Ambiguity in Text Messages: "I Hate You for Using Emojis Inconsistently With Your Text in WhatsApp 😐"

***Ricky Van-yip Tso[1,2] (rvytso@eduhk.hk)**
***Matt Wing-hang To[1] (s1104798@s.eduhk.hk)**

1. Department of Psychology, The Education University of Hong Kong, HKSAR
2. Psychological Assessment and Clinical Research Unit, The Education University of Hong Kong, HKSAR
**Co-first authors*

Abstract

This study investigates whether incongruency of valences between emoji and text in texting will promote stronger negative inference in readers. An experiment assessed participants' judgments of the text messages by recording their response times and perceived valence from the messages (either positive or negative) under the following manipulations: positive or negative messages paired with an emoji that convey positive, negative or ambiguous/neutral emotions (i.e. the pairing of emojis and test may be congruent or incongruent in their valences). Compared with congruent text messages, we found that incongruency between emojis and texts promoted stronger negative inference and elicited a longer processing time, even in texts that conveyed a positive meaning or when the emoji itself was ambiguous/neutral. These results suggest that texts and emojis jointly influence the perceived mood of messages, hinting the importance of the effective use of emojis in order to convey intended meanings and emotions efficiently.

Keywords: emojis; congruency; ambiguity; emojis valences, valences of text messages

Introduction

Human social interaction relies on both verbal and nonverbal communication. In order to communicate accurately and effectively, humans use nonverbal cues more than 90% of the time in communication (Mehrabian, 1972). Including body gestures and facial expressions, these nonverbal cues can provide extra emotional information for communicators to understand others' emotional state, with effective use of facial expressions regarded as a predictor to facilitate social interactions (Van Heijnsbergen, et al., 2007; Haxby, et al., 2002; Calder, et al., 2001; Waller, 2017). However, due to advancement in technological communication since the past decades, the traditional way of communication is no longer limited to face-to-face conversations. Instead, computer-mediated communication (CMC) allows us to communicate through computer-based applications such as emails and internet conferences (Walther, et al., 1994). Inventions of smaller portable devices like smartphones and tablets have allowed us to communicate through mobile-mediated communication (MMC) in the recent years (Brasher, 2017), effectively facilitating sending of instant text messages.

Because of restrictions in conveying the affective contents in plain text messages, a variety of emoticons has been created to express emotions. Face-like symbols such as ' :) ' and ' :(' are accepted by people to tell others about the emotional state of text-senders (Tossell et al., 2012). These combinations of letters, numbers, and punctuation marks to imitate human facial expressions are called 'emoticons'. Emoticons have now transitioned to 'emojis', which are human-face pixel graphics with a variety of facial expressions (Brasher, 2017).

Linguistic Functions of Emojis

Emojis can serve as a facilitator to express more than texts in messages. According to symbolic interactionism, Blumer (1969) believed that symbols served as a purpose of language to elicit responses from communicators, and people use it to assign the meanings between symbols and their private thoughts. Similarly, emojis are used like symbols which are associated with images and meanings to express one's feelings, perceptions and attitudes. Thus, emojis also facilitates human interactions by compensating the insufficient information of human emotion through text-based communication.

Emojis can be utilized with a linguistic purpose to assist comprehension in communication. Since emojis are the ideograms existing in various genres, they can also be regarded as a universal language to convey emotional meanings in international communications (Danesi, 2017). Alshenqeeti (2016) agreed that the universal meanings of emojis could "increase the cross-cultural communication clarity" (p.56), effectively reducing misunderstandings in the text-based communication. Emojis can also simplify contents by providing extra pictorial cues (Daniel & Camp, 2018). For instance, a thumb-up gesture generally expresses the meaning of "OK" or "Good" in face-to-face communication in Western cultures (Morris, 2015). Likewise, texters also used a thumb-up emoji 👍🏻 to substitute the texts "OK" or "good" in CMC and MMC (Brasher, 2017). Moreover, emojis could replace words if they were organized in a visual narrative sequence (Cohn, 2016). For example, official video of the song "Roar" by Katy Perry demonstrated how the logical sequence of emojis could substitute words and present the narrative meanings as words could function (Wolfe, 2018).

Nonverbal Functions of Emojis

Emojis can show non-verbal signals to indicate emotional states compensate for insufficient information in text-based communication. Jina (2007) added that emoticons could indicate the nonverbal cues similar to what people do in face-to-face communication with facial expressions and body gestures. A fMRI study showed that emojis could activate the

same area of the brain as emotional words and face-to-face communication would (Han et al., 2014). Thus, emojis could serve as the function of nonverbal cues to express emotion in the messages, which can also invoke empathetic responses (Daniel & Camp, 2018). For instance, a smiley face 😃 in a message likely invoke positive affections while people may feel sad by seeing a sad face 😕.

