Liberty University who were at least 18 years old. Through an online questionnaire, participants read a series of text messages with a randomly assigned condition of having either punctuation and emoji, punctuation and no emoji, no punctuation and emoji, or no punctuation and no emoji. Results indicated a significant main effect for the presence of emoji on perceived warmth, such that emoji use was associated with higher ratings of warmth. The main effect for the presence of punctuation and the interaction were not significant. Findings expand on previous research by confirming the use of emoji as social markers, while also enhancing perceived warmth. This research has implications for virtual interactions in both personal and professional settings.

Keywords: technology mediated communication, virtual communication, punctuation, emoji, miscommunication

The Influence of Texting on Perceived Warmth: The Role of Punctuation and Emoji

Virtual communication has grown to be a major part of interpersonal interaction in lieu of in-person communication, especially after the worldwide COVID-19 pandemic (Golz et al., 2022). This type of communication is also referred to as Computer Mediated Communication (CMC) and has become increasingly important in everyday communication, so much so that it has been labeled as being its own language. McWhorter (2013) gave virtual communication the label of *talk-writing*, while Turner (2010) labeled virtual communication as *digitalk*. The label Technology Mediated Communication (TMC) utilizes the concept of CMC but encompasses the medium of texting as well. Typically, CMC occurs over a phone, rather than a computer. Since texting occurs across a screen, important parts of non-verbal communication are lost, including facial expressions, tone of speech, and body language. The absence of these elements has resulted in other nonverbal factors of digital communication taking their place, such as varying types of punctuation or the addition of emoji (Bai et al., 2019; Gunraj et al., 2016; Holtgraves & Robinson, 2020; Houghton et al., 2018; Marengo et al., 2017; Miller et al., 2017; Riordan, 2017; Sidi et al., 2021; Weissman & Tanner, 2018). The emerging nonverbal factors of texting have differing effects on the perceived warmth of the intended message.

Technology Mediated Communication and Miscommunication

Research has supported the role of many factors in the communication and miscommunication that occurs TMC. There is considerable room for differences in perception when it comes to nonverbal cues in communication. Truss (2009) listed a few scenarios which convey completely different messages with subtle changes in nonverbal elements. An example was outlined with the following statements: "A woman, without her man, is nothing" versus "A woman: without her, man is nothing" (p. 9). With the introduction of ambiguity of

communication that is either written, virtual, or containing a perceived meaning that evolves from different understandings of certain elements of communication, potential for miscommunication increases.

One study that has examined the causes and effects of miscommunication, especially in virtual communication with inherent ambiguity, is that of Holtgraves (2021). In this study, participants were given the assignment of either creating or interpreting a text message with a certain purpose. Holtgraves (2021) found that while participants assigned to sending text messages were more confident in their communication abilities, their communicative success, as well as the communicative success of the participants assigned to interpreting text messages, was unrelated to their confidence.

Miscommunication, as a construct, can be defined as the inability to reach a shared meaning in communication between people (Mortensen, 1997). Kelly and Miller-Ott (2018) defined four themes that underlie miscommunication in texting between friends and romantic partners: texting while also engaging in other activities, not providing enough nonverbal information, ambiguous use of punctuation and acronyms, and external technical difficulties. These themes are helpful in beginning to find the source of miscommunication. However, the root of many of these themes are often a difference in cultural understanding.

Godwyn and Gittell (2012) identified some core concepts of the essence of culture: being comprised of members who share some ideas, deal with external pressures on their patterns and dynamics which have remained somewhat constant over time, as well as teach their way of living to new members of the group. This definition is not limited to ethnolinguistic culture, which means cultural misunderstanding can happen at any level. This can include generational, regional, subcultural, and other levels. Furthermore, each cultural level can potentially have a

different interpretation of certain variations in text messages, especially when considering text messages that occur in a cross-cultural context.

Ethnolinguistic Differences

One cultural level that has a significant impact on the interpretation of text messages which vary with punctuation and emoji is the ethnolinguistic level. Ethnolinguistics deals with the intertwining of ethnic groups and language (Norova, 2021). That is to say, an individual's ethnicity affects how one views language, and research strongly supports the idea that language has a considerable impact on TMC; therefore, ethnolinguistic background would also have a great impact on TMC.

Present research on the impact of ethnolinguistic differences on interpretation of varying text messages shows that socio-cultural norms according to ethnolinguistic background can vary the intended and perceived meaning of certain emoji (Lu et al., 2016; Park et al., 2013; Sadiq & Shahida, 2019). Sadiq and Shahida (2019) applied the phenomenon of ethnolinguistic differences in emoji to Finnish, Hindu, and Pakistani online communities and found that each community used emoji for certain purposes specific to their ethnolinguistic culture. For example, Hindus used the 'Happy Diwali' emoji frequently on Facebook. Barbieri et al. (2016) found that the meanings of emoji were largely similar across cultures but acknowledged that differences in interpretation could be due to socio-geographical differences.

