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Research article

Which emoji are markers of sarcasm among Chinese teenagers using the WeChat app?

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ABSTRACT

This study explored emoji-based sarcastic statements made by Chinese teenagers using the WeChat app. Two experiments ($N = 597$) were conducted to investigate both language production and comprehension. In Experiment 1 ($N = 236$), a free-response task was used to determine which emoji Chinese teenagers would use to signal their sarcastic intentions. The results showed that the smiling emoji (🙄) and the tears-of-joy emoji (😂) were the most commonly used emoji to indicate sarcastic intent. Experiment 2 ($N = 361$) involved a rating task to investigate the role that two selected emoji played in the comprehension and emotional impact of WeChat messages (literal and sarcastic statements). Our findings revealed that both emoji generally increased the perceived sarcasm in literal comments; however, while the smiling emoji intensified the perceived sarcasm in sarcastic comments, the tears-of-joy emoji had no significant effect on such comments. Regarding emotional impact, the smiling emoji amplified the negativity of the statement, whereas the tears-of-joy emoji mitigated it. This indicates that both emoji and context are reliable cues for interpreting sarcasm, though their levels of reliability may differ. Specifically, the smiling emoji carries greater weight than context, while context is afforded stronger weight than the tears-of-joy emoji in the constraint-satisfaction process of sarcasm. Overall, the smiling emoji is perceived as more sarcastic and more negative than the tears-of-joy emoji.

1. Introduction

Irony is a form of figurative language in which the implicit meaning contradicts the literal meaning [1]. *Sarcasm* represents a specific type of irony that targets an individual or a proposition with a critical or negative attitude [2]. For instance, when a speaker says, "You are a good friend" to a friend who has mistreated them, the speaker may implicitly mean, "You are not a good friend". The disparity between what is said and what is meant can complicate the interpretation of irony and sarcasm [3,4]. Nevertheless, recipients can discern a speaker's intentions using paralinguistic features, such as facial expression, tone of voice, and gestures [5–7]. Unlike face-to-face communication, text-based computer-mediated communication (CMC)—such as instant messaging, blogs, and email—is devoid of the nonverbal cues that facilitate the interpretation of irony [8]. Thus, users of such messages have developed various ways to compensate for the lack of such cues, with one of the most innovative being the use of graphicons,[1] such as emoticons and emoji.

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[1] "Graphicon", labelled by Herring and Dainas (2017) [46], means graphical icons.

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Building on research originally focused on emoticons, previous studies have identified that the wink and tongue-face emoticons (i.e.) and: P) indicate ironic intentions [9–13]. As emoji have gained popularity over time, researchers have shifted their focus accordingly, and it is now widely accepted that the wink emoji (😉) serves as a marker of sarcasm or irony [14,15]. However, it is unclear how culturally robust such findings are. Previous qualitative research has indicated that the smiling emoji (🙄) functions as an ironic marker among young Chinese generations. Nevertheless, a systematic investigation into this phenomenon has yet to be conducted. The display of emoji is platform-dependent, and their interpretation is culture-specific and age-related. Different digital platforms often present various graphic renderings of the same emoji [16]. For instance, the same emoji on the Apple, Google, and Samsung mobile platforms may differ not only in appearance and naming but also in intensity and emotion [17,18]. In addition, the same emoji might convey diverse meanings across diverse cultures [19]. Conversely, similar meanings can be conveyed by disparate appearances owing to cultural distinctions [20,21]. Even users from the same culture, such as those of different ages, often disagree on the usage and interpretation of emoji [17,22,23]. Young people tend to use emoji more frequently than older adults, and they identify a broader range of motivations and functions for using emoji [23]. These graphicons are often perceived as symbols of youthfulness and trendiness, making them closely associated with teenagers [24–26].