Ambiguity of Emojis

Valence is a psychological term for analyzing emotions by a continuum into three independent dimensions: (1) positiveness to negativeness, (2) active to passive and (3) dominant to submissive (Russell, 2003). Valence as a measurement of evoked emotions inside an emoji is "one of the most important scientific concepts at the heart of emotion experience" (Charland, 2005, p.83). The dimension of positiveness to negativeness was prevailed in the previous research investigating emotional impact of emojis (Daniel & Camp, 2018; Weissman & Tanner, 2018). Different emojis can be classified to valences of positive (e.g. joy and happiness) or negative (e.g. anger or fear).

Effective communication requires both senders and receivers to comprehend and indicate the meaning of emojis in the same way. However, nonverbal cues do not have one single meaning (Burgoon et al., 1996). There are many ways that may lead to different meanings in the interpretations, such as the users' age, gender and the level of experience (Alshenqeeti, 2016). Although emojis can compensate for the drawbacks in text-based communication, critics pointed out that ambiguity of emojis may hinder the understanding of the meanings and intentions of messages (Gibbs & Colston, 2012; Miller, et al., 2017). Ambiguity in the meaning of emojis suggests that they should be comprehended with sufficient contextual information (Gibbs & Colston, 2012; Aguado et al., 2018).

Ambiguity of the meaning of text messages also arises from sarcasm. Walther and D'Addario (2001) suggested that an emojis like the 'wink' (😉) was sarcastic in nature. Walther and D' Addario (2001) added that a mixed text message which contains incongruent valence of texts and emoticons could create the sarcastic meanings, suggesting that sarcasm in a message mostly occurred in a specific type of sentence structure. Using emoticons and texts of different valences to create various congruent and incongruent combinations in a message, Aldunate et al. (2018) showed that incongruent messages (i.e. that a positive message paired with negative emoticon or a negative message paired with positive emoticon) had a higher tendency to be inferred affectively as negative. Lo (2008) suggested that the incongruent valence of emoticons alone can alter the perceived mood from positive to negative. These studies suggest that incongruent use of emoticons in messages creates sarcasm in messages and arouse negative inferences.

However, the above studies failed to acknowledge the effects of emojis which are inferred with a neutral affect. Novak et al. (2015) posited that the valence of specific emojis (e.g. 😂 and 😐) are more neutral, rather than positive or negative—analysis of emojis should not be limited to positive or negative valence; but the focus should be shifted in order to study the impact of neutral emojis. This viewpoint inspires the current study to investigate the impact of neutral emojis as follows.

The Present Study

We aim to investigate how participants infer the valence of text messages of different combinations of emojis and texts. In particular, this study examines (1) how the mood of messages are inferred if people saw an emoji of mood that is incongruent with the text message, and; (2) the impact of ambiguity on mood inference of text messages when the text is paired with a neutral emoji. We speculate that the valence of the emojis alone cannot alter the valence of message, but the interaction between texts and emojis jointly influence the perceived valences of messages when the mood of the emoji is inferred as neutral. With the increased tendency of using emojis, the study also shifts the focus on the use of emojis instead of emoticons like in earlier versions of similar studies.

Methodology

Participants

A total of 30 individuals (14 males and 16 females) aged between 18 to 35 were recruited to participate in the experiment. All targeted participants were millennials, who all were identified having a high frequency of social media and networking use (Fry, 2016). All the individuals were native Cantonese speakers without any psychiatric disorders, and had normal or corrected visions.

Materials

The stimuli of this study were chosen by validating the emotional intensity of both the situational sentences and emojis that are commonly used in the Hong Kong context in the initial pilot phase. Participants indicated their feelings, attitudes or perceptions toward each sentence and emoji presented to them by a 5-point Likert scale (1 = very negative and 5 = very positive). In the first part of the pilot, participants rated 60 situational sentences extracted from instant messages and social media platforms. 30 situational sentences were chosen which were categorized to demonstrate positive and negative situations. For the second part, 33 emojis were preliminary shortlisted according to Novak et al. (2015). The emojis were also selected to demonstrate positive, negative or neutral emotion and to be rated by participants for validation.

