# Using punctuation as a marker of sincerity and affective convergence during texting

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**Abstract**

Face-to-face communication is a rich, natural form of communication that incorporates multimodal behavioral cues belying meaning and intention. However, computer-mediated communication (e.g., texting) removes many of the multimodal cues in face-to-face communication (e.g., vocal prosody). Recent research has suggested that punctuation might mimic vocal prosody in text (Gunraj et al., 2016), but there is no clear indication of what the overall effects may be. Therefore, the current study investigates the use of punctuation to express intonation. We first replicate Gunraj and his colleagues by showing that a single word ending in a period promotes the appraisal of negative affect. Interestingly, we extend this research by demonstrating that intonational punctuation has the potential to increase social distance, which our preliminary results suggest may occur through processes of emotional contagion and interactive alignment.

**Keywords:** pragmatics; texting; emotion contagion; interactive communication

## Introduction

With an increased reliance on technology during communication, mistaking the tone of a message may be common. Though mistakes are possible, numerous interesting studies suggest that some aspects of text may help interlocutors interpret conversational (i.e., affective) tone (e.g., lexical choices, punctuation, character features, emoticons; Byron & Baldridge, 2007; Gunraj et al., 2016; Niederhoffer & Pennebaker, 2002; Riordin & Kreuz, 2010).

While these studies have touched on many features of text, less is known regarding the impact of pragmatic tone as indicated by punctuation (i.e., intonational punctuation), on lexical style matching during texting conversations. In the current study, we evaluate the effect of a sender's punctuation use as a paralinguistic cue to emotional tone, and its effect on a receiver's tendency to align their tone and texting preferences with the sender.

## Conveying Tone of Voice in Text

Face-to-face (FFC) communication benefits from the use of multimodal nonverbal cues like eye gaze, vocal prosody, and shared attention (e.g., Banziger & Scherer, 2005; Burgoon et al., 1995; Knapp et al., 2013). One common area that most strongly affects text-based communication (TBC) is its unimodality. This unimodality is typically confined to linguistic, typographical, and/or grammatical cues, making TBC less rich in non-verbal cues found in FFC (e.g., Byron & Baldridge, 2007; Kruger et al., 2005). However, a large body of research demonstrates that language users adapt to and make use of the communication medium to convey richer information about their message. For example, interlocutors make use of vocal spelling ("yeaaaaaaah"), non-standard spelling ("ermahgerd"), emoticons, and manipulated grammatical markers ("..."); all of these *typographic cues* have the potential to indicate tone of voice (Harris & Paradice, 2007; Riordan & Kreuz, 2010).

More recently, Gunraj et al. (2016) found that the use of a one-word response followed by a single period in TBC (relative to written communication) was perceived by participants to be rude and insincere. In fact, the use of typographical cues is adaptive, as it may aid in the decoding of an ambiguous message (e.g., when information is missing; Byron & Baldridge, 2005; Derks et al., 2008; Harris & Paradice, 2007; Lo, 2008; Riordan et al., 2014; Walther & D'Addario, 2001). Though conventional multimodal nonverbal cues are absent from TBC, interlocutors have the potential to interpret a sender's intentions beyond the literal meaning.

## Faster but Ambiguous Messages

In a texting context, language users are constrained by the texting medium, in which their messages are typically fast, agrammatical, and largely ambiguous (for review see

Ling & Baron, 2007). When an interlocutor lacks the relevant cues, one might rely more heavily on their own representations of the world (i.e., egocentric perspective). When this information is decoded incorrectly or the message is overly ambiguous, miscommunication has the potential to follow shortly behind.

Ambiguity has the potential to make receivers (listeners) of a message uncomfortable with uncertainty. However, listeners may handle this uncertainty by making predictions about a speaker's (sender's) intentions (Uncertainty Reduction Theory; Berger & Bradac, 1992). Interlocutors essentially make predictions to decode ambiguous information by relying on nonverbal cues (e.g., paralinguistic cues) presented by a communication partner (Byron & Baldridge, 2007). From this account, the receiver evaluates typographic cues (e.g., capitalization, emoticons, etc.) in the message to determine the sender's intentions.

