



Complex and Ambiguous: Understanding Sticker Misinterpretations in Instant Messaging

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Stickers, though similar in appearance to emoji, have distinct characteristics because they often contain animation, diverse gestures, and multiple characters and objects. Stickers can convey richer meaning than emoji, but their complexity and placement constraint may result in miscommunication. In this paper, we aim to understand how people perceive emotion in stickers, as well as how miscommunication related to sticker occurs in actual chat contexts. Toward this goal, we conducted an online survey ($n = 87$) and in-depth interviews ($n = 28$) in South Korea. We found emotional and contextual aspects of sticker misinterpretation. In particular, emotion misinterpretation mostly happened due to stickers' ambiguous (multiple) facial/bodily expressions and different perception of dynamism in gestures. In real chat settings, there were also contextual misinterpretations where senders and receivers differently interpret stickers' visual representation/reference, or/and corresponding textual messages. Based on these findings, we provide several practical design implications such as context awareness support in sticker interaction.

CCS Concepts: • Human-centered computing → Human computer interaction (HCI) ; Interaction design; • Information systems → Chat;

KEYWORDS

Sticker; Emoji; Message Interpretation; Instant Messaging

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1 INTRODUCTION

In recent years, stickers have become widely used in instant messaging apps such as WhatsApp, WeChat, LINE, and KakaoTalk. Billions of stickers are exchanged every day in LINE, and they are considered one of the fundamental features of instant messaging [29]. In general, stickers are different from emoticons and emoji because they are more expressive (diverse animations, multiple objects and characters). Also, stickers have placement constraints because they cannot

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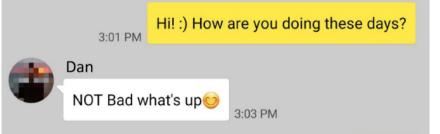
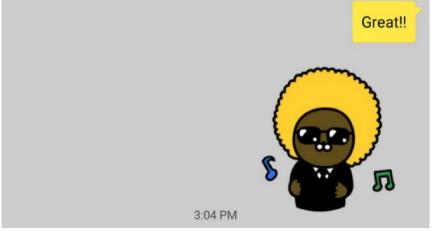
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Table 1. Comparison among emoticon, emoji, and sticker

	<i>Format</i>	<i>Usage</i>	<i>Example</i>
Emoticon	Text	Can be sent with or without text	
Emoji	Image (Unicode mapping of text)	Can be sent with or without text	
Sticker	Image/Animation	Must be sent separately from text	Emoticon (top), Emoji (middle), and Sticker (bottom)

be embedded into a text message; they are sent individually as a separate message (See Table 1). Instant messaging apps offer several sets of free stickers, each of which features a character within a unique theme. Users can also purchase additional sticker sets from an online store, or create their own stickers by uploading images. Recent premium smartphones even allow users to generate their own animated stickers, such as Apple iPhone X’s Animoji and Samsung Galaxy S9’s AR Emoji.

Prior studies showed that emoji and stickers offer ways to compensate for the loss of nonverbal cues, such as gestures and facial expressions—important aspects of face-to-face conversations [15, 23, 38]. Emoji and stickers support functional use that supplements or substitutes for text, and strategic use of conveying a social presence and managing impressions [10, 22]. Emoji can also strengthen emotional intensity by complementing and enhancing verbal messages [11]. But researchers have raised concerns about emotion misinterpretation in emoji usage [24–26]. Miller et al. [25], for example, found significant disagreement in the emotion interpretation of popular emoji, and this difference became worse because of the diversity of emoji rendering across different platforms.

In this work, we focus on sticker misinterpretation in instant messaging. Unlike traditional emoticon and emoji, stickers may contain animation with multiple characters and objects [22, 38]. More importantly, the placement constraint of stickers is different from emoji, as stickers must be sent as singular entities and cannot be included next to text in the same way that emoji can. Extending the previous work [24, 25], we first investigate how emotion misinterpretation happen in stickers, by conducting an online survey ($n = 87$) using default stickers from KakaoTalk, the most popular instant messaging app in South Korea. We also note that the distinguishing characteristics of stickers, such as rich expressiveness and placement constraint, may result in misinterpretation. Thus, it is important to deepen our understanding of how these characteristics are related to sticker interpretation between senders and receivers. Toward this goal, we then collected real-world chatting data about sticker usage and interviewed senders and receivers ($n = 28$) to identify common patterns of sticker misinterpretation. Because of the unique characteristics of stickers, in this analysis we extended the scope of message misinterpretation, considering both the emotional and contextual aspects of construal. According to a theory in social psychology, misinterpretation (or misconstrual) happens if participants (in this case, the speaker and the addressee) fail to reach agreement on (or to construe) what the speaker is taken to mean (or the speaker’s intention) [8].

Our results showed that sticker misinterpretation frequently happens due to the unique characteristics of stickers such as rich expressiveness and placement constraint. In particular, emotion misinterpretation is largely originating from complexity and ambiguity of emotional expressions in stickers. In real chat settings, there are also context misinterpretations in sticker use where senders and receivers differently interpret stickers' visual representation/reference, or/and corresponding textual messages. Based on our findings, we discuss several practical design guidelines that can mitigate emotional and contextual misinterpretations of stickers in instant messaging.

Our work provides new insights into the importance of the emotional and contextual aspects of sticker misinterpretation in instant messaging. The problem is that sticker misinterpretation may lead to conflicts or breakdowns in online conversations. Furthermore, this negative experience may even lead to non-use of stickers as prior work of technology non-use alluded [3]. The alarming finding in our study is that 22.1% of the sticker uses resulted in misconstruals, which implies that sticker misinterpretation commonly occurs in our daily lives. Considering that average of 2 billion stickers are sent per month according to recent statistics published in 2017 by Kakao [32], we estimate that more than 400 million stickers could be misinterpreted in a month. These statistics clearly support the importance of studying sticker misinterpretation, and thus, we call for further studies in the CSCW and HCI community.

2 BACKGROUND AND RELATED WORK

We review the related studies about (1) what are the roles of instant messaging, (2) how emoticons/emoji/stickers attempt to compensate for a loss of non-verbal cues, and (3) what are the impacts of their usage on message interpretation in CMC.

2.1 Role of Instant Messengers in Everyday Life

Prior studies identified that instant messaging is primarily used for relationship maintenance purposes, such as planning, coordinating, sharing, discussing, and reflecting on everyday activities [2, 28]. Chatrooms in instant messaging as *dwelling places* of everyday narratives—chitchats, news, and images—are known to foster togetherness and intimacy [28]. Significant variations in the use of diverse channels, including instant messaging for relationship maintenance, exist depending on the types of interaction partners and their relationships [2]. Diverse relationships are maintained via instant messaging (e.g., strong vs. weak ties), and users often make deliberate efforts toward boundary regulation (constantly adjusting attentiveness and self-disclosure levels) [21]. Compared with the traditional short messaging service (SMS), instant messaging is regarded as more social, conversational, and informal than SMS [7]. In recent years, people often use multiple messaging apps (e.g., WhatsApp and Facebook Messenger) simultaneously, depending on their contacts' behaviors and relationship dynamics, as well as on the apps' technical constraints (WhatsApp for family, perhaps, and Facebook Messenger for friends) [27]. Beyond relationship maintenance, instant messaging also permeates into diverse group work contexts, such as teaching [5] and emergency operations [17].