Gender Differences

Gender is another variable which plays into the relationship between variations in texting phrases and perceived warmth. Some studies have explored this relationship, with one of the most notable being the study by Tossell et al. (2012), who performed a quasi-experimental longitudinal study lasting 6 months, collecting data from 21 participants. These participants

comprised 11 male students and 10 female students, varying by their academic major, socioeconomic level, and ethnicity. Each participant was given an iPhone for the duration of the study, from which data was recorded automatically every night. For the 6 months that the study went on, participants used the given iPhone as their primary phone, although their identities were anonymous and word content was rendered unclear, so that the collected data would include text messages with a timestamp, number of words, and any emoticons that accompanied the message. After the study concluded, the full scope of data included 158,098 text messages, although many of those text messages were sent by one outlying participant who sent and received over 34,000 text messages.

Tossell et al. (2012) ultimately found that emoticons were not used frequently, and males used more emoticons than females. This finding might not be applicable to this study, as it focused on emoticons, not emojis. Additionally, the study by Tossell et al. (2012) was conducted only five years after the invention of the iPhone, meaning that the smartphone phenomenon, as well as emoji and emoticon use, were still relatively new. Since the publication of the study by Tossell et al. (2012), non-verbal cues, including emoticons and emoji, have become increasingly popular and have ingrained themselves in everyday communication of males and females alike (Manganari, 2021).

The Function of Punctuation and Emoji in TMC

According to Phutela (2015), communication can involve both verbal and nonverbal elements, each of which has different impacts based on the communicator, the receptor, and the situation in which the communication occurs. Nonverbal communication is best described in context of verbal communication, which occurs using speech; nonverbal communication is

characterized by information that is conveyed in the absence of speech. Within TMC, punctuation and emoji are two facilitators of nonverbal communication.

Historically, the function of punctuation was rhetorical, not grammatical. Specifically, it was to inform the reader of a given text of pauses, including location of the pauses and lengths of the pauses, and emphases of certain words or phrases (Houghton et al., 2018). Over time, this function gave way to grammatical purposes of punctuation, such as the demonstration of structural elements of phrases. Today, both purposes are present, as written communication has once again become a reflection of oral speech. Furthermore, texting in particular attempts to convey other elements of nonverbal communication which are present in spoken conversation, like facial expression and tone.

Emoji are tools that have been developed far more recently than punctuation but are still vital in their role in TMC of conveying nonverbal elements. Due to their replacement of nonverbal elements, emoji function in a different way than linguistic cues that are typically characteristic of spoken communication. The predecessor to emoji is the emoticon, which is an assembly of different keyboard characters to form a facial expression (Holtgraves & Robinson, 2020). From the emoticon, emoji proceeded, expanding their illustrations to include not just faces but other elements of body language, objects outside of the body, symbols, and many other representations of things that can be portrayed over text. As with all communication, nonverbal communication involves a communicator as well as a recipient of the communication.

Technology Mediated Communication: The Role of Punctuation and Emoji

Punctuation

Crystal (1995) defined four primary uses for punctuation: providing grammatical structure around which to organize words, letting the reader know how to vocalize the text,

classifying segments of text that contain meaning, and providing an extraverbal component of

meaning. Phutela (2015) classified different elements of nonverbal communication into four

distinct categories. The first of these categories was *aesthetic communication*, which

encompasses different forms of art and expression. The second was *physical communication*, or

bodily cues. *Signs* were included in the third category, described as a mechanical version of

communication which serve to convey information and symbols. *Aesthetic communication* was

described to encompass different forms of art and expression, and *symbols* add to or take away

from self-esteem by attributing implicit meaning to objects. Solomon (1990) likened punctuation

to musical notation: both can dictate volume, separation of words, and tone of voice.

　　　Sidi et al. (2021) explored the use of punctuation in TMC as it was affected by the

increased transition to virtual environments during the COVID-19 pandemic through a pilot

study and two experiments. Hypotheses by Sidi et al. (2021) suggested that repeated punctuation

marks in emails would be perceived as more important, less competent, and less warm than

emails with single punctuation marks. General discussion relating the pilot study and two

experiments suggested that extraverbal cues in punctuation in TMC were instrumental in the

creation of first impressions and communication of personality traits, although limitations

included the one-sided and asynchronous nature of the experiments.

　　　The pilot study of Sidi et al. (2021) involved 63 American undergraduate students who

were 52% female and had an average age of 25.9 years old. These participants filled out a

questionnaire with items that had seven-item Likert scales. Items in the questionnaire asked

participants to rate the affective reasoning, contextual reasoning, and person-related reasoning

for repeated question marks. Data indicated affective reasoning and contextual reasoning to be

significantly higher than person-related reasoning, providing support for the phenomenon of multiple punctuation marks portraying extra information about a situation or personality.

In the first experiment of the research by Sidi et al. (2021), 142 undergraduate students were recruited from a Dutch university to participate. These participants completed an online questionnaire through which they evaluated a hypothetical applicant for a job position based on an email written by the applicant with either one or three question marks used at the end of their questions. Participants rated the warmth of the applicant using a scale adapted from Cuddy et al. (2007) and willingness to recommend the applicant for the position using four items with seven-item Likert-type scales. Results of Experiment 1 indicated a significant indirect effect of warmth and competence, as well as perceived importance of inquiry, as mediating variables in the relationship between multiple question marks and behavioral intentions.