Subsequently, the receiver attempts to synthesize known personality traits with the typographic cues to derive the correct intention. For example, when vocal tone is absent from the sender, a receiver reading a text message may construct an egocentric "tone" representation, similar to that of representing verbally produced "tone" in a face-to-face conversation -- as a means to reduce ambiguity, promote successful communication and decrease social distance (Byrne, 1971; Chartrand & Bargh, 1999; Dennis & Valacich, 1999). This leads one to question how a receiver's representation of tone is integrated in a deprived texting environment. More specifically, do interlocutors use similar communicative mechanisms to decrease social distance, when the cards are stacked against them?

### Convergence in Interpersonal Communication

A large amount of research has shown that lexical style matching during communication has the potential to decrease social distance (Byrne, 1971; Bernieri & Rosenthal, 1991; Chartrand & Bargh, 1999; Niederhoffer & Pennebaker, 2002). However, recent research has shown that alignment need not always occur to promote positive communication outcomes (Fusaroli et al, 2012). In fact, these researchers show that though interlocutors have a proclivity to converge linguistically, dyads that adapted and diverged linguistically improved performance on a task - i.e., more is not always better (Giles & Coupland, 1991). It is possible, that under emotional contexts, one would be more likely to converge linguistically and para-linguistically during positive interactions and strategically diverge in negative interactions to decrease social distance (Paxton & Dale, 2013). Currently, the utility of behavioral convergence and divergence during communication as a potential means to promote pragmatic interpretation, has been less well established in an emotional texting context.

When texting, the receiver of the message automatically colors the message with their interpretation of the sender's tone. If the sender produces emotionally valenced non-verbal cues, then the receiver might produce a similarly valenced response. Hatfield et al. (1994), for example, showed that interlocutors emotions tended to align when interacting with a social other. Additionally, it has also been argued that interlocutors prime each other (at various levels of the interaction), to promote effort saving communication behaviors (phonological to pragmatic priming: Dijksterhuis & Bargh, 2001; Garrod & Pickering, 2004). But what if the very nature of the intonational punctuation cue intends to increase social distance? Does the receiver of such a message diverge emotionally or with intonational punctuation? Or will the receiver follow suit and respond reciprocally (e.g., Theory of Reciprocity; McCroskey & Richmond, 2000), further breaking down the conversation and increasing social distance?

The purpose of the current study is to determine the effect of intonational punctuation on a texting conversation. There are three main goals: (1) As a replication of previous studies, do interlocutors process punctuation for affective intent?, (2) Given intonational punctuation matching, will intonational convergence occur equally across positive and negatively valenced communication? and (3) What are the effects of punctuation alignment on the perception of conversational sincerity? We expect to see intonational punctuation impacting the perceived sincerity, and thus impacting the reciprocal use of punctuation to match conversational tone. We evaluate convergence through a distributional analysis, rather than time series analysis (Paxton et al., 2016). This allowed for the preliminary establishment of alignment, at the global level.

## Method

### Participants

Twenty Kent State University undergraduate students (females = 11, $mean_{age}$ = 19.5yrs, $min_{age}$ = 19 yrs, $max_{age}$ = 23yrs, sd = 1.30) participated in return for a $5 gift card. One participant was excluded, because the program crashed half-way through the experiment. All participants were native speakers of English, with normal to normal-corrected vision and no diagnosed speech or hearing impairments.

### Materials

All stimulus presentations and data collection were controlled by a Matlab, Psychtoolbox-3 program, that recorded computer-mouse clicks. All participants were seated in front of a 21-inch iMac computer screen in a sound-attenuated booth.

## Stimuli

The pseudo-confederate (fake texting partner) texting conversation was a neutral conversation about living in Kent, OH. Thirty-two pseudo-confederate texting response bubbles were created and paired with 5 alternative forced choice participant response bubbles. The participant response bubbles ranged from positive to neutral to negative (similar to a Likert scale), with the top most response option representing positive, the middle being neutral, and the bottom most option being most negative (e.g., Fig. 1). More specifically, the participant response bubbles contained one of the punctuation types, with the exclamation being most *positive*, no punctuation, ellipsis, and question mark being *neutral*, and the period being most *negative* (see Fig. 1).