2.2 Role of Emoticons, Emoji, and Stickers in CMC

As part of relationship maintenance, emoticons/emoji/stickers are frequently used in text messaging as illustrated in Table 1. According to the literature on computer-mediated communication (CMC), textual communication lacks nonverbal cues such as gestures, facial expressions, and tone of voice, which often contain a range of social and emotional information. The social information processing (SIP) model of CMC [35] states that users make sense of the communication medium and appropriate the technology to develop ways of compensating for the loss of non-verbal cues.

Prior studies clearly showed that emoticons/emoji/stickers play such a role. Lo [23] stated that emoticons or ASCII typographics for representing emotion can be considered as quasi-nonverbal cues in that emoticons help a receiver to better interpret the sender's emotion and attitude expression. In addition to conveying emotion and facial expressions, Dresner and Herring [15] argued that emoticons have illocutionary force meaning emoticons supplement what the user intends by what he or she writes in text (e.g., asserting a claim, asking a question, making a promise, begging, or threatening). Kaye et al. [19] identified interpersonal functions of emoticons: aiding personal expression (e.g., establishing emotional tone or lightening the mood) and reducing ambiguity of discourse. Furthermore, emoticon usage differs across different platforms—for example, it was deemed less appropriate to use emoticons in emails when compared to text messaging and posting in social media.

In recent years, emoji (or pictographs)—that are actual pictures of emotion instead of typographics—are widely used alongside stickers. Note that stickers are typically bigger than emoji, taking up a much larger screen space. Cramer et al. [10] identified intended function of embedded emoji: for example, providing additional emotional and situational information, changing a user's tone, and facilitating engagement and relationship. Due to the rich expressiveness of stickers, Lee et al. [22] showed that stickers have a functional use of supplementing or even substituting for text, and a strategic use of delivering social presence and managing impression.

Kelly and Watts [20] identified three themes of appropriation (or repurposing) of emoji in close personal relationships; maintaining a conversational connection, permitting a playful interaction, and creating new meanings in conversation. More detailed typologies and reasons of appropriation are further explored in the follow-up study [37]. In the recent study of WeChat, Zhou et al. [38] found that emoji/stickers are often used to add connotative information to convey behaviors, actions, and attitudes. Hsieh and Tseng [16] showed that emoticon use increases information richness, and thus can lead to increased playfulness (e.g., flow, good feeling, fun) in mobile instant messaging. Beyond delivering non-verbal cues, researchers found other usage purposes of emoticons/emoji/stickers. For example, emoji was used not only for relationship maintenance tools, but also aesthetic expressions among Japanese teens [30]. In addition, stickers can be used for personalizing interpersonal communication (by the use of custom stickers and sticker shopping) as well as for the sake of simply exchanging/collecting stickers, thereby making sticker subculture (e.g., sticker showoff and sticker gift) [38].

2.3 Message Interpretation with Emoticon and Emoji Use

Recently HCI researchers studied the potential problems of miscommunication in emoji usage. There are over 1,800 emoji in the Unicode specification, and their image rendering is very diverse across different platforms. In other words, the same character code may look slightly different when we compare emoji in Google's Android and Apple's iOS platforms, for example. Miller et al. [25] analyzed the perceived emotion of popular emoji across different platforms. They found that the disagreement rate can be over 40% in some emoji (e.g., “smiling face with open mouth and tightly closed eyes”). Furthermore, rendering difference across platforms resulted in significant perception discrepancy. For example, “grinning face with smiling eye” had the average disagreement score of 4.7 out of 10. Morstatter et al. [26] performed a large-scale sentiment analysis of a Twitter dataset and found that some emoji had significant emotion disagreements (e.g., fearful face, clapping hands, and person pouting). Miller et al. [24] further studied whether such disagreements of perceived emotion can be reduced, when emoji were used within a text message, by comparing users' emotion ratings of emoji in isolation and those within a random sample of tweets. However, they found that emotion disagreements of emoji were not significantly reduced even though there were accompanying texts.

While these results showed the evidence of emotion misinterpretation in emoji usage, prior studies showed conflicting results on emoticons' impact on message interpretation (i.e., a receiver's emotion perception of a text message). Walther and D'Addario [36] showed that emoticons had few influences on message interpretation, mainly because the sentiment of an accompanying verbal statement dominates the overall interpretation due to emoticons' supplemental roles. However, Derk et al. [11] found that emoticons can strengthen the intensity by complementing and enhancing verbal messages. In this way, a positive message can be interpreted more positively if a smile emoticon is accompanied. Nonetheless, emoticons did not change the interpretation of a verbal message—a negative verbal message is still perceived as negative even with a smile emoticon.

In this work, we study misinterpretation of stickers in a chatting context. Stickers are very different from emoticons/emoji because they may contain animation with multiple characters/objects, and they cannot be embedded into a text message. We first studied patterns of *emotion misinterpretation* in stickers. We then collected real-world chatting data of sticker usage and interviewed both senders/receivers to investigate the patterns of message misinterpretation in sticker usage, including both *emotional* and *contextual* disagreement. This extended view on message interpretation is due to the expressiveness of stickers as illustrated in recent studies [22, 38]. Our work complements prior studies in that our focus is mainly on stickers, which have received a considerable spike in popularity in recent years. Moreover, we believe that our analysis of real chat data can bring new insights into the importance of the contextual aspects of message interpretation in sticker-enabled CMC such as instant messaging.

3 STUDY 1: INTERPRETATION DISCREPANCY OF POPULAR STICKERS

In Study 1, we conducted an online survey to examine if users had different perceptions about emotions and the semantic meaning of basic stickers used in KakaoTalk. We only recruited people who used KakaoTalk, which is one of the most popular instant messaging apps in Asia. KakaoTalk had an average of 49.7 million global monthly users in 2017 [9]. In particular, in South Korea, its market share is over 95% [9]. Like other popular instant messengers such as WhatsApp, Facebook Messenger, and WeChat, KakaoTalk provides users with various stickers—a feature that was introduced in 2011. According to recent statistics published in 2017 by Kakao [32], 17 million users purchased stickers over the past six years, and an average of 2 billion stickers are sent per month. This study was approved by the Institutional Review Board (IRB).

3.1 Study 1 Design

3.1.1 Procedure. We used the Russell's core affect theory to measure the emotional misinterpretations associated with each sticker [1]. This model has been widely used in analyzing emotion discrepancies of emoji as mentioned in related work [24, 25, 34]. The Russell's model demonstrates that human emotions can be represented through a combination of two dimensions: valence and arousal levels (see Figure 1). The valence level denotes how pleasant (or displeasant) a user's emotion is, and the arousal level describes how active (or inactive) a user's emotion is. "Happy" emotion, for instance, is a pleasant, activated emotion, while "upset" emotion is displeasing and activated. These two emotions are distinguished by their valence level. "Sad," on the other hand, is a displeasing, deactivated emotion. So "upset" and "sad" differ by their arousal levels.