According to the China Internet Network Information Center[2] (CNNIC, 2024), approximately 97.2 % of teenagers are Internet users (around 200 million individuals), and the time spent on mobile phones accounts for about 90 % of their total online time. Emoji serve as a significant means for Chinese teenagers to express emotions and sentiments on social media platforms, particularly within the WeChat app [27]. WeChat is the most popular instant messaging application in China and has become an integral component of Chinese people's personal lives; as of August 2024, there were over 1.37 billion monthly active users. Consequently, the current study focused on Chinese teenagers' production and comprehension of emoji-based sarcasm on WeChat.

1.1. Emoticons or emoji as indicators of sarcastic intent

Evidence from the literature shows that users who employ wink and tongue-face emoticons have evolved new uses for indicating ironic or sarcastic intentions in CMC. In an online newspaper investigation, Carvalho et al. [9] suggested that positive emoticons (e.g.) and: P) are intrinsically ironic. Similarly, Skovholt et al. [28] found that positive emoticons (e.g.),), and; P) can be used as markers for irony and jokes in a corpus-based investigation. Walther and D'Addario [29] conducted a rating task, showing that the wink emoticon received the highest scores for sarcasm and humour. Additional evidence can be found in Thompson and Filik's [11] two irony production tasks, which revealed that tongue-face and wink emoticons compensate for the loss of paralinguistic features in written communication.

The use of graphicons follows an evolutionary trajectory characterised by distinct stages [30]. The decline in emoticon usage over time has given way to the rising popularity of emoji, with emoticons often viewed as precursors to contemporary emoji [15]. Based on prior research [14,15,31,32], users from different cultures exhibit varying preferences for emoji to indicate their ironic intentions. A neurophysiological study conducted by Weissman and Tanner [15] illustrated that emoji-induced irony (i.e. the wink emoji 😉) is processed similarly to word-induced irony. The P600 and P200 effects and late frontal positivity elicited by emoji seem to be isomorphic to those of verbal irony. Further evidence from Garcia et al. [14] suggests that the wink emoji serves as a clear marker for improving their perception of sarcastic intent. Hu et al. [31] analyzed participants' willingness to use emoji to indicate their intentions, and they found that neutral emoji (e.g. 😎, 🤔, 😳, 😐 and 😑) work better to express irony than other types of emoji. However, their study was isolated from the usage context, which counters the notion that the interpretation of emoji closely relates to the text and the context [33]. Zhou et al. [32] conducted a qualitative study on the use of emoji in the WeChat app among Chinese. They found that the smiling emoji (🙄), originally designed as a genuine smile, has evolved into "a mysterious smile" to signal sarcasm or speechlessness among Chinese youth. Notably, Zhou et al. [32] arrived at their conclusion by interviewing only 30 Chinese participants (aged 18–63 years), thereby raising concerns about the generalisability of their findings. More reliable conclusions can only be reached when a larger sample is examined. Therefore, it is necessary to conduct a systematic study to gather sufficient evidence regarding the use of emoji as markers of sarcasm in China.

1.2. Role of emoticons and emoji in the comprehension and emotional impact of sarcasm

Previous research suggests that in texts containing an emoticon or emoji, the text conveys ideas. While the emoticon or emoji expresses emotions [34]. However, this approach to delineating the functions of texts and emoticons/emoji has its limitations. Users employ emoticons and emoji in online communication not only to convey their emotions but also to modulate the emotional tone of the accompanying text or to indicate their intention to mitigate ambiguity [10,28,35]. It is more plausible to consider the dynamic interplay between texts and emoticons/emoji.

Moreover, there are distinct perspectives on the roles of emoticons and emoji in text interpretation, generally categorised as either complementary or compensatory. Prior research suggests that in unambiguous contexts, the wink emoticon does not contradict but rather complements the perceived sarcasm and positivity of verbal messages, as it is often overwhelmed by the accompanying text [12,28,29]. Conversely, the wink emoticon can compensate for the absence of supportive context, thereby increasing the perceived

[2] https://static.www.tencent.com/uploads/2024/08/27/b4be8f6abc923f2bce5fe6ee766648c8.pdf.

sarcasm of ambiguous and literal comments [10,13,25,29]. These findings suggest that the influence of emoticons on the comprehension and emotional impact of sarcasm is contingent upon the context in which they appear.