These five types of punctuation were also used in the pseudo-confederate text messages: question mark, ellipsis, period, no punctuation, and exclamation. No punctuation, question marks, and ellipses acted as fillers and reflected typical uses of typographical markers in texting behavior (two-thirds of the trials; see Riordin & Kreuz, 2010). The rest of the trials were primarily made up of exclamations (positive condition) ***or*** periods (negative condition).

## Design & Procedures

At the beginning of the task, participants were told they would be having a texting conversation with another person, but instead of being able to freely type their responses, they would be given five response options to choose from (see Fig. 1). The participant was also asked to imagine that the conversation he or she was having was with a person he or she knew well, to promote ecological validity.

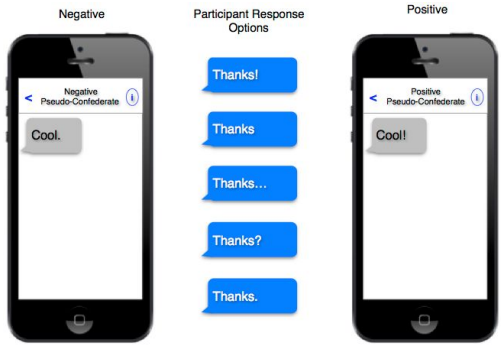


Figure 1: This is an example of a negative (left) and positive (right) pseudo-confederate text bubble, with the participant 5 alternative forced-choice response bubbles.

During the course of the interaction, the participant was presented with an image of an iPhone (Apple, Inc.), with a pseudo-confederate text bubble. They were then asked to read the text message, then to click the "next" button to transition into the *participant response screen*. On this screen, they were able to see the pseudo-confederate text message bubble, with the 5 forced choice response options to the right of the iPhone (Fig. 1). After the response was made, the participant was brought to another screen that displayed a continuous rating scale, that required the participant to rate his or her perception of the conversation's sincerity (Fig. 2). Participants were randomly assigned to one of two between subjects conditions: Pseudo-confederate Valence Condition (positive: n = 9 or negative: n = 10).


Figure 2: The continuous rating scale participants used to rate the sincerity of the conversation, after each trial ("Please rate how sincerity of the conversation.")

## Measures

**Participant Valence Selection** Participants had five responses to choose from, that were ordered from positive (exclamation), to neutral (no punctuation, ellipsis, question mark), to negative (period). The response option chosen corresponded with an ordinal scale (exclamation (1) = most positive to period (5) = most negative). Though the difference was not large, the participants in the positive condition chose response options on the more positive side of the Likert scale (mean: 1.99), relative to the negative conversation (mean: 2.23; $t = 2.212$, $p < .05$ - independent samples t-test), with a larger number indicating a more negative valence. In order to reflect a more continuous measure of emotional contagion, a running average of the Likert scale ratings was calculated to reflect fluctuations in valence over the course of the interaction.

**Intonational Punctuation Alignment** Each pseudo-confederate response had one form of punctuation -- with each participant response bubble containing one of the five punctuation types. Depending on the response option chosen, the response was recoded as matching or mismatching the pseudo-confederate's use of punctuation. That is, if the pseudo-confederate used a period, what was the likelihood of the participant selecting a response option containing a period, too? Participants in the positive condition matched the pseudo-confederates choice of punctuation approximately 48% of the time, but only 28% of the time in the negative condition ($t = 2.913$, $p < .001$ - independent samples t-test).

**Conversation Sincerity** Participants were also asked to rate the sincerity of the conversation. This was done by clicking along a continuous rating scale (see Fig 2), and was measured based on pixels. The pixel rating scale ranged

from approximately 400 - 1200px, with smaller numbers being related to more sincerity, and higher numbers related to lack of sincerity. Overall, positive conversations were rated as significantly more sincere (mean: 613.22px) than negative conversations (mean: 778.13px; t = 3.848, $p$ < .001- independent samples t-test).

## Results

Outcomes are reported from linear mixed-effects models built using lme4 package in R (R Core Development Team, 2008). A mixed effects regression was used to predict receiver perceived sincerity by Pseudo-confederate Valence Condition (positive or negative), Participant Valence Selection (Likert-like response options), and punctuation alignment (match or mismatch). The models implemented maximal random effect structures to achieve model convergence, with participants and trial set as random intercepts. All categorical variables were dummy coded.