After conducting the pilot survey, the situational sentences and emojis that were associated with low value of item-total correlation were removed to maintain a high level of internal consistency of the emotional intensity. The Cronbach's alphas for 24 items of both positiveness and negativeness of situational sentences were .89 and .87 respectively. The positive and negative emojis were found to be highly reliable (of $\alpha = .79$ and .73 respectively). Shrigley and Koballa (1984) advised that mean scores ranging from 2.5 to 3.5 in a 5-point Likert scale were recommended as a guide to determine the neutral point. However, the Cronbach's alphas of neutral emojis was not reliable ($\alpha = .23$), suggesting that participants' perception towards this group of

emojis were more ambiguous rather than neutral, demonstrating a large variance (M = 2.97; SD = 0.80). Concerning a better understanding of this study, the neutral emojis were suggested to be renamed as ambiguous/neutral.

Procedures

Participants first filled out a questionnaire to provide information of their background, which includes frequency of electronic networking usage, the type of the social media platforms frequently, age and gender.

In the experimental trials, procedures were adopted from Novak et al. (2015) in which the experimental trials were structured by presenting a situational text message, followed by an emoji. Each stimulus was comprised of a randomized valence of a situational sentence and a randomized valence of an emoji. The randomization was designed to create congruent, incongruent and ambiguous conditions. Shown in Table 1, a 2 × 3 (valence of situational sentences vs valence of emojis) metrics was set up to form three conditions of equal number of stimulus combinations in each group:

(1) *Congruent* [Positive Emoji with Positive Sentence (**PP**) or Negative Emoji with Negative Sentence (**NN**)]
(2) *Ambiguous* [Ambiguous Emoji with Positive Sentence (**AP**) or Ambiguous Emoji with Negative Sentence (**AN**)]
(3) *Incongruent* [Positive Emoji with Negative Sentence (**NP**) and Negative Emoji with Positive Sentence (**NP**)].

Table 1: Congruent, Incongruent and Ambiguous conditions

		Valence of Emojis		
		Positive	Ambiguous/ Neutral	Negative
Valence of Situational Sentences	Positive	Congruent (PP)	Ambiguous (AP)	Incongruent (NP)
	Negative	Incongruent (PN)	Ambiguous (AN)	Congruent (NN)

Each trial starts with an anchor to direct attention to a situational sentence on a white background. The situational sentence was presented for 1500 ms on the screen, followed by an emoji for 500 ms. The participants then saw the cues "Positive/ Negative" on the screen, after which, the next trial would only appear if a judgment was made by pressing the keyboard to indicate whether the sentence was positive or negative. Participants were instructed to respond as quickly as possible.

Before the experiment, three fixed practice trials were arranged for a better understanding of the actual operation. Feedbacks were provided to ensure that the participants were familiar to the procedures of the experiment. After the practice trials, participants were guided to indicate the perceived valence of each message according to their self-feeling or self-perception. The response time and the answers of every presented trial were recorded. The experiment was conducted using the psychological test tool E-Prime.

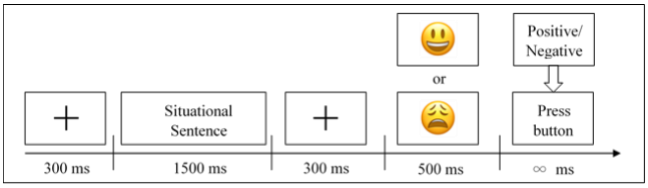

Figure 1. Design of the Experiment

Participants also filled in a 50-items Autism-Spectrum Quotient (ASQ) to measure their autistic quotient (AQ; see Baron-Cohen et al., 2001). Because people with high autistic quotient had been shown to demonstrate difficulties recognizing other non-verbal emotional information, the AQ scores was measured as a control. To control for the effect of IQ, the abbreviated nine-item forms of the Raven's Standard Progressive Matrices Test (RSPM) was also administered to measure nonverbal intelligence (see Bilker et al., 2012).

Result

Response Time

The result showed no main effect of the emoji type, $F(1, 27) = 0.481$, $p = 0.621$, a marginal effect of sentence type, $F(1, 27) = 3.947$, $p = 0.057$, and a significant interaction effect between emoji and sentence types, $F(2, 54) = 4.914$, $p < 0.05$. Post hoc t-tests showed that participants responded differently in the three conditions: Faster responses were recorded in the congruent conditions (in both *PP* and *NN*); while participants responded slower in the ambiguous conditions (i.e. *AP* and *AN*), and slowest in the incongruent conditions, (i.e. *NP* and *PN*). The results suggest that the combination of the different valences of emojis and sentences influenced the processing time, with longer time to process text messages in incongruent and ambiguous conditions (Figure 2).