Intriguingly, an emoji-based study conducted by Garcia et al. [14] demonstrated that the wink emoji enhanced the perceived sarcasm of sarcastic comments across both younger and older adults. In contrast, Howman and Filik's [13] research indicated that the wink emoticon did not enhance older adults' ability to interpret ambiguous comments as sarcastic. Garcia et al. [14] attributed these disparities to the use of varied stimuli (unambiguous vs. ambiguous comments) and underscored that the interpretation of ambiguous comments reflected a preference or bias in interpretation rather than a conclusive "correct" response. However, the clarity of comments is influenced by context. A neutral or ambiguous context paired with a comment tends to result in an ambiguous comment, whereas a negative context combined with a positive statement often generates a case of sarcastic criticism (i.e. an unambiguous comment). In other words, Garcia et al.'s [14] assertion essentially attributed their differences to contextual factors. Conversely, Cui et al. [23] examined the effects of the smiling emoji on both ambiguous and unambiguous comments across various age groups in China. Their findings revealed that the smiling emoji heightened the perceived sarcasm of both types of comments among young adults, while demonstrating no significant effect on older age groups. This suggests that the observed differences between Garcia et al.'s [14] and Howman and Filik's [13] findings may be attributed to variations between graphicons (emoji vs. emoticons), rather than context. Drawing on Cui et al.'s [23] findings, it is anticipated that sarcasm-conveying emoji would amplify the perceived sarcasm of the accompanying text, whether it consists of literal or sarcastic comments.

1.3. The present study

The current study investigated which emoji serve as markers of sarcasm and their influence on the comprehension and emotional impact of sarcasm. Specifically, in Experiment 1, we used a language production task (i.e. a free response task) to examine which emoji indicate sarcastic intent among Chinese teenagers. In Experiment 2, we employed a language comprehension task (i.e. a rating task) to explore how the sarcasm-conveying emoji identified in Experiment 1 affect text comprehension and the associated emotional impact (see Fig. 1a). In summary, we addressed the following two research questions.

1) Which emoji serve as markers indicating sarcastic intent among Chinese teenagers?
2) What effect do these emoji markers have on the comprehension and emotional impact of sarcasm?

2. Experiment 1

The aim of this experiment was to investigate which emoji are used to indicate sarcastic intentions among Chinese teenagers on WeChat. This application features proprietary and platform-specific emoji that are particularly favored by Chinese users. The emoji within the app are pictorial in appearance, differing from the Unicode emoji registered on Emojipedia [36]. Of all the built-in emoji in the WeChat app that represent facial expressions, gestures, common objects, facial emoji are the most frequently used type [17]. Hence, the current study focused on the WeChat-specific facial emoji.

2.1. Method

2.1.1. Participants

Twenty-four volunteers (14 females, $M_{age} = 16.43$, $SD = .75$, ranging from 15 to 18 years old), were recruited through snowball sampling to participate in a pilot study aimed at rating the most frequently used facial emoji in their WeChat communication. A second group of 259 Chinese teenagers (144 females, $M_{age} = 16.39$, $SD = .74$, ranging from 15 to 18 years old) participated in the formal experimental task. All participants were native Mandarin speakers recruited from two high schools in East China, and none had reading or learning difficulties. Informed consent was given by both the guardians and the students. After completing the task, the participants were rewarded with gifts. They were also allowed to ask questions or withdraw at any time.

2.1.2. Pilot study

This section was designed to identify the most frequently used emoji in WeChat communication. Individuals develop preferences and form customary features in their use of emoji in online communication, resulting in certain emoji being used with greater frequency [37]. The WeChat app includes 54 facial emoji that can be quickly inserted into messages using keyboard shortcuts, along with 24 facial emoji that are not accessible via shortcut keys. This amounted to 78 WeChat-specific facial emoji (see emojiall.com[3]). To select the most frequently used facial emoji on WeChat, we followed the procedure of Luor et al. [38]. Twenty-four Chinese teenagers were asked to select the 10 most frequently used facial emoji from 78 WeChat-specific options based on their daily WeChat communication. All emoji were presented in a printed questionnaire.