In Experiment 2, Sidi et al. (2021) expanded the types of punctuation examined to include exclamation marks in order to increase ecological validity. The resulting combinations of repeated punctuation were repeated question marks, repeated exclamation marks, or a mixture of exclamation marks and question marks. 100 students in the process of obtaining their MBA in Israel were used in the sample, where they shared emails that they had sent with researchers. These emails were work-related and in Hebrew. After a deidentification process, emails with repeated punctuation were categorized by the type of punctuation. Participants rated these messages based on competency (Cuddy et al., 2007) and negative affective state using seven-item Likert-type scales, using the PANAS scale (Watson et al., 1988). There was a statistically significant effect of competence as a mediating variable in the relationship between repeated punctuation and behavioral intentions (similar to Experiment 1), but the other indirect effects and total indirect effect were insignificant.

Physical communication is the only form of nonverbal communication that cannot be conveyed through written communication, TMC, and texting. Therefore, aesthetic communication, signs, and symbols are left as the remaining categories. With texting in particular, punctuation serves to convey information that is normally transmitted within nonverbal cues in in-person conversation (Houghton et al., 2018). One form of punctuation that has a notable impact on the perception of the message itself, according to previous literature, is the period or full-stop. The period, or full-stop, is conventionally used to complete phrases, and in this way, they separate independent thoughts with a sense of ending one before starting another (Dawkins, 1995; Trask, 2019). This practical function has transformed over time to today's usage in TMC, where additional emotion is often perceived with the usage of the period.

In the study by Gunraj et al. (2016), perceptions of punctuation in text messages were explored, specifically with the period. Participants, being comprised of 126 undergraduate students from Binghamton University, either rated the sincerity of text messages on pictures of cell phones or the sincerity of handwritten notes. Each text message or note had an initial question posed by one person and then a response consisting of one word that affirmed the preceding question, using a seven-item Likert scale. Results indicated that text messages with a period were perceived as significantly less sincere, while there was not a significant difference of perceived sincerity with the addition of a period in handwritten notes. Gunraj et al. (2016) concluded that based on these findings, punctuation is a potential communicator of paralinguistic cues in TMC.

Houghton et al. (2018) expanded on the findings of Gunraj et al. (2016) in three experiments which explored the effect of irregular use of punctuation on perceived sincerity in text messages. In Experiment 1, 49 undergraduate students from Binghamton University were

recruited to participate by rating the positivity of a series of simulated text messages on a seven-

item Likert scale. Positivity was assessed using a focused question based on each text message.

For example, if a response to a text message was a one-word affirmation without punctuation,

the participant would rate the level of genuineness of the responder in the specific scenario of the

text message. Participants were also instructed to imagine that the text exchanges that they read

had occurred between themselves and a person that they knew. Analysis of the resulting data

revealed a significantly less positive rating of text messages with periods than text messages

without periods.

Experiment 2 of the research by Houghton et al. (2018) included responses that were

negative, instead of only affirmative responses. Forty-one participants were recruited for this

experiment from the population of undergraduate students at Binghamton University.

Participants rated the level of enthusiasm of each one-word negative response that either had a

period at the end or did not have a period on a seven-item Likert scale. These ratings were

responses to focused questions, similar to Experiment 1. Results indicated that text messages

with a period were rated as significantly more negative than text messages without a period,

although all text messages were rated as negative.

Participants in Experiment 3 rated the sincerity of neutral phrases in text messages with

or without the inclusion of a period at the end. These participants were also undergraduate

students from Binghamton University, with a sample size of 47. Text messages and rating were

presented in a similar manner to Experiment 1 and Experiment 2. Concurring with Experiment 1

and Experiment 2, text messages with a period were rated as significantly more negative than

text messages that did not have a period. Although the three experiments by Houghton et al.

(2018) only involved a passive observation of text message as opposed to an active involvement,

findings provide a further basis for the extraverbal functions of punctuation that are unique to TMC.

Similar to the study by Sidi et al. (2021), both studies by Gunraj et al. (2016) and Houghton et al. (2018) used a Likert scale from 1 to 7 in order to measure perceptions of text messages, but the study by Gunraj et al. (2016) presented booklets with the messages printed in them to students, while the study by Houghton et al. (2018) only presented cell phone screens to their participants. Both studies also used samples of undergraduate students at Binghamton University. One notable specification that was made in the study by Houghton et al. (2018) that was not made in the study by Gunraj et al. (2016) is that the participants in their study were native English speakers. Participants' spoken language could potentially impact their usage of nonverbal cues, although neither Houghton et al. (2018) nor Gunraj et al. (2016) addressed this factor.

Emoji

It has been fewer than 30 years since the development of emoji which are unique in that they were created within the bounds of TMC, whereas punctuation adapted to the functions of TMC (Bai et al., 2019). The first emoji to be developed was the smiley face emoji, which evolved from the emoticon of a smile created with a colon and parenthesis. After the smiley face emoji came a set of emoji in 1999, which expanded on the functions of emoji to not only represent facial expressions but also abstract concepts like emotions and parts of nature like plants and animals.