At the beginning of the online survey, we explained the survey's purpose. We then illustrated the core affect theory with Figure 1. We provided a detailed explanation of valence and arousal dimensions, using examples. We then provided 20 basic stickers (see Figure 2) in KakaoTalk and asked the participants to answer the following questions for each sticker:

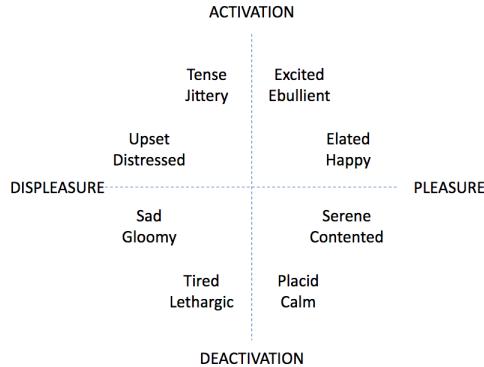


Fig. 1. Core affect map ([1], p.148)



Fig. 2. The 20 basic stickers on KakaoTalk

- What is the valence level of this sticker? (on a 7-point Likert scale, where -3 = very displeased and 3 = very pleased)
- What is the arousal level of this sticker? (on a 7-point Likert scale, where -3 = very deactivated and 3 = very activated)
- Please tell us what this sticker means. (in an open-ended question)

The first question asks the respondent to rate the perceived valence level of each sticker (i.e., whether it describes a happy or sad emotion). The second question asks the respondent to rate the perceived arousal level of each sticker (whether it has high or low activeness). The last question is intended to observe how respondents perceive certain emotions in detail, because even though a certain sticker has the same level of valence and arousal level, more detailed interpretation may vary according to each person.

3.1.2 Participants. We posted the survey link on an online campus community and on Facebook. The survey was open for one week, from November 26 to December 1, 2017. A total of 87 participants (42 males and 45 females) with an average age of 22.4 ($SD = 3.41$) responded. We randomly selected ten respondents and compensated them for their participation with an online gift card which was worth 6,300 KRW (approximately 6 USD).

3.1.3 Data Analysis. After the data collection, we analyzed the answers gathered from the survey to determine how their emotion interpretations are varied. We calculated the standard deviations of the valence and arousal levels for each sticker. For the stickers with high standard deviation in valence or arousal, we then performed a qualitative content analysis [33] for the user responses to elucidate detailed reasons for the varying interpretations.

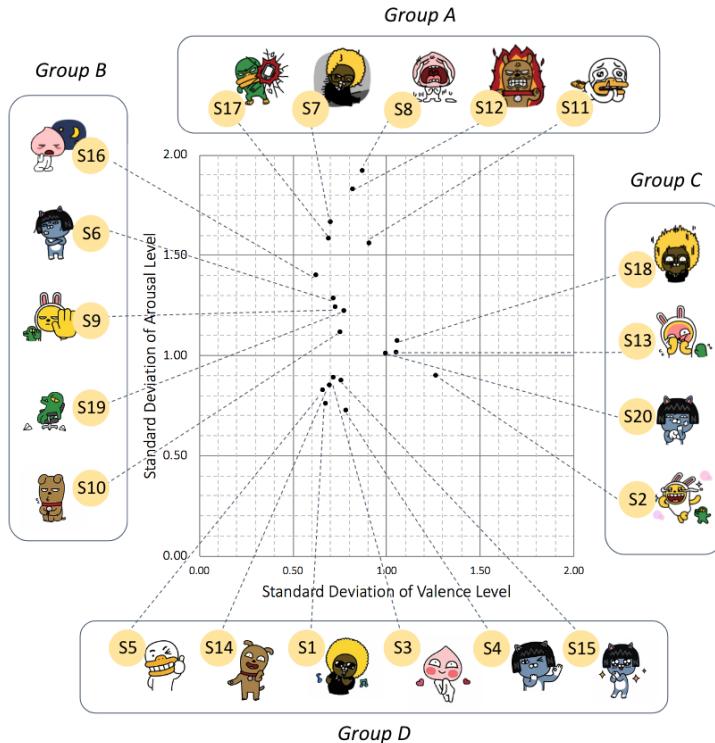


Fig. 3. The standard deviations of valence (x-axis) and arousal (y-axis) levels for 20 stickers

3.2 Findings in Study 1: Interpretation Discrepancy of Popular Stickers

To find out how people perceive emotion levels differently for popular stickers, survey participants were given the 20 basic stickers from KakaoTalk (see Figure 2). Unlike conventional emoji, all of these stickers are animated. Participants rated each sticker's depicted emotion (valence and arousal levels) and wrote about its meaning in free text. Then we investigated whether there are emotional and semantic interpretation discrepancies in attributing meaning to these stickers.

3.2.1 Valence and Arousal Level Distribution. To compare both the valence and arousal dimensions together, Figure 3 depicts a scatter plot of standard deviations of valence and arousal levels for all the stickers. The standard deviations of arousal levels are greater than that of valence levels in general. A higher deviation in arousal level indicates a lesser consistency in perceiving the arousal level of a sticker. The stickers in Figure 3 are clustered into 4 groups. *Group A* has the highest deviation in arousal level. Most of these stickers have dynamic animation in terms of characters' bodily movements, expressing strong anger or sadness. Stickers in *group B* have slightly lower deviation in both valence and arousal levels than those in *group A* and have less dynamic animation. *Group C* has the highest deviation in valence level, containing multiple nuanced facial or bodily expressions. Lastly, stickers in *group D* have the lowest deviation in both valence and arousal levels. These stickers depict positive emotions, and their bodily expressions are simple and clear, relative to other stickers. We further examine each dimension (valence and arousal) and analyze participants' textual descriptions to deepen our understanding about the variations in interpretation in the following sections.

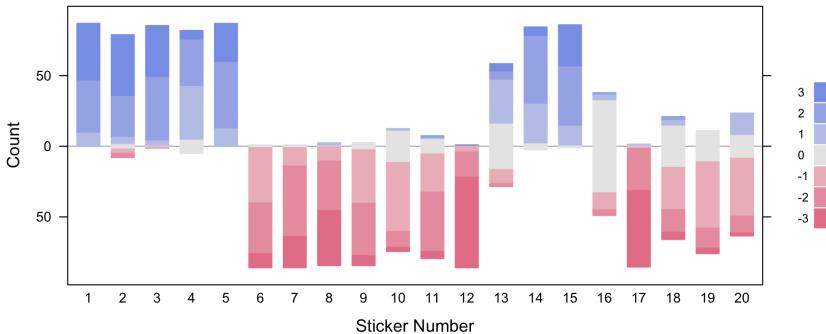


Fig. 4. A stacked barplot of valence level counts for each sticker

3.2.2 Sticker Interpretation in the Valence Dimension. A barplot of valence levels for 20 stickers is depicted in Figure 4 for each Likert scale value. Here, -3 indicates the most unpleasant emotion, and 3 the most pleasant emotion. The barplot stacks the counts of positive and negative responses in opposite directions. It shows that most stickers clearly tend to have either positive valence (S1-5, S14, S15) or negative valence (S6-9, S12, S17). There is one neutral sticker (S16), and the rest of the stickers are positive- or negative-dominants (S13 vs. S10, S11, S18-20).

We analyzed participants' textual descriptions for each sticker from the survey answers. Our analysis revealed that interpretation discrepancy in the valence dimension was due primarily to ambiguous facial or bodily expressions. Sticker 13 ($M = 0.51$, $SD = 1.06$) was interpreted as showing both shyness and embarrassment. Some participants ascribed high valence level to the sticker, commenting, "I am shy" because the character's cheeks are blushed. In contrast, other participants ascribed low valence level to this sticker, stating, "I am ashamed that I made a mistake" because the character is covering his face with clothes and sweating a little. Likewise, Sticker 18 ($M = -0.79$, $SD = 1.06$) was interpreted as both surprised by a good news and shocked by misfortune. One participant rated the sticker with high valence describing it as, "I am surprised by joyful events" because the character's big eyes and hands covering his head indicate surprise. In contrast, others described it as low valence, stating, "I am shocked by horrific events" because the animation looks as if the character is falling down with its hairs being blown by the wind.