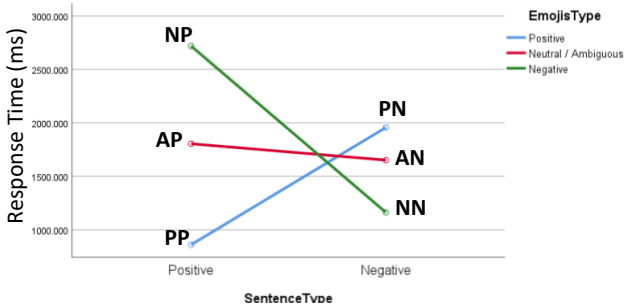

Figure 2: Response time (ms) of difference emoji-text valence combinations.

Valence Perception of Text Messages

Repeated-measures ANOVA on perceived valence of text messages revealed a significant main effect of sentence type, $F(1,27) = 7.271$, $p < 0.05$, and interaction effect between emoji and sentence type, $F(2,54) = 4.006$, $p < 0.05$. No significant main effect was found in the emoji type alone $F(2, 54) = 0.421$, $p = 0.652$. Post hoc t-tests showed that the emojis made impacts to the perceived responses whenever emojis were combined with different valences of situational sentences (see Figure 3).

Post-hoc t-tests showed a significant difference only between the combinations in the congruent condition (*PP* vs *NN*), t(29) = 66.983, p < 0.01, and ambiguous conditions (AP vs AN), t(29) = 14.142, p < 0.01. No significant differences were found in the incongruent condition (PN vs NP), t(29) = -1.546, p = 0.133.

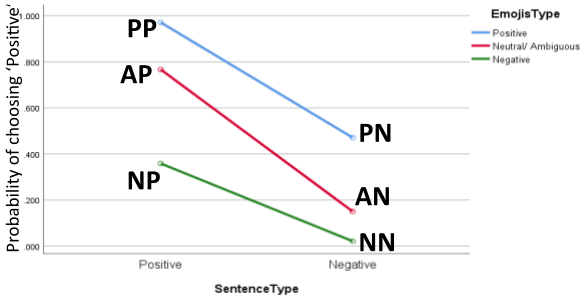

Figure 3. Probability of choosing 'Positive' in different emoji-text combinations

Table 2. Post-hoc t-tests of RTs between different emoji-text combinations

Comparing the Emoji Type within the same Sentence Type:

Conditions		*Df*	*t*	*p*
PP	*AP*	29	-4.576	.000
PP	*NP*	29	-5.679	.000
AP	*NP*	29	-2.835	.008
PN	*AN*	29	1.114	.275
PN	*NN*	29	2.810	.009
AN	*NN*	29	3.265	.003

Comparing the Sentence Type within the same Emoji Type:

Group A	Group B	*Df*	*t*	*p*
PP	*PN*	29	-5.824	.000
NP	*NN*	29	4.356	.000
AP	*AN*	29	.649	.521

Comparing within Conditions:

Group A	Group B	*Df*	*t*	*p*
PP	*NN*	29	-1.536	.135
AP	*AN*	29	.649	.521
NP	*PN*	29	3.174	.004

To further understand the above analyses, one-sample t-tests showed that participants had varied perceptual tendencies in different conditions. They tended to perceive positive valences from text messages in *PP*, t(29) = 47.958, p < 0.01, and AP , t(29) = 7.550, p < 0.01; while they tended to perceive negative valences in *NN*, t(29) = -45.531, p < 0.01, *AN*, t(29) = -13.259, p < 0.01, and *NP*, t(29) = -3.166, p < 0.01. However, the only condition without a significant effect was the *PN* condition [M = 0.471, SD = 0.289; t(29) = -0.552, p = 0.293], suggesting that texts with positive meanings induced ambiguous mood inference when paired with an incongruent emoji of negative valence. See Figure 4.

Analysis of Covariates

With the AQ and IQ scores as covariates, the same pattern was observed as in the analyses above. However, AQ was found to be a significant predictor of the interaction effects between sentence and emoji type. Preliminary analyses suggests a positive correlation between AQ with response time and ambiguous perception of valences in incongruent and ambiguous conditions. Specifically, when AQ was controlled in the study, no effect was found for response time for any of the conditions, whereas an interaction effect was still found between emojis and sentences type on perceived response, F(2, 42) = 4.006, p < 0.05. This result suggests that the adults with high AQ scores may respond as quickly as the adults with relatively lower AQ scores, while the adults with high AQ scores may have significant differences to perceive messages. Hence, an impact was still found in the perceived responses when AQ scores was taken into consideration. However, due to word limits, the effect of AQ on the results will be discussed in the future as this is not the scope of the current paper.