Marengo et al. (2017) conducted a study whose aim was to link emoji usage to personality traits. Participants of this study were 234 adults who spoke English; they completed an online questionnaire which asked them to describe how emoji were linked to certain aspects

of personality and pick out emoji that they felt would accurately represent the personalities of themselves and their friends. The personality of each participant was measured with the Ten-Item Personality Inventory (TIPI) (Gosling et al., 2003), which used the traits of the Big Five personality (extraversion, agreeableness, conscientiousness, emotional stability, and openness to new experiences). The resulting data from this study indicated that 96.2% of the participants self-identified with at least one of the emoji that was presented in the survey. There was a total of 91 emoji that were presented to the participants upon taking the survey. The emoji that had the highest level of self-identification by participants was the heart emoji, while the emoji that had the lowest level of self-identification was the demon face emoji. The emoji that had the most variability was the upside-down smiley face emoji. Ultimately, the blushing smiley emoji had the highest correlation with the dimension of agreeableness (0.83). The sunglasses emoji, winking emoji, and standard smiley emoji had the highest correlation with the dimension of extraversion (0.68). Despite limitations of snowball sampling and a relatively small sample, the study by Marengo et al. (2017) effectively demonstrated self-identification of personality with emoji.

In light of the recent development of the emoji, there are not many existing studies on their psychological effect. Regarding emoticons in emails as a predecessor to emoji in text messages, Byron (2008) concluded that email senders communicate emotion through verbal cues, such as punctuation, and emoticons. Existing literature on emoji has shown various results regarding their psychological effect on perceived emotion. Notable studies have linked emoji to different functions, including emoji being a facilitator of meaning, a marker of irony, a tool for positive connotation, and related to Big Five personality traits (Holtgraves & Robinson, 2020; Riordan, 2017; Marengo et al., 2017; Weissman & Tanner, 2018). Glikson et al. (2017)

combined the psychological effect of emoji with TMC in an exploration of perceptions of warmth and competence of text message senders when using smiley face emoji.

Holtgraves and Robinson (2020) explored the interrelationship of emoji and non-verbal communication through an experimental design where participants assessed the accuracy of interpretations of text messages via the replies to the text messages. In the experiment, Holtgraves and Robinson (2020) used emoji to examine its effect on text message interpretation. Participants included 76 undergraduate psychology students. Of these participants, 43 were female, 29 were male, and 4 did not identify their gender. These participants were each presented with 36 scenarios, which consisted of a situation, a series of questions, and replies. The situation comprised a description of the two people who were involved in the text conversation, the questions were either requests for opinions or requests for actions, and the replies did not provide the information or action that was previously requested. One third of the scenarios had replies that included an emoji, another third only had an emoji with no other words, and the final third did not have an emoji. Holtgraves and Robinson (2020) found that participants had an overall accuracy rate of 86% when interpreting the accuracy of the replies. The findings also indicated that the accuracy of the reply interpretation was significantly lower for replies without emoji. Conversely, the accuracy of the reply interpretation was significantly higher in replies that either had text with an emoji or just had an emoji.

Weissman and Tanner (2018), in their examination of emoji as a vessel for irony, investigated neural responses to irony in emoji. The aim of the study was to determine if ironic emoji usage elicited the same neural reaction as the neural reaction to verbal irony. Participants of this study included 40 students at the University of Illinois at Urbana-Champaign who only spoke English. Additionally, these participants did not have brain trauma or impairment and they

did not use psychoactive medication at the time of the study. During the experiment, participants

were presented with English phrases that contained an emoji. The emoji were either a match, a

mismatch, an ironic match, or a filler. An example of a match would be a smiling emoji

accompanying a positive sentence, a mismatch would be a smiling emoji accompanying a

negative sentence, an ironic match would be a winking emoji accompanying a negative sentence,

and a filler would be a laughing-with-tears emoji accompanying a neutral sentence. After being

presented with these stimuli, the neural responses of the participants were recorded via

continuous EEG on scalp electrodes. Behavioral results showed a tendency for participants to

interpret phrases literally, with a minimal level of interpretation of irony. The interpretation of

irony only occurred with the presence of the winking emoji. Ultimately, the emoji condition had

a statistically significant effect when the neural response was measured 170 to 250 milliseconds,

450 to 750 milliseconds, as well as 600 to 900 milliseconds after the stimuli was presented.

Weissman and Tanner (2018) concluded that the neural reaction to ironic emoji in their own

study was identical to the P600 effect, or the neural reaction to verbal irony. This finding

suggests that the systems within the brain that are involved with comprehending and responding

to verbal irony are also used with ironic emoji, and that emoji can utilize similar nuances as

verbal language in this way.

Riordan (2017) similarly explored emoji as it relates to communication and meaning,

using an experimental design to assess participants' perception of positive affect in text messages

containing certain emoji. Participants of the study included 185 university students, including

144 females and 41 males, and an average age of 20.74 years. These participants took part in the

study by completing an online questionnaire, where they first gave demographic information and

rated the emotion of four text messages on a scale from –50 to +50, where -50 represented a very

negative emotion and +50 represented a very positive emotion. Then, participants rated the

presence of eight specific emotions: joy, trust, fear, surprise, anger, sadness, disgust, and

anticipation. Likert-type scales were used to rate these emotions from 1, which represented no

presence of a particular emotion, to 7, which represented considerable presence of a particular

emotion. Finally, participants rated their confidence on a scale from 1, which represented a total

lack of confidence, to 7, which represented substantial confidence. Each message also had a

different context, as text subjects varied from money, a game, a party, spring coming, and dinner.

Results of this study indicated that the messages about dinner and sleep were rated as

significantly more positive when they had 2 or 3 emoji than when they had no emoji.

Additionally, the message about sleep was rated as significantly more positive with one emoji, as

opposed to no emoji. Generally, the presence of emoji was correlated with more positive

emotion. Limitations of this study included a lack of scope regarding type of emoji used in the

study.