Another major reason was that stickers can indicate multiple emotional expressions at the same time. In Sticker 2 ($M = 2.10$, $SD = 1.27$), the character bursts into a flood of tears but also smiles. Some participants rated this sticker as having high valence by commenting, "I am joyful with tears" because the character is smiling and is surrounded by bubbles. Others, however, rated it as having low valence, stating, "crying because I am mentally broken down" because the character is crying and running all around.

3.2.3 Sticker Interpretation in the Arousal Dimension. A barplot of arousal levels for 20 stickers is presented in Figure 5. Here, -3 indicates the lowest activeness, and 3 the highest activeness. Generally, the arousal ratings of stickers were more dispersed than their valence ratings. More stickers have both positive and negative arousal levels.

To understand why this happened, we again analyzed participants' textual descriptions. Our analysis of these descriptions showed that participants had different perceptions of the intensity and dynamism of facial or bodily expressions, even though they had similar perceptions of valence. Sticker 8 had the highest deviation in terms of arousal level ($M = 1.08$, $SD = 1.92$) and its descriptions showed different intensities with regard to a crying action. Participants who rated Sticker 8 as having low arousal level simply described it as "sadness" or "crying." But other participants who

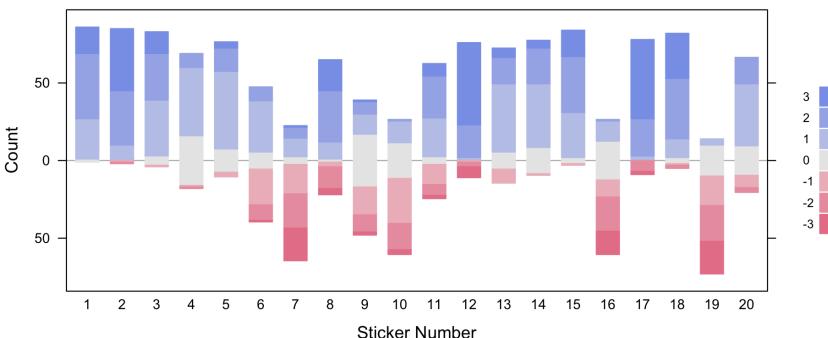


Fig. 5. A stacked barplot of arousal level counts for each sticker

rated it as having high arousal described it in terms of active crying, such as “wailing loudly” or “bursting into tears.” These different interpretations might be due to the dynamic animation of the crying character. Sticker 12 has the second highest deviation in arousal level ($M = 2.01$, $SD = 1.83$). Some interpreted this sticker as having high arousal level, giving various interpretations such as, “angry as I want to hit you” or “being pissed off,” possibly due to its animation of clenching fists. But others rated it as having low arousal level and described it as “pretending to be angry at a joke” or “hatred,” without considering its gesture too seriously. Sticker 7 ($M = -1.11$, $SD = 1.66$) was also interpreted as having both high arousal level (“knocked out” or “be utterly exhausted”) and low arousal level (“tired” or “in despair”). Although the sticker’s emotion (being tired) indicates low arousal according to the core affect theory, in its animation, the character is falling down to the left side, and this bodily movement thus could have resulted in high rating of activeness. Another interesting finding is that some stickers showed low deviation in valence and arousal ratings, but they somehow had diverse interpretations. Sticker 5, for example (valence: $M = 2.16$, $SD = 0.66$, arousal: $M = 1.02$, $SD = 0.82$), was interpreted variously as “I feel proud,” “cheer up,” and “showing off,” possibly because of its multiple gestures of giving a thumbs-up and winking together. Diverse interpretations may arise if a person focus on a single gesture only or combine the meaning of multiple gestures.

In Study 1, we used an online survey to investigate users’ perceptions about the emotional meanings of stickers in instant messaging. Our results showed that the stickers can be interpreted at varying levels—in terms of valence level, because of a character’s ambiguous facial or bodily expressions, and in terms of arousal level, because of the intensity and dynamism of a character’s gestures. These varying interpretations can be severe in real-world, computer-mediated communications where diverse stickers are used. This leads us to the following study in the next section.

4 STUDY 2: MISCONSTRUAL IN REAL STICKER USAGE

Study 1 revealed that there are significant differences in stickers’ emotion interpretations. In Study 2, we wanted to deepen our understanding of misconstruals in real-world chatting contexts—the speaker and addressee fail to reach an agreement on what the speaker’s sticker use is taken to mean. Based on our interviews with 14 pairs of users ($n = 28$), we collected and analyzed 140 instances of sticker usage in real-world chatting contexts. In our interview, senders and receivers described their intentions and interpretations, respectively, and we had discussions with participants to determine why such misconstruals occurred. Study 2 was also approved by the Institutional Review Board (IRB). For the privacy reasons, we gathered informed consent from the participants in Study 2 that their conversation can be included in the paper.

Table 2. Participant demographics and relationships

<i>Participant number</i>	<i>Gender</i>		<i>Age</i>		<i>Relationship</i>	<i>Duration of knowing each other (month)</i>	<i>Frequency of sending KakaoTalk messages each other (number of days a week)</i>	
P1	P2	M	M	27	28	Friend	13	6
P3	P4	M	F	26	25	Couple	50	7
P5	P6	F	F	18	19	Friend	46	4
P7	P8	F	F	22	23	Friend	56	6
P9	P10	F	F	18	18	Friend	8	4
P11	P12	M	F	31	33	Couple	17	7
P13	P14	F	F	23	25	Friend	9	6
P15	P16	M	M	26	29	Colleague	20	6
P17	P18	F	F	21	22	Friend	38	3
P19	P20	M	F	24	21	Couple	13	7
P21	P22	M	F	19	20	Couple	19	7
P23	P24	M	F	20	19	Couple	11	7
P25	P26	F	F	18	19	Friend	8	3
P27	P28	M	F	21	21	Couple	10	7

4.1 Study 2 Design

4.1.1 Participants. Toward this goal, we recruited 14 pairs of KakaoTalk users through an online campus community and a university Facebook page. We limited the recruiting to user pairs who had used KakaoTalk recently (in the last three months) to exchange at least 10 stickers. A total of 14 pairs (28 participants, of which 18 were females) participated in our study, and their ages ranged from 18 to 33 (mean: 22.71, median: 21.5, SD: 4.15). Our participants' relationships varied: 7 pairs of friends, 6 couples, and 1 pair of coworkers. The average duration of a user pair having known each other was 22.71 months. The average number of days per week of sending each other KakaoTalk messages was 5.64. Demographics of participants are shown in Table 2. Interviews were conducted from November 23 to 29, 2017. A pair of participants was interviewed together, and a participant was compensated with 10,000 KRW (approximately 9 USD).

4.1.2 Procedure. Before the interview, we asked each pair of participants to screen-capture 10 chat instances in which they had exchanged a sticker in the past three months and then submit the captured images to the researchers via email. For privacy reasons, we let the participants freely decide which instances they would submit. When capturing the screen images, they were asked to include a sticker and its adjacent texts (as in Figure 6) so that researchers could understand the context of the sticker's use. All the conversations included in the screenshots were in Korean. We recruited two bilingual graduate students (one Korean and one American) who spent more than 10 years of their education (middle/high school and university) in English-based countries (New Zealand and US). We then asked them to translate all the quotes and conversations into English. One student translated the texts, and then another student checked whether the translation was accurately matched the original texts.