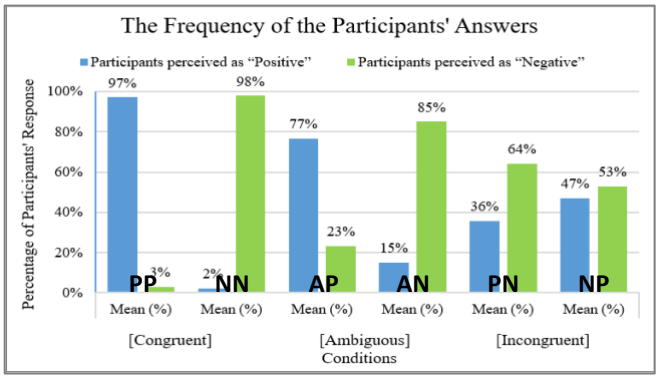

Figure 4. Participants' perceived responses in the three conditions

Discussion and Conclusion

Incongruency with Negative Emoji Promotes Higher Probability of Negative Inference

This study indicated an interaction effect between emoji and situational sentence in consideration of RTs and perceived valence: Incongruency of the valences between emojis and situational sentences led to longer process time then in congruent conditions. People tend to hesitate in judgments in the when the valences between the emojis and the texts are incongruent, requiring a longer time to process the whole meaning of the message. This is consistent with previous findings that incongruency in text and emoticons promotes negative inference when the emoticons had a negative valence (Aldunate et al., 2018; Lo, 2008). However, our results suggest that people felt more affectively negative when they see a negative emoji with a positive sentence (NP) than a positive emoji with a negative message (PN). This effect may be due to the negative bias people have towards messages in which there a higher probability of negative inference whenever text messages, either in texts or emoticons, contain negative information (Walther & D'Addario, 2001). Negative valences in emojis has a stronger influence in people's negative inference of text messages because emojis have a strong functional role in indicating the pragmatical emotional meaning in test-based communication (Dresner & Herring, 2012). Hence, when people receive the incongruent message, the negative valence of emojis

influences the overall valence of messages more strongly, orienting towards negative inference in text-based conversations.

Our results also showed that participants had ambiguous tendencies to judge the valence of messages in the *PN* condition. This phenomenon is due to "sarcasm", in which messages are perceived to be more sarcastic when they comprised of a positive emoticon with texts of negative valence (Derks et al. 2008; Derks et al., 2007). The *PN* condition can be categorized as a simple structure in the messages to create sarcastic meanings (Thompson & Filik, 2016; Filik et al., 2015). Moreover, sarcasm can be used as buffering for the emotional impact of messages, serving as a softening function for criticisms and praises (Dew, Kaplan, & Winner, 1995). Hence, inconsistent messages are difficult to be understood as the judgment of the message valence will be hindered.

Ambiguous/ Neutral Emojis

In past studies, researchers attempted to investigate the impacts of neutral messages by the using pure texts and found that emoticons had a function to strengthen the intensity of a message (Derks et al., 2008; Thompson & Filik, 2016). Complementing their findings, here we showed that neutral emojis could also weaken the emotional impact in messages with a clear valence.

Nevertheless, our results also showed a significant difference between *AP* and *AN* condition, with judgments more inclined to the valences of the text. It implies that the neutral emoji is not a main element to create the ambiguity of a message and does not demonstrate the robust effects of changing the valences in messages as incongruent text messages do—participants more likely considered the valence of the texts for judgments with ambiguous emojis.

Another limitation of this study is that specific human habit in sending instant messages was not studied. Moreover, as people have different expressions to communicate in instant messages, the sentence structures were not limited to one specific type as are more complex in real-life texting. Future studies may investigate various complex combinations of emojis, pictures and texts in order to gain a full picture of how these combinations affect text message comprehension in real-life

To conclude, emojis are performing an important role to assist effective communication as they simulate the function of non-verbal cues in face-to-face communication. The interactions in the perceived valences of emojis and texts significantly modulate the perceived meaning, i.e. the original meaning vs hidden pragmatic intentions. Even though each emoji and word are individually understandable in a message, the contextual meaning of the whole message can be inferred differently in various combinations of text and emojis. The 'emoji lexicon' is expanding and more unique emojis are created each year which may convey more ambiguous valence and meaning. Hence, one should pay extra attention when emojis in texting in order to convey ideas more effectively and to avoid misunderstanding.

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