One study by Miller et al. (2017) did not find an effect of emoji in TMC. However, that

study looked at the potential for miscommunication as possibly differing between emoji by

themselves and emoji in context of a conversation, with no significant differences. Miller et al.

(2017) and Holtgraves and Robinson (2020) both mention the need for future research in the area

of perceived meaning of emoji in context of text messaging. Glikson et al. (2017) attempted to

bridge the gap presented by earlier research in the perceived meaning of emoji and TMC by

assessing perceptions of warmth and competence when adding a smiley emoji to text messages.

Glikson et al. (2017) compared the effect of smiley emoji and smiles of real people in

photographs. Two hundred and six participants were recruited from the University of Amsterdam

to assess either a photograph or a text: the photograph was of either a neutral or smiling face; and

the text either contained or did not contain smiley emoji. Participants assessed the perceived

warmth and competence of the person in the photograph using 7-point Likert-type scales

(Glikson et al., 2017). Results showed that smiling faces in photographs indicated significantly

higher levels of perceived competence and warmth. Smiley emoji in text indicated significantly

higher levels of perceived warmth but significantly lower levels of perceived competence. With

further investigation into the social effects of emotions, especially through TMC, the research by

Glikson et al. (2017) has implications for the impact of the smiley emoji. However, it did not

address the effects of the combination of punctuation and emoji.

Gap in Literature/Research Question

Previous research on virtual communication has been conducted using media such as

email and online messaging, hence the term *Computer* Mediated Communication (Bai et al.,

2019; Gunraj et al., 2016; Marengo et al., 2017; Tossell et al., 2012). There is a lack of research

on texting through smartphones, which is currently the primary form of casual, everyday virtual

communication. Literature on the effects of nonverbal cues in TMC has indicated perceptions of

paralinguistic aspects of communication through punctuation, especially periods (Sidi et al.,

2021; Gunraj et al., 2021; Houghton et al., 2018). There have been comparable findings in

studies on emoji, as research has shown self-identification of personality with emoji, facilitation

of message content with the use of emoji, a mirroring of neural responses to irony in verbal and

emoji uses, and increased perceptions of positivity in text messages with emoji (Holtgraves &

Robinson, 2020; Marengo et al., 2017; Riordan, 2017; Weissman & Tanner, 2018). This study

will address the gap in research to include the prevalence of smartphones in the perception of

warmth in texting phrases. The research questions of this study are:

1. Do texting variations in punctuation (period or no period) or emoji (emoji or no emoji) vary on perceived warmth?

2. Is there an interaction between texting variations in punctuation (period or no period) and emoji (emoji or no emoji) and on perceived warmth?

As indicated by Gunraj et al. (2016) and Houghton et al. (2018), the presence of punctuation may result in a lower level of perceived warmth. Glikson et al. (2017) indicate that the presence of emoji may result in a higher level of perceived warmth. Thus, the following are the hypotheses for this study:

Hypothesis 1a: Texts with punctuation would be perceived as less warm than texts without punctuation.

Hypothesis 1b: Texts with emoji would be perceived as warmer than texts without punctuation.

Hypothesis 2: Texts with emoji and no punctuation would be perceived as less warm than texts with punctuation and no emoji.

Method

Participants

Participants included 305 residential undergraduate students who are 18 years old or older at Liberty University. Four participants who did not complete the study were removed from the data, and 10 participants were screened out prior to accessing the survey due to ineligibility based on the age requirement. Participants were 84% female and 16% male, ranging from 18 to 31 years old. The participants were volunteers and were presented with the incentive of using participation in this study for partial course credit in one of their psychology classes. All participants completed the online questionnaire in English.

Procedure

The study was approved by the IRB, and participants were provided with an informed consent form, which was viewed prior to accessing the survey. Participants also verified that they were at least 18 years of age via a screening question. Upon qualifying for the survey via the screening questions, participants completed demographic questions, which asked for their gender and age. This study used an adapted version of the design developed by Glikson et al. (2017), with the added variable of punctuation—specifically, the period. Text messages were also modified slightly from the original study (see Table 1).

Table 1

Comparison of Variations of Punctuation and Emoji between Glikson et al. (2017) and Present Study

	Glikson et al. (2017), p. 16	Present Study: Period	Present Study: No Period
Emoji	Hi guys, My name is Alex and I just wanted to say hello to everybody. I'm glad to work with you and I suggest starting asap. ☺	Hi guys. I just wanted to say hello to everybody. I'm glad to work with you and I suggest starting asap. I look forward to getting to know you. 😬	Hi guys I just wanted to say hello to everybody I'm glad to work with you and I suggest starting asap I look forward to getting to know you 😬

	When is the best time for you to meet online and can everyone use Skype? I look forward to getting to know you		
No Emoji	Hi guys, My name is Alex and I just wanted to say hello to everybody. I'm glad to work with you and I suggest starting asap. When is the best time for you to meet online and can everyone use Skype? I look forward to getting to know you	Hi guys. I just wanted to say hello to everybody. I'm glad to work with you and I suggest starting asap. I look forward to getting to know you.	Hi guys I just wanted to say hello to everybody I'm glad to work with you and I suggest starting asap I look forward to getting to know you

Participants were then randomly assigned to read one of four sets of four text messages, which varied by their inclusion of punctuation and emoji. The four groups were as follows: (a) punctuation and emoji, (b) punctuation and no emoji, (c) no punctuation and emoji, and (d) no punctuation and no emoji. Similar to Glikson et al. (2017), a gender-neutral name for the hypothetical text message sender, Jordan, was used in this study (see Figure 1).