After collecting these images, we prepared a survey form. The form was loaded onto the researchers' iPads so that each interviewee could fill out the survey form individually in the beginning of the interview. While answering the survey, interviewees were not allowed to interact with one another. The following survey questions were asked in the interview:



Fig. 6. A sample of a chat image used in the interview

- Please describe the situation in the screenshot image.
- Are you a sender or a receiver of the sticker?
- Explain the intention of using that sticker. (only the sender)
- What do you think was the sender's intention of sending the sticker? (only the receiver)
- Replace the sticker's meaning in the context with a sentence.
- How do you perceive the valence level of the sticker? (on a 7-point Likert scale, where -3 = very displeased and 3 = very pleased)
- How do you perceive the arousal level of the sticker? (on a 7-point Likert scale, where -3 = very deactivated and 3 = very activated)

After this survey, we interviewed the pairs of participants about sticker usage and showed them the survey results. We asked them to explain each instance of sticker usage in detail to check whether 1) the sender's and receiver's understandings of the situation matched, and whether 2) the sender's intentions and the receiver's interpretations were in agreement. During this process, the sender was also asked if the sticker supported any other sentence or sticker within the messaging context. The receiver was asked whether the sender's answer to the question was the same as what he or she had thought.

We also asked them to show us the stickers on their smartphones so that we could gain a better understanding of the sticker's characteristics (whether the sticker was animated and whether the sticker included any text). We did this because we only received still images of the stickers, captured at certain moments. Also, most of the participants used stickers purchased from an online store, which makes it difficult to search them manually. The average length of each interview was one hour. All interviews were audio-recorded and later transcribed for analysis.

4.1.3 Data Analysis. We performed a qualitative content analysis [33] on our participants' responses for 140 stickers (10 stickers per pair; total of 14 pairs). It was conducted as follows: first, categorizing matched/mismatched stickers, and then deriving common themes of mismatched stickers. Note that our participants frequently used commercial sticker packs (not just the default sticker pack), and all except one of the stickers were distinct. This diversity shows that our participants were frequent sticker users and that commercial sticker packs are widely used—as also indicated by Line and KakaoTalk's sticker sales revenues [29].

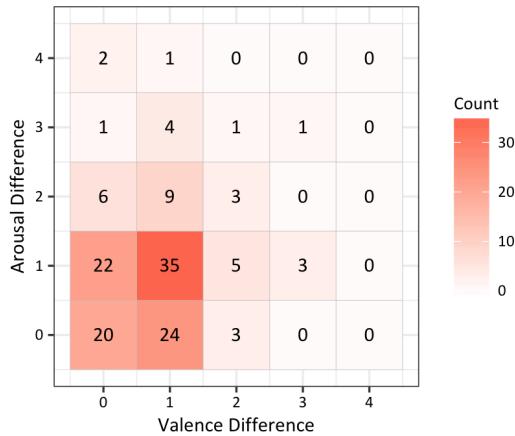


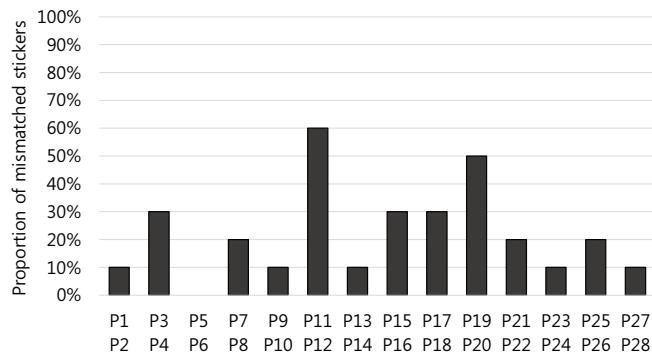
Fig. 7. The valence and arousal difference distribution of 140 stickers

First, we investigated whether the senders' and the receivers' interpretations of stickers matched, and found 22.1% ($n=31$) among 140 stickers resulted in misconstruals. To analyze the interview data, two of the authors manually examined the screenshots and interview data about sender's intended message and receiver's interpretation independently. Comparing the two descriptions, sticker uses were classified as *matched* or *mismatched*. The two authors then discussed the identified codes until consensus was reached. For example, if a sender's intended message was "I am eager to meet you soon," and the receiver understood it as "the sender wants to see me soon," it was labeled as *matched*. Answers that were not perfectly matched but very similar were also categorized as *matched*. If the sender's message was "where did you go during the conversation?" and the receiver's interpretation was "please come back," it was categorized as *matched*, because the receiver understood the sender's intention correctly. If, however, a receiver interpreted a sticker differently from the sender's intention, then it was labeled *mismatched*. For example, if the sender's intention in using a sticker of waving hands was to say "bye-bye," but the receiver interpreted the sticker as "consolation with patting," it was labeled as *mismatched*.

For the mismatched stickers only, we then conducted a thematic analysis to identify the major reasons for misconstrual. Two of the authors collaboratively categorized all of the misinterpreted stickers by using affinity diagramming [4]. During the process, how the sender's understanding of the sticker differ from the receiver's was compared. Whether the sender's intention in sending a sticker was different from what the receiver understood was also considered. This was performed with repeated iterations until consensus was reached, and final themes were derived.

4.2 Findings in Study 2

4.2.1 Misconstrual Analysis. In our interview, we asked both senders and receivers to rate valence and arousal levels by using the 7-point Likert scale, as in Study 1. We found that these ratings had similar levels of dispersion in terms of standard deviation as in Study 1 (valence: $M = 0.78$, $SD = 0.72$; arousal: $M = 0.96$, $SD = 0.93$). For each sticker, we calculated the difference in valence and arousal ratings assigned by the sender and receiver. Let's say, for example, that the rating pairs of valence and arousal levels of a sender and a receiver are given as (3, 3) and (2, 2), respectively. The resulting valence and arousal level difference is given as (1, 1). Figure 7 shows a heat map, or 2D histogram, of the valence and arousal differences of 140 sticker usage instances. Many stickers tended to have fairly consistent interpretations in both valence and arousal levels (as indicated by the hot area of

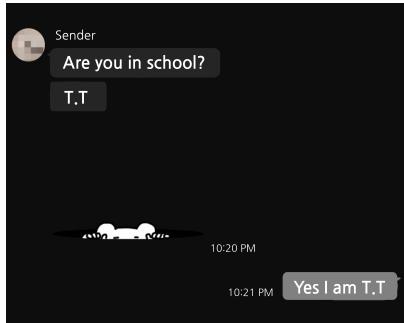
**Fig. 8. The proportion of miscommunicated cases per pair****Table 3. The two major patterns of misconstruals**

		<i>Visual Representation and Reference</i>	
<i>Message Correspondence</i>		Matched	Mismatched
		Matched	Mismatched
	Matched	109	20
	Mismatched	5	6

the figure), but overall, arousal levels have higher dispersion than valence levels. This result echoes our findings in Study 1 in that misinterpretation is more prevalent in the arousal dimension than in the valence dimension. According to the plot, 27.8% of the stickers have differences of 2 or more in at least one dimension ($n = 39$). The proportion of stickers with differences of 2 or more in the arousal level was 20.0% ($n = 28$), and in the valence level 11.4% ($n = 16$), confirming that deviation in arousal level is greater than in valence level.

We then performed a qualitative content analysis [33] to classify the miscommunicated sticker uses. Based on the interview responses, two of the authors analyzed the senders' intended message and the receivers' interpretations of the stickers used. As shown later, we found that misconstruals are related to contextual factors in the real chat settings, which we call context misconstruals. With regard to the 140 stickers, 22.1% of the sticker uses ($n = 31$) resulted in context misconstruals. We found that 13 out of 14 pairs of participants had experienced at least one miscommunication among their 10 sticker usage situations, as plotted in Figure 8.