The 10 facial emoji with the highest frequency were selected (see Fig. 2; for more details about these emoji, refer to reports on chinadaily.com.cn[4]). Since the wink and tongue-face emoji have been suggested as ironic markers [14,15], these two emoji were also

[3] https://www.emojiall.com/en/platform-wechat#google_vignette.

[4] http://www.chinadaily.com.cn/life/2016-11/23/content_27458498_3.htm.http://www.chinadaily.com.cn/life/2016-02/02/content_23375582.htm.

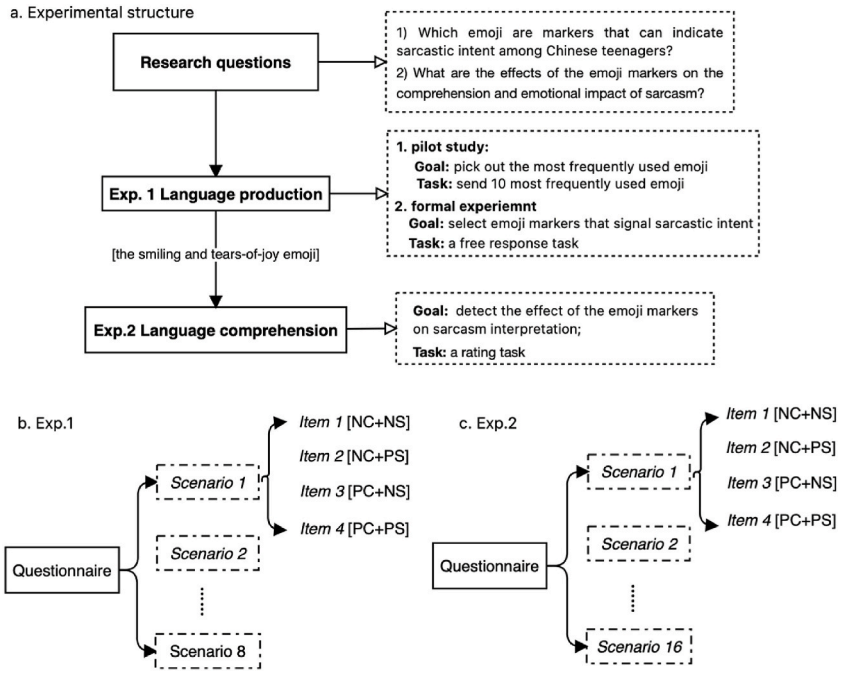

Fig. 1. The flow chat of the present study. NC = negative context, PC = positive context, NS = negative statement, PS = positive statement.

included as potential choices. Thus, a total of 12 emoji were utilized for the formal experiment.

2.1.3. Materials and design

Eight scenarios were constructed, each with four different variations (i.e. four items; see Table 1 for an example). Each item consisted of a context followed by the first character sending a message to a second character, with the final comment of the second character left blank. The contexts for each of the four items were designed to feature either a negative event (i.e. a negative context) or a positive event (i.e. a positive context). The message from the first character was either consistent or inconsistent with the context. The interplay of the context and the first character's words influenced the second character's response. Participants were instructed to stand on the shoes of the second character to complete the final comment in each scenario, indicating whether the response was intended to be literal or sarcastic. This manipulation targeted the factor of *Literality* (literal vs. sarcastic). Additionally, the final comment generated by participants was categorised as either superficially positive or superficially negative. A superficially negative comment after a negative context constructed a case of literal criticism (item 1), while when it followed a positive context, it often led to sarcastic praise (item 3). Conversely, a superficially positive comment following a negative context was likely to create a case of sarcastic criticism (item 2), whereas a superficially positive comment after a positive context typically resulted in literal praise (item 4). This manipulated the factor of *Polarity* (praise vs. criticism).