Figure 1

Sample Item from Online Questionnaire Modified from Glikson et al. (2017) with Punctuation

and Emoji

After viewing the image of the text message, participants completed the perceived

warmth subscale from Glikson et al. (2017) to assess the perceived warmth of the theoretical

sender of the text messages. The design of the study was a 2x2 factorial design, as the text

messages varied by their inclusion of a full stop punctuation mark (period or no period) and the

inclusion of emoji (emoji or no emoji).

Measure

The given online questionnaire assessed perceived warmth as the extent to which a given

text message seems good-natured, trustworthy, tolerant, friendly, and sincere (Cuddy et al.,

2008). A questionnaire developed by Glikson et al., (2017) contained 12 items to assess

perceived warmth, with each question asking the participant to rate the warmth of a particular

text message. Items were slightly modified from the original, as "teammate" was replaced with

"classmate." A sample item adapted from Glikson et al. (2017) is the following statement: "I can

share with this classmate personal problems and difficulties". Items assessed perceived warmth

using a 7-point Likert scale. A score of 1 indicated the least perceived warmth, and a score of 7

indicated the most perceived warmth. Scores were then averaged, with higher scores indicating

higher perceived warmth. Cronbach's alpha for the current sample was .75 and the average for

the warmth scale was 4.69 ($SD = 1.01$).

Results

A two-way ANOVA was performed in order to evalute the effect of the presence of

emoji and the presence of punctuation on perceived warmth (see Table 2).

Table 2

ANOVA Summary Table of Perceived Warmth Based on Punctuation and Emoji

Predictor	Sum of Squares	df	Mean Square	F	p	Partial η^2
(Intercept)	6394.535	1	6394.535	6507.839	<.001	
Emoji	11.254	1	11.254	11.453	<.001	.038
Punctuation	.290	1	.290	.295	.587	.001
Emoji*Punctuation	.986	1	.986	1.003	.317	.003
Error	282.003	287	.983			

Four assumptions of a two-way ANOVA were met: perceived warmth was measured as a

continuous variable, both independent variables of punctuation and emoji were categorical

variables, groups of participants in each condition were independent of each other, and normality

was assumed due to the sample size being greater than 30 for each condition of punctuation and

emoji. Random selection was not used due to participants volunteering rather than being chosen.

Group means and standard error values are also presented for the emoji condition and the

punctuation condition (see Table 3).

Table 3

*Descriptive Statistics for Perceived Warmth Based on Punctuation and Emoji*

Emoji	Punctuation	*M*	*SD*
No	No	4.475	1.087
	Yes	4.528	1.005
Yes	No	4.986	.933
	Yes	4.806	.924

The two-way ANOVA revealed a statistically significant main effect of the presence of

emoji (smiley emoji vs. no smiley emoji) in the text message on perceived warmth, $F(1, 287) =$

11.453, $p < .001$, $R^2 = .04$, (see Figure 2).
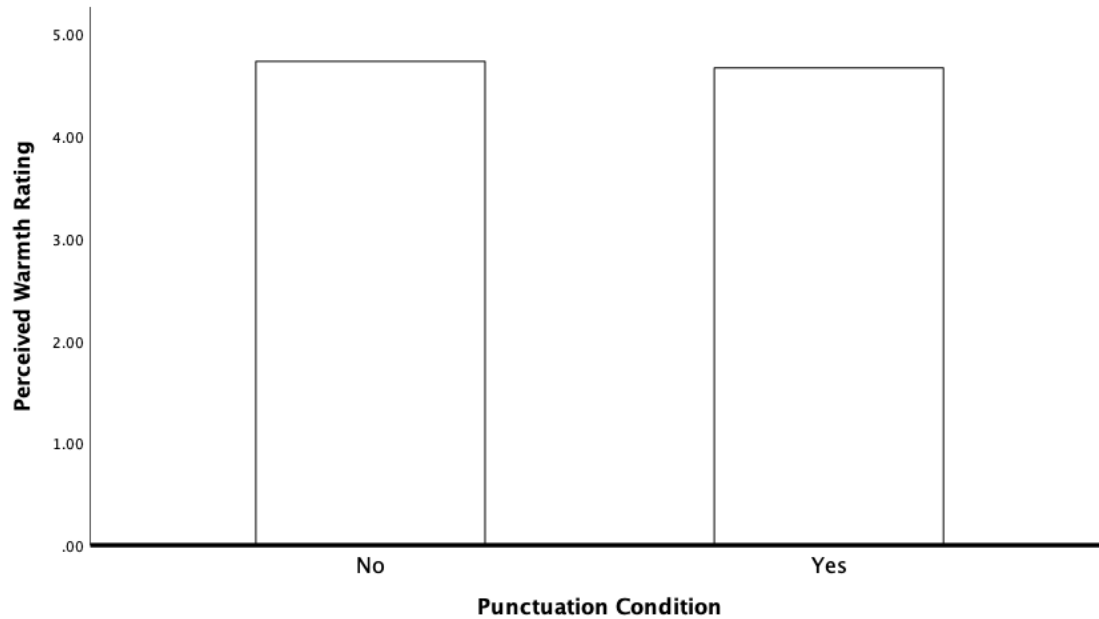
Figure 2