To deepen the understanding of context misinterpretation, two of the authors examined the textual descriptions as well as interview data from the miscommunicated sticker usages (e.g., senders' intentions and receivers' interpretations) via affinity diagramming [4]. We uncovered two major patterns of context misconstruals related to the real chat settings: mismatch in the sticker's visual representation/reference and message correspondence mismatch (see Table 3). Visual representation and reference mismatch refers to cases where the sender and the receiver understood the visual representations and references in the stickers differently, as we observed in Study 1. Message correspondence mismatch denotes cases where the texts that a sticker corresponds to is different. As shown in Table 3, 26 sticker uses were miscommunicated, because the sender and the receiver perceived the visual representation of the relevant sticker differently. A total of 11 sticker uses were miscommunicated due to a mismatch in the message correspondence. Both dimensions occurred simultaneously in 6 instances of sticker use.



(a) Sender's intention: "*Is it okay to ask you something?*" / Receiver's interpretation: "*Where are you?*"



(b) Sender's intention: "*I feel happy and comfortable to be with you*" / Receiver's interpretation: "*I love you*"

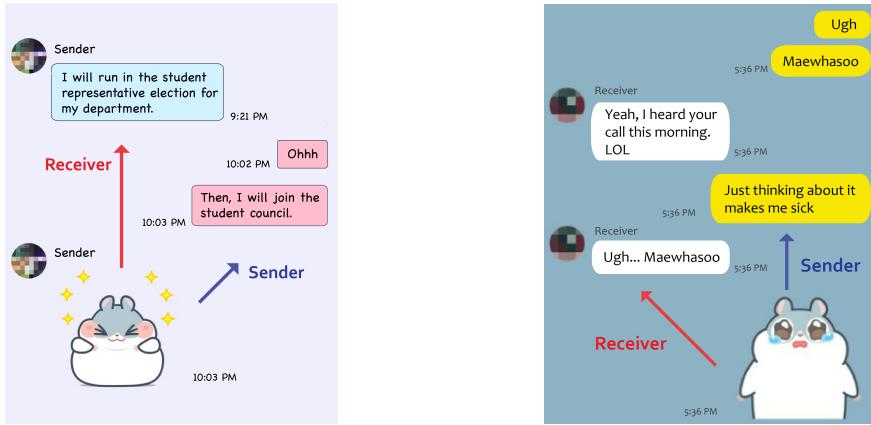
Fig. 9. Examples of visual representation and reference mismatch

4.2.2 Visual Representation and Reference Mismatch. The majority of misconstruals in our participants' sticker usage originated from different understandings of the sticker's visual representation and reference ($n = 26$). The receivers often failed to catch the sender's intention in using a particular sticker mainly due to the sticker's depiction of ambiguous face/body expressions.

Mismatch with regard to visual representation occurred quite clearly. In Figure 9a, a mouse character is peeking out of a hole. In response to the question, "How would you describe the message contained in the sticker in words?", the sender wrote, "*Is it okay to ask you something?*" (P15). The sender used this sticker to show that he was sorry about interrupting a conversation to ask questions. He used it because the mouse character in the sticker is carefully poking its head out of a hole, and thus, he thought that its action would be interpreted as not wanting to upset anybody, by saying "*It was late at night on Sunday. I did not want to bother [the receiver]. But I was in an urgent situation of having to ask questions. So when I sent a message to him, I wanted to mitigate the complex emotion of sorriness, embarrassment, and hesitation*" (P15). The receiver, however, interpreted the mouse character in the sticker to be looking for someone above the hole, and, thus, the sticker was interpreted as asking, "*Where are you?*" (P16). During the interview, the receiver mentioned, "*Well, I thought there is nothing for [the sender] to feel sorry about. I stay at school on Sunday nights. And as a mentor, it is okay for him to ask me anything. I didn't know he thought like that*" (P16).

A visual reference mismatch also occurred in Figure 9b where the sender used the sticker to express the message "*I feel happy and comfortable to be with you*" (P26) by representing the receiver as the cat. In the interview, the sender said, "*I wanted to show my comfort by sending a sticker with a character hugging a cat, which represents [the receiver]*" (P26). The receiver, however, thought that the sticker denoted "*love you*" (P25), because of the hearts in the sticker. Also, the receiver mentioned, "*never thought the cat inside the sticker represented myself. Haha (laughing). [The sender] uses various stickers, unlike me, so it is usually hard to interpret exactly what she means*" (P25).

We showed that stickers can be interpreted differently by senders and receivers due to their individual visual representations and references. We then checked whether animated stickers were less ambiguous to interpret than non-animated stickers. This hypothesis was formed because animated stickers can express more detailed and focused gestures. We found that animated stickers were less likely to be misinterpreted (21 out of 114, 18.4%) than non-animated stickers (10 out of 26, 38.5%) by conducting a one-tailed test for equality of proportions with significance level 0.05. (χ^2 -squared = 3.84, p-value = 0.0250)



(a) Sender's intention: "*I am excited to work together with you*" / Receiver's interpretation: "*I am excited to apply to be the student representative*"

(b) Sender's intention: "*Thinking of the drink makes me feel sick*" / Receiver's interpretation: "*I don't like that liquor*"

Fig. 10. Examples of message correspondence mismatch

4.2.3 Message Correspondence Mismatch. Miscommunications also happened due to message correspondence mismatches between the sender and the receiver ($n = 11$). In other words, a dyad may have interpreted which text message a sticker was referring to differently. In Figure 10a, both the sender and the receiver interpreted the meaning of the sticker as "excited." Nevertheless, they interpreted which text message the sticker was referring to differently. The sender used the sticker to express "*I am excited to work together with you*" (P9) while replying to the receiver's previous text "*Then, I will join the student council*" (P10). The receiver, however, interpreted the sticker to mean "*I am excited to apply to be the student representative*" (P10) by interpreting the sticker in the context of [the sender's] previous text, "*I will run for department representative*" (P9). During the interview, the sender said, "*I used this sticker as an answer to [the receiver's] text. I usually do this to make conversation less rigid, or when I don't have much to say*" (P9). The receiver mentioned, however, "*I thought the sticker represented [the sender's] own emotion of being excited and thrilled. I didn't know that she used the sticker for other purposes*" (P10).

Another example of message correspondence mismatch is shown in Figure 10b. The sender and the receiver were able to understand that the sticker expresses dislike in this context because it has a crying expression. Despite this common understanding of the sticker expression, the receiver wrongly interpreted the sender's intention in using the sticker. The receiver thought that sticker meant "*I don't like that liquor*" (P18) because it was sent in response to her last text message. That message read "*Ugh... Maewhasoo [a hard liquor brand]*" (P18), whereas the sender's intention was to say, "*Thinking of the drink makes me feel sick*" (P17). This was to emphasize her own last text, which read "*Just thinking about it makes me sick*" (P17). The sender said that the misinterpretation was happened due to the receiver's quick response to the sender's last text, which happened while the sender was choosing a sticker. In the interview, the sender stated, "*I wanted to send text and sticker together. But when I sent text first, [the receiver] replied too fast, so she interrupted my intention of sending the text and the sticker together. I actually wanted to express my sadness and gain sympathy from [the receiver]. But the conversation ended because the sticker was sent after the receiver's text*" (P17). The receiver also mentioned, "*Oh, I did not know that [the sender] wanted to send text and sticker together. I just thought she sent the sticker as a reply to my message to end the conversation. I feel sorry for her*" (P18).