Thus, the experiment consisted of a 2 (literality: literal vs. sarcastic) × 2 (polarity: criticism vs. praise) × 12 (emoji: 🙄, 🧐, 🤔, 😉, 😝, 🧐, 😂, 😒, 😬, 😊, 😴 and 😆) mixed design. In this design, *literality* and *polarity* were between items and within subjects, while *emoji* was within items and within subjects. There were four versions of questionnaire such that each participant saw each scenario in only one of the four conditions (2 literality × 2 polarity) (see Fig. 1b).

Four questions followed each scenario (see Table 2). The first was an open-ended question asking participants to respond with any words they liked ("1.1 What is your response to your friend?"). Two multiple-choice questions asking participants' willingness to use emoji ("1.2 Will you use an emoji in your response?" – *Yes/No*), and their selection of emoji ("1.3 If YES, which emoji will you choose from those below?"). The fourth question was also an open-ended question asking about participants' real intent in their minds ("1.4 What are your true inner thoughts?"). The first three questions tapped into the superficial response of participants (praise or criticism). The last question tapped into the intention (literal or sarcastic) of them. If a participant's response was contradictory to his or her inner thoughts, then the response was classified as sarcastic. Conversely, if the response was consistent with the inner thoughts, the response was classified as literal.

Participants were instructed to provide comments that were less restricted, which could be either literal or sarcastic, praise or criticism. The response could include an emoji or not, depending on their preferences and habits. In addition, participants were asked to take down their true inner thoughts, enabling coders to objectively code the responses as either literal or sarcastic, and as either praise or criticism. Take Context 3 in Table 2 as an example, a participant responded with a statement of approval followed by a tears-of-joy emoji "You are such a fragile person 😂", while their true inner thoughts were "You walked as if on wings. How dare you call yourself fragile? Were you a King Kong Barbie?" This contrast suggests a sarcastic intention in the participant's response.

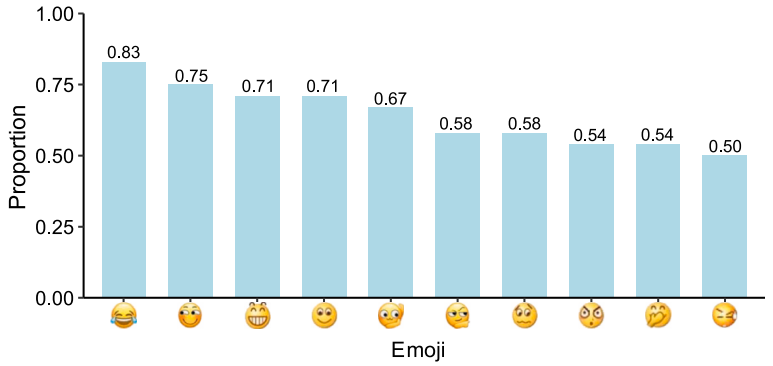

Fig. 2. Top ten emoji selected to be frequently used in WeChat conversations. The proportion was calculated based on the frequency of the emoji being selected divided by the entire number of participants.

Table 1
An example scenario with four variants in Experiment 1 (see the Chinese version in Appendix 1).

Scenario	Context and conversation
Item 1	**Context 1:** Your friend got a 'luxurious house' from her boyfriend. When you visited, you found the house was actually small and remote. **Your friend:** I apologise for asking you to visit my simple, crude house. **You:** _____
Item 2	**Context 1:** Your friend got a 'luxurious house' from her boyfriend. When you visited, you found the house was actually small and remote. **Your friend:** Isn't my house luxurious? **You:** _____
Item 3	**Context 2:** Your friend's boyfriend gave her a villa. When you visited, you found that the house was large and luxurious, with an open-air swimming pool and a big garden. **Your friend:** I apologise for asking you to visit my simple, crude house. **You:** _____
Item 4	**Context 2:** Your friend's boyfriend gave her a villa. When you visited, you found that the house was large and luxurious, with an open-air swimming pool and a big garden. **Your friend:** Isn't my house luxurious? **You:** _____

Table 2
Example materials in Experiment 1 (see the Chinese version in Appendix 2).