Bar Chart of Perceived Warmth Based on Emoji
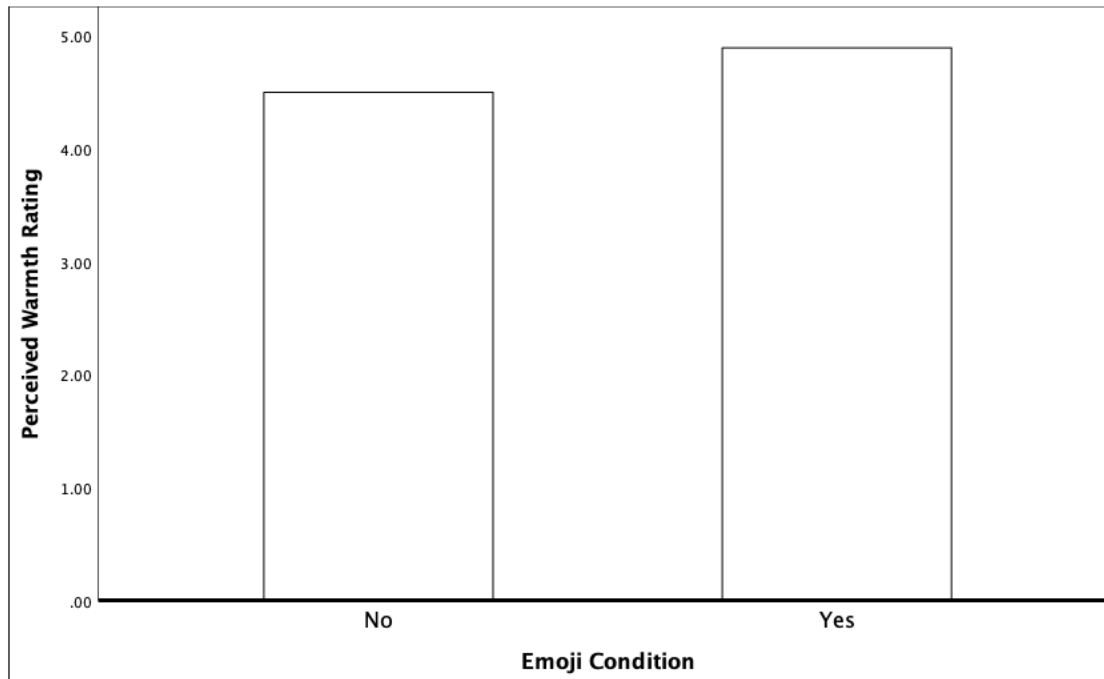
The main effect for the presence of punctuation (period vs. no period) in the text message was not significant, $F(1, 287) = .295$, *ns*, $R^2 = 0.00$. (see Figure 3).

Figure 3

Bar Chart of Perceived Warmth Based on Punctuation

In addition, the interaction effect of punctuation and emoji was not significant, $F(1, 287) =$

1.003, *ns*, $R^2 = 0.00$ (see Figure 4).

Figure 4

Interaction Plot of Perceived Warmth
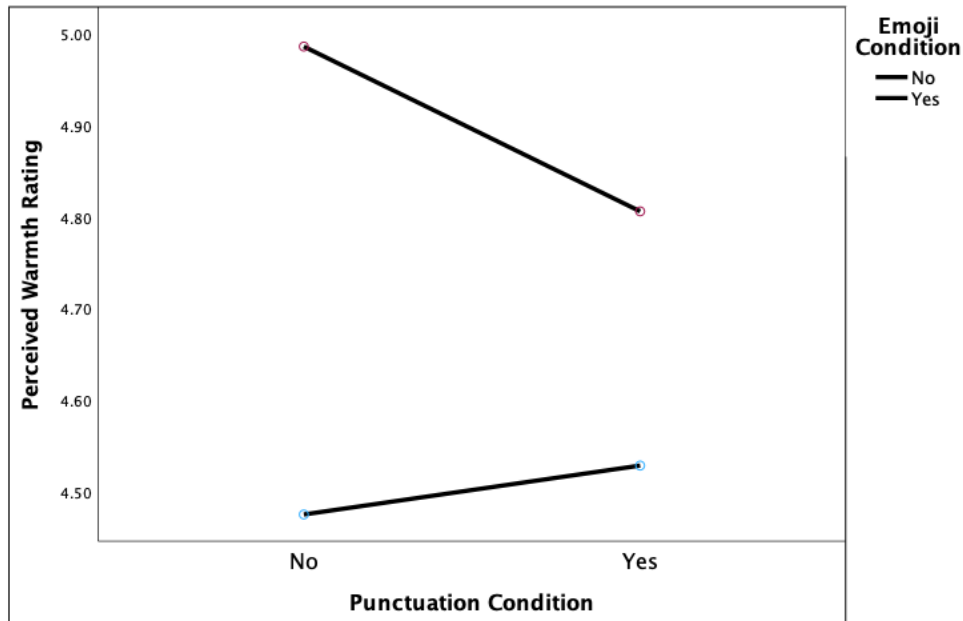
Discussion

In light of the first research question of this study, results indicate that while texting variations in punctuation do not have a significant effect in perceived warmth, texting variations in emoji do result in a significantly higher level of perceived warmth. Additionally, results indicate that there is not a significant interaction between texting variations in punctuation and emoji on perceived warmth. In this way, Hypothesis 1b was supported while Hypothesis 1a and Hypothesis 2 were not supported.