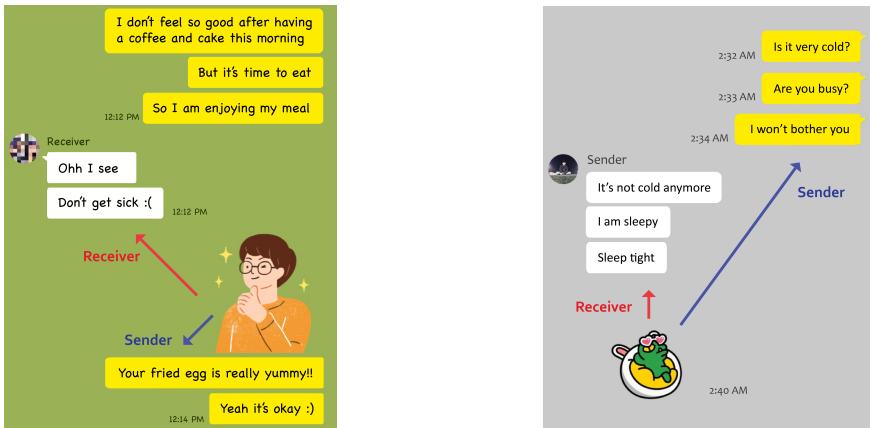


Fig. 11. Examples of mixed mismatch

4.2.4 Mixed Mismatch. We found six cases that had mismatches in terms of both visual representation and message correspondence. In Figure 11a, the sender used the sticker to say, "Your dish is really good" (P12) because the boy is giving a thumbs up in the sticker, and the sender's intention was to emphasize her text message, which read "Your fried egg is really yummy!!" (P12). The sender said in the interview, "I was eating a fried egg that the receiver cooked. So I wanted to say that his fried egg is really good, using the sticker character showing a thumbs-up gesture" (P12). The receiver, however, interpreted the sticker to be a response to his last text, which read "Don't get sick :(" (P11). He therefore interpreted the meaning of sticker to be "Thank you for your kindness" (P11). The receiver said, "The order of the sticker was right after the text that I sent to [the sender]. So I thought she used the sticker as a reply to my message" (P11).

As shown in Figure 11b, the receiver sent a text: "I won't bother you" (P19). The sender then thought that receiver had become sulky, so he used a sticker to say, "Please don't be sulky" (P20) because the animal character is wearing cute heart-shaped eyeglasses. In the interview, the sender stated, "I thought [the receiver] was mad at me because I did not reply to her message for a long time. So I wanted to send a cute character being conscious of her state" (P20). The receiver, however, understood the sender's use of the sticker to mean "Sleep tight" (P19), because this sticker was used right after the sender's text "Sleep tight" (P20), and it looks like the animal is resting on a sofa. The receiver said, "I didn't think that the sender was conscious of me. I just thought that he wanted to escape from the conversation with the sticker because I was mad at him. So I didn't send any message after that" (P19).

4.2.5 Context Misconstruals and Perceived Emotion Differences. In Study 1, we observed that emotional discrepancies are quite large across different types of stickers, which could potentially lead to misconstruals in chatting contexts. Moreover, our results in Study 2 mostly showed that the misconstruals also happen due to contextual reasons such as visual representation and reference, and message correspondence in real chat settings. We further investigated how emotion differences are related to context misconstruals by examining chat instances that showed high emotion differences (in either the valence or arousal dimension). We considered both matched and mismatched chatting instances in our dataset.

In the case of matched instances ($n = 109$), we examined eleven instances whose valence differences were greater than 1, and eight instances whose arousal differences were greater than 2. Our manual analysis revealed that such valence and arousal differences were due to the same reasons as shown in Study 1: i.e., ambiguous face/body expression and different perceptions of expression intensity and dynamism. Here, most instances of sticker use were supplemental, and emotion perception differences did not change a sender's intention in the text messages.

Our analysis of mismatched instances ($n = 31$) revealed that there were five instances whose valence difference were greater than 1, and two instances whose arousal differences were greater than 2. We found that in some instances valence differences were caused by the fact that the emotion portrayed in stickers can be differently perceived, in terms of visual representation, by sender and receiver. For example, Figure 9a's valence was rated as -1 and +1, by the sender and receiver, respectively. The sender's low rating was due to the fact that he felt sorry for asking a question, whereas the receiver interpreted the sticker as a gentle way of looking for someone. Likewise, Figure 11b's valence resulted in high differences: the sender rated the sticker -1 in valence, but the receiver rated it as +1. The sender chose the sticker to mitigate a situation in which the receiver had become sulky due to his own slow response, resulting in his low valence rating of -1. However, the receiver thought that the sticker complemented his last sentence, which read "*Sleep tight,*" resulting in her valence rating of +1.

Overall, the results showed that perceived emotion differences were partly related to context misconstruals. Despite significant divergence in emotional ratings, both senders and receivers were able to establish contextual construals in case of the matched instances. Perceived emotion differences were largely due to the complexity and ambiguity of stickers as Study 1 indicated. In some cases, context misconstruals also caused divergent emotional ratings.

5 DISCUSSION

Our findings showed that people may have different interpretations of stickers not only when these stickers are presented independently but also when they are used in real chatting contexts. We found that the unique characteristics of stickers such as rich expressiveness and placement constraint are the major contributors of sticker misinterpretation. Stickers can be misinterpreted because of the complexity and ambiguity of emotional expressions and because of the contextual factors that arise in real chat settings.

5.1 Complex and Ambiguous: Emotion Misinterpretation

Prior studies identified the high possibility of misinterpretation in emoji usage [24, 25, 34]. In particular, Miller et al. [25] showed that rendering the differences of emoji across diverse mobile platforms can worsen emotion misinterpretation. They also found that within-text use of emoji did not significantly lower misinterpretation rates, when compared with its standalone use scenarios. Our work extends these prior studies by investigating whether misinterpretation similarly happens in stickers, and what are the impacts of stickers' rich expressiveness and placement constraint, which are the main differences from traditional emoji. We analyzed the perceived emotions in terms of the valence (happiness) and arousal (activeness) dimensions. We found that valence and arousal differences are mostly due to the ambiguity of complex face/body expressions and perception differences in the intensity/dynamicity of such expressions in stickers.

5.2 Complex and Ambiguous: Context Misinterpretation

Prior studies on misinterpretation of emoji focused on the receiver's interpretation as observers [24, 25] or only on the sender's intention [10]. Furthermore, none of the prior studies examined real-world interpersonal conversational data to study how misconstrual of emoji/sticker use happens in

chatting scenarios. Prior studies emulated real-world usage by asking the participants to pretend that a message had been sent to the participants by their friends [36]. In practice, researchers repeatedly found that observing others' messages rather than being an actual recipient could have an effect on message interpretation due to the lack of interpersonal relationship and prior experiences (e.g., the positive bias in the valence of participants who shared close relationships [6]).