**Pseudo-Confederate Valence (Manipulation Check)** As a manipulation check, to determine if the conversations would be perceived as positive or negative by our participants, the pseudo-confederate responses were presented to four female participants (mean age = 20.5) who did not participate in the pseudo-texting conversation. These participants were asked to rate each pseudo-confederate response bubble on a continuous rating scale for positive/negative valence. The rating scale spanned 400 - 1200 pixels, with lower numbers representing more positive valence, and higher numbers representing negative valence. The positive pseudo-confederate messages received an average pixel rating of 642.11px, while the negative pseudo-confederate messages were rated at approximately 850.77px (ß = -208.66, se = 28.03, t = -7.37, $p$ < .001; similar to Fig 2.).

**Intonational Punctuation Replication** To determine if pseudo-confederate punctuation was interpreted as affective in nature (question 1), conversational sincerity was assessed between the conversational valence conditions (dummy codes: positive = 0, negative = 1). Results revealed that the negative condition was rated as significantly more insincere than the positive condition (ß = 208.66, se = 25.53, t = 8.17, $p$ < .001), replicating Gunraj et al. (2016).

**Intonational Punctuation Style Matching** To determine if participants aligned with the pseudo-confederate's use of punctuation (question 2), intonational punctuation was evaluated between the two conversational conditions (dummy codes: positive = 0, negative = 1). Results from this mixed effects model revealed that the negative condition was rated as significantly more insincere than the positive condition (ß = -1.05, se = 0.20, t = -5.22, $p$ < .001; logistic model, family set as binomial; Jaeger, 2008). This suggests that interlocutors might be more likely to align under positive, than negative contexts.

**Conversational Appraisal** In the above analyses, we show that intonational punctuation and style matching occurs differently depending on the conversational valence. The last analyses (question 3) intended to determine whether or not the appraisal of the interaction (sincerity) should be affected by the pseudo-confederate's tone, similarity (to the pseudo-confederate) of their intonational punctuation, and the valence of the response selection.

The results indicated a number of main effects and an interaction. Specifically, there was a main effect of Pseudo-confederate Valence Condition, indicating that participants in the positive condition rated the conversation as significantly more sincere than participants in the negative condition (ß = 124.675, se = 52.747, t = 2.364, $p$ < .05). This suggests that participants were sensitive to pseudo-confederate affective tone.

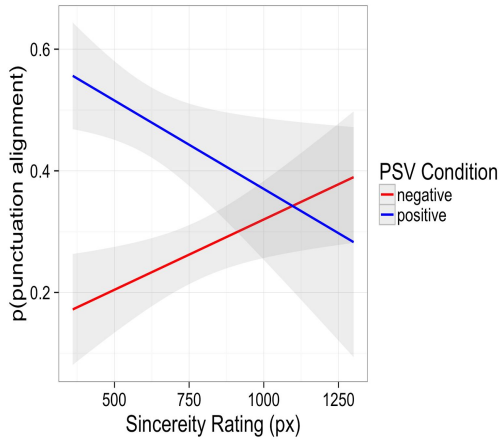


Figure 3: This figure represents the relationship between punctuation alignment and sincerity, as a function of pseudo-confederate valence.

There was also main effect of Participant Valence Selection (i.e., Likert-like responses; ß = 97.348, se = 43.442, t = 2.241, $p$ < .05) but no interaction between Pseudo-confederate Valence Condition x Participant Valence Selection. This suggests that as participants rated the interaction as less sincere, they chose more negative response options (e.g, emotional contagion).

Lastly, though there was no main effect of intonational punctuation style matching ($p$ = .352), there was a significant Pseudo-confederate Valence Condition x punctuation alignment interaction (ß = 49.841, se = 18.424, t = 2.705, p < .01; see Fig. 3). This indicated that as participants assessed the sincerity of each turn, the more sincere the turn seemed, the more likely the participant would match the pseudo-confederate's punctuation.

Alternatively, the more insincere the conversation, participants were less likely to align their punctuation, with the caveat that highly insincere ratings increased negative punctuation alignment.