In convergence with previous studies, the data from this research confirms that emoji are used as a marker of social communication (Holtgraves & Robinson, 2020; Marengo et al., 2017; Riordan, 2017; Weissman & Tanner, 2018). Perceptions of perceived warmth of a text message sender were significantly higher with emoji in the text messages than without emoji, confirming

Hypothesis 1a. The findings of this research also expand upon the findings of Glikson et al. (2017), who concluded that emoji could serve the purpose of enhancing perceived warmth in TMC. As for punctuation, the findings are inconsistent with prior research by Gunraj et al. (2016) who found that periods in text messages were perceived as less sincere, and Houghton et al. (2018) who found that periods were perceived as less positive. Thus, Hypothesis 1b was not confirmed in this research.

In contrast to the studies by Gunraj et al. (2016) and Houghton et al. (2018), this study used text messages that were professional in nature instead of being casual communication. For example, one of the text messages presented to participants in the study by Gunraj et al. (2016) referred to an invitation from a friend to go to a concert, while the text messages in this study related to a classmate working on a project. The insignificant effect of punctuation on perceived warmth in text messages might have occurred due to the professional nature of the text messages. The professional nature of the text messages of this study might have led readers to interpret the text messages in a more formal way. Although participants were presented with text messages, the professional-sounding tone could have been interpreted in a similar way to emails, in which punctuation such as periods is frequently used. Ultimately, this tone might have resulted in an insignificant effect of the punctuation condition on perceived warmth.

Limitations

Despite insights that uncover valuable information regarding nonverbal cues in TMC, limitations in this study exist, and they originate from methods of sampling, usage of an online questionnaire, and threats to internal validity. The participants that took part in this study were self-selected from the population of residential psychology students at Liberty University, indicating that this group might not be representative of the entire population. Psychology

students also might have had more knowledge or awareness of the topic of social biases, and

therefore might have tried to find what they thought was the correct answer, instead of their own

perception. Although the members of the population of residential psychology students at

Liberty University are diverse (ethnolinguistically, as well as in other aspects), these students

might tend to adopt a similar way of interpreting emoji and punctuation simply due to their

belonging to the same organizational culture with its own cultural rules and norms.

One limitation that arose from the online questionnaire design is self-report bias.

Participants also might not have felt comfortable revealing honest opinions of punctuation if

those opinions differed from what was accepted to be proper etiquette. Even though the identity

of all participants remained anonymous, social pressure could have played a role. Within the

survey, specifically the perceived warmth subscale adapted from Glikson et al. (2017), the

interpretation of the Likert scale could have varied by the participant. For example, for the fourth

item on the perceived warmth subscale (I can share with this classmate personal dreams and

hopes) a participant could interpret '1' as being disinclined to share personal dreams and hopes

with the sender of the text messages, or inclined to share only trivial personal dreams and hopes.

Threats to internal validity could have come from demand characteristics (e.g., answering

according to social convention rather than actual perception) or potential confounds.

Ethnolinguistic and gender information was not collected from participants, but both

ethnolinguistic and gender identity could have affected perceptions of warmth of the hypothetical

text message sender. A manipulation check was also not conducted, increasing the risk of a type

II error.

Future Research

This research adds to the field's understanding of text-based communication and its impact on perceptions of the sender. However, the field of TMC is a rapidly evolving one. Since their beginning, the number and complexity of emoji used daily have increased exponentially (Beyersmann et al., 2023). This study only included the smiley emoji, but future research can explore the facets of more emoji. Language itself, not just within the bounds of TMC, is subject to variations (Hammarström, 2016), which result in a large amount of diversity, that can be studied in the context of TMC. Future research can also include more sentence-final punctuation, such as the exclamation mark or the question mark, as well as mid-sentence punctuation marks.

Future research can focus on additional perceived emotions, such as perceived sincerity (Glikson et al. 2017) or positive affect (Houghton et al., 2018). Within the context of a class group project, competence and credibility might also be noteworthy outcomes to explore. This area of research could ultimately enhance the understanding of emoji as a newer but salient nonverbal cue for communication. To address limitations of this study, future research can also include more representative sampling of university students, demographic data such as ethnolinguistic and gender information, and a manipulation check.

Conclusion

The aim of this study is to identify the effects of perceived warmth in text messages as they vary with the inclusion of punctuation and emoji. With the significant finding of emoji resulting in a higher level of perceived warmth, the findings of this study have implications for technology mediated communication. By better understanding perceptions of varying nonverbal elements of texting phrases, researchers and professionals can potentially increase participants' metacognition regarding TMC. Being aware of the differences in perception when it comes to

punctuation or emoji can help minimize communication issues or improve the reader's

understanding of the emotional context within which a message is communicated. Moreover,

trainings can help professionals and students to understand how emoji might be used to enhance

or even clarify their virtual communication skills. Based on this study, future researchers can

look at further effects of emoji, punctuation, and other nonverbal elements of TMC in order to

ameliorate interpersonal communication and the conveying of information.

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