In our study, we collected 140 real-world chat instances of sticker use and thoroughly interviewed participants to determine their intentions and interpretations with regard to sticker use. We found that 31 out of 140 sticker uses had resulted in contextual misinterpretation. As shown in our emotion analysis, these cases of misinterpretation were mostly due to the rich, expressive nature of stickers, as reported in prior studies—stickers can be used for complementing text, and, in some cases, substituting text with additional connotative information [22, 38]. We discovered two main dimensions that affect contextual misinterpretation between the sender and the receiver. One of these dimensions is the visual representation and reference of a sticker, which contains ambiguous gestures and multiple characters/objects. The richness and complexity of the visual representations in stickers allows for ‘nuanced’ communications that can convey diverse types of connotative information. However, this affordance may also cause both emotion and context misinterpretation. The other is the message correspondence of a sticker, i.e., ambiguity regarding which text a sticker is referring to (e.g., either the sender's or the receiver's text message). Unlike emoji, stickers have placement constraint and must be sent as a singular entities and cannot be included right next to text. Because stickers always appear above or below certain text, interpreting which text a sticker corresponds to can be confusing and increase the risk of stickers being misinterpreted. Given that interpersonal communications involve emotional, contextual, and relational aspects, there should be further studies about the impact of sticker misinterpretation on overall construals as well as the patterns of conversational breakdowns and recoveries.

5.3 Intention and Contextualization

When considering sticker interpretation, we realize that intent and context are often nuanced and multi-faceted. Intent can be further subdivided into designer's intent and sender's intent. In fact, the designer's intent may be very different from the actual users' intent. This gap can be mitigated if designers address potential misinterpretations originating from sticker complexity and ambiguity per se during their initial design phase. Furthermore, sticker use is likely to be contextualized, and shared awareness of contexts can mitigate sticker misinterpretation. In practice, sticker interpretation may be dependent on users' current activities, interaction histories, and interpersonal relationships, as the interactional model of context posits [14]. So far, our work has had a limited view of contextual interpretation, in that it focuses primarily on sticker representation and references (or deixis), which are related to shared awareness in conventional mediated communications [12]. Expanding our work to incorporate the interactional model of context would be an interesting direction for future work. As an example of such contextualization, prior studies showed that emoji can be appropriated (or repurposed) in close relationships [20, 37], meaning that their interpretation in real use can be very different from the designer's intent (known as appropriation [13]); food lovers, for example, may use an emoji of a piece of pizza to represent their love for one another.

6 DESIGN IMPLICATIONS

Based on our findings, we provide the following practical design implications for mitigating emotion and context misinterpretations of sticker uses in instant messaging: sticker interaction with explicit reference pointers and textual annotations.

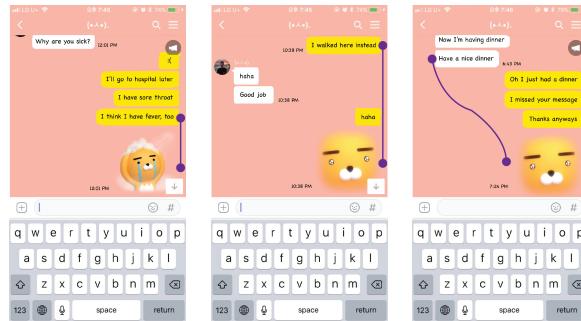


Fig. 12. An example of linking stickers' supporting texts



Fig. 13. An example of annotating stickers with texts

6.1 Linking Stickers' Supporting Texts

In the online conversational context, where sender and receiver share common textual context with the sticker, misunderstanding can arise with regard to which text the sticker is referring to. In order to support the sticker's role of complementing a certain text, we suggest linking the sticker with its corresponding text. If a sender wants to support their own textual message with a sticker, he/she can link it with a line. If a sticker sender wants to support the recipient's text with a sticker, the sticker can be linked with that text. This way, both senders and receivers can easily establish a common ground by understanding which text a sticker is referring to. In Figure 12, we show an example where a line is used, but there could be diverse ways of using such linking in user interactions (e.g., highlighting, blinking, etc.).

6.2 Annotating Stickers with Texts

The complexity of stickers can lead to ambiguity in message interpretation. The resulting ambiguity is amplified because stickers cannot be embedded into a text message. As one way of mitigating ambiguity, we can help users choose predefined messages that best suit their needs. Furthermore, we can let users type their own text if needed. We can even recommend personal text messages based on a sender's textual context and a sticker's gestures. For example, in Figure 13, the waving hand gesture can convey multiple meanings, and, thus, we can provide messages such as "how are you?", "goodbye," "you're welcome," etc. As the sender clicks the sticker, the application service can even recommend personalized messages that fit the sticker's gesture, thereby making the choice easier and more personalized. Thus, the sender can easily convey the best possible meaning contained in the sticker in messages to the receiver.

7 LIMITATIONS AND FUTURE WORK

This study was a first step toward understanding the misinterpretation of stickers. There are several limitations that can be further explored in the future work.

First, our study was conducted in South Korea, and due to cultural specificity, there is limited generalizability in our findings. It is well known that, compared to Western nations (that are low-context cultures), Eastern nations have high-context cultures, meaning that a message carries implicit meanings with more information than the message per se, and thus, common understanding is largely dependent on interpersonal relationships and situational factors, including nonverbal cues. Indeed, Kayan et al. [18] showed that emoticons were much more popular in Asia than in North America. Studying cultural differences in sticker usage and interpretation is an interesting direction for future work.

Second, in Study 2, the number of chatting instances (collected from 28 participants) numbered only 140, which is not comprehensive enough for investigating all cases of misinterpretation in sticker usage. More sample data will provide insights on sticker uses between diverse relationships and people with different levels of intimacy.

Third, we focused on sticker usage in 1:1 online chatting. In practice, we also use stickers in group chat rooms, and, thus, extended analysis of sticker usage in group chatting contexts should also be considered. While we limited the study's scope to the stickers used in instant messengers, stickers are also used in various social media such as Facebook, which is essentially designed for group chatting. Sticker usage on other platforms might lead to different insights regarding sticker misinterpretation, as alluded by Tauch and Kanjo [31].

Lastly, we simply analyzed textual descriptions of sender/receiver pairs to judge whether misinterpretation occurred. This binary treatment helped us uncover common patterns of contextual misinterpretation. But this approach focused narrowly on a scope of a given conversation (e.g., a few lines of chat around the sticker use). Our work brought limited insight into how stickers' contextual misinterpretation affected the overall construal in an online conversation session. In future work, we will design controlled experiments involving well-defined sticker use tasks. More specifically, we can measure how much each sticker misinterpretation will hinder the overall conversation, and how different degrees of sticker misinterpretation are related to breakdown of conversation. Furthermore, we can gain in-depth insight into how people might recover from the breakdown issues and how we can design chatting features that enable convenient recovery.

8 CONCLUSION

This work investigated sticker misinterpretation in instant messaging. In Study 1, we analyzed the emotion ratings on popular stickers ($n = 87$) to find the patterns of emotion misinterpretation in stickers. In Study 2, we collected 140 sticker usage instances from 14 pairs of users and performed an in-depth interview to deepen our understanding about sticker misinterpretation. Our results showed that the unique characteristics of stickers such as rich expressiveness and placement constraint are the major contributors of sticker misinterpretation. Emotion misinterpretation was largely originating from complexity and ambiguity of emotional expressions in stickers. Likewise, complexity and ambiguity of stickers were related to context misinterpretation in terms of visual representation/reference and message correspondence. Based on these findings, we provided several practical design implications for mitigating emotion and context misinterpretations such as linking supporting texts and annotating stickers. Our work significantly extended prior studies on message interpretation by focusing on stickers, which has attracted enormous attention in recent years. Furthermore, our results brought new insights into the importance of contextual aspects of sticker misinterpretation in sticker-enabled CMC.

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