## Discussion

Texting provides a wealth of communicative benefits. However, texting necessarily requires a fast, reduced, and often ambiguous delivery of information (Ling & Baron, 2007). In the face of ambiguity, the receiver of these messages must use their own representations of the world to interpret tone correctly, especially when the tone is not as explicit as vocal tone because of its dual meaning (i.e., grammatical and adapted pragmatic cues; Byron & Baldridge, 2005; Derks et al., 2008; Harris & Paradice, 2007; Lo, 2008; Riordan et al., 2014; Walther & D'Addario, 2001). Therefore, it is not always easy for a receiver of an emotionally valenced text message to correctly interpret tone. In the current study, we specifically evaluate the role of positive and negatively valenced punctuation and its effect on a receiver's ability to interpret tone.

Consistent with Gunraj et al. (2016), the results indicate that participants are in fact sensitive to punctuation as an effective cue to conversational tone. Additionally, the participants perception of the pseudo-confederate's sincerity shaped the participants' responses -- with a more insincere pseudo-confederate receiving responses that were more negatively valenced, though dampened. And finally, we see the convergence and divergence of punctuation use by the participant for pragmatic effect.

Though the current results provide interesting insight into the pragmatic nature of intonational punctuation, the current study is not without limitation. The main limitation of the current study is the lack of ecological validity, which may have affected patterns of responding. For example, participants in the positive condition may have attempted to decrease social distance by using the same communicative mechanisms engaged in FFC (behavioral entrainment; Byrne, 1971; Bernieri & Rosenthal, 1991; Chartrand & Bargh, 1999; Niederhoffer & Pennebaker, 2002). Specifically, participants in the positive condition exhibited emotional contagion and intonational punctuation alignment, which in other domains has been suggested to promote interpersonal liking and communicative smoothness (Chartrand & Bargh, 1999). Even though the participants were instructed to imagine they were texting with someone they knew well, our participants may have aligned less and been unsure of how to interpret the one word responses ending with a period (negative), because they lacked relevant history with their texting partner (Bernieri & Rosenthal, 1991).

Alternatively, participants may have defaulted to rules of social engagement, in that it is typically socially unacceptable to have contentious interactions with strangers (Morand et al., 2003). Therefore, participants may have been more likely to disengage synchronous mechanisms to defuse the negative interaction. However, the more contentious (i.e., more insincere the conversation seemed) the more likely the participant converged their text response with the pseudo-confederate. One should approach this interpretation with caution, because it is difficult to claim intentionality because the interaction was with an assumed stranger, and behavioral frequencies were assessed, and not via time course analysis. These results, nonetheless, are consistent with negative FFC interactions, in which decreases in convergence have been found (Abney, Paxton, Kello, & Dale, 2014; Paxton & Dale, 2013).

Finally, we did not look specifically at the time course of synchrony across the interaction. This was mostly due to the low sample size and the preliminary nature of the current study. We first wanted to show that emotional valence has the potential to differentially impact communication in a texting context. Punctuation matters just as much as vocal prosody, because of the pragmatic implications of the cue. Therefore, the next step of this project will be to expand this paradigm, by collecting more data so we might be able to explore the temporal dynamics of emotional valence during text based communication.

## Conclusions

We are relying more and more on digital forms of communication, with even the most prominent political leaders communicating through short, fast text-based responses via social media. In the current study, we provide preliminary insight into the cognitive mechanisms (e.g., emotional contagion) that drive the interpretation of intentionality. Texters (college-aged) not only use typographic variation to indicate pragmatic meaning, but also use it to infer intentions. Additionally, the choice to use certain typographical cues may push the valence of a conversation in a more positive or negative direction. Therefore, one should be aware that one's use of punctuation has pragmatic implications over and above grammatical form, in texting. We see that texting follows similar rules as FFC. In that, language is naturally ambiguous, but in a texting context ambiguity is a critical feature of communicating. Additionally, the texter will follow the valence of their communicative partner as a means to increase and decrease social distance. Therefore, failure to use the appropriate (texting) affective cues could lead to higher rates of miscommunication, misunderstandings, and generally hard feelings.

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