Context 3. Your friend invited you to go hiking in a forested, mountainous national park during the weekend. On that day, he walked swiftly and easily, though you were soon exhausted. Finally, your friend had to carry you down the mountain, which you thought would be quite a chore for him, despite his height and strength. When you returned home…

Your friend: I am sooooo fragile and exhausted today. I need more exercise.

You: _____

1.1 What's your response to the speaker? _____

1.2 Will you use an emoji in your response? A. Yes B. No

1.3 If YES, which emoji will you choose from these below?

A. **B.** **C.** **D.**
E. **F.** **G.** **H.**
I. **J.** **K.** **L.**

1.4 What are your true inner thoughts? _____

Consequently, coders could infer that participant's response actually implied sarcastic criticism.

2.2. Procedure

Participants received a booklet consisting of a consent form, basic demographic information about their age, gender, and their use of emoji ("Do you often use emoji in your daily life?" – *Yes/No*), and the formal task, which included eight scenarios with four questions each. Participants were instructed to imagine that the conversations occurred between themselves and a friend over the WeChat app. They were encouraged to provide any text message response they wished and to choose any emoji they preferred. The estimated time for completing the questionnaire was about 10 min.

2.2.1. Statistical analysis

Responses were analyzed using hierarchical log-linear models and chi-square tests in R (Version 4.0.2; R Core Team, 2020). Based on the participants' responses and their inner thoughts, as shown in Table 2, the data were coded by the first author and a colleague in terms of the two manipulated factors (*literality* and *polarity*). Responses that were not directed at the first speaker or could not be clearly valued as praise or criticism were excluded. Textual responses lacking any emoji and those consisting solely of an emoji without accompanying text were also excluded from the database. Participants who reported infrequent emoji usage in their daily lives ($N = 16$) and those who did not complete the questionnaire ($N = 7$) were likewise excluded. Consequently, 236 participants (128 females, $M_{age} = 16.33$, $SD = .76$) remained in the final database. The interrater agreement between the first author and the other coder for identifying the literality of a statement was 88.37 % (=[number on sarcastic statements of the first author/number on sarcastic statements of the second coder]), and the agreement for identifying the polarity of a statement was 96.16 % (=[number on criticism of the first author/number on criticism of the second coder]). Coders discussed cases in which they disagreed until they reached full consensus. Ultimately, 1137 responses (59.72 %) were included in the second stage of analysis (see Appendix 3).

According to Tabachnick et al. [39], there should be at least five times as many cases as there are cells in a multiway table. In our dataset, there were 1137 cases and 48 cells, thereby satisfying this criterion. In every possible two-way contingency table, all expected frequencies should be greater than 1, and no more than 20 % should be less than 5. We excluded emoji with an observation smaller than 30 ($n < 30$) (5 emoji, i.e. 🧐, 🤔, 😉, 😝 and 🙄, were deleted), so that only 14.29 % of the cell frequencies were less than 5. The remaining seven emoji ($n = 1032$) entered the model (see Fig. 3).

2.3. Results

An exploratory hierarchical analysis was conducted to ascertain the fit of the model, encompassing three first-order effects, 3 s-order effects, and one third-order effect. The examination of *K*-way effects revealed a significant diminution in the amount of unexplained variance upon incorporating the first-order effects into the model ($\chi 2_{(27)} = 1271.76$, $p < .001$). Furthermore, the inclusion of the second-order effects resulted in a significant reduction in variance ($\chi 2_{(19)} = 452.75$, $p < .001$), as did the third-order effects ($\chi 2_{(6)} = 54.96$, $p < .001$). This suggests that the incorporation of the first-, second-, and third-order effects facilitates precise prediction of cell frequencies.

Examination of the partial associations showed that 6 of the 7 effects attained statistical significance. Specifically, the interaction between *literality* and *polarity* was significant ($\chi 2_{(1)} = 146.57$, $p < .001$). Moreover, the interactions between *literality* and *emoji* ($\chi 2_{(6)} = 112.68$, $p < .001$) and between *polarity* and *emoji* ($\chi 2_{(6)} = 28.50$, $p < .001$) were also significant. Additionally, the main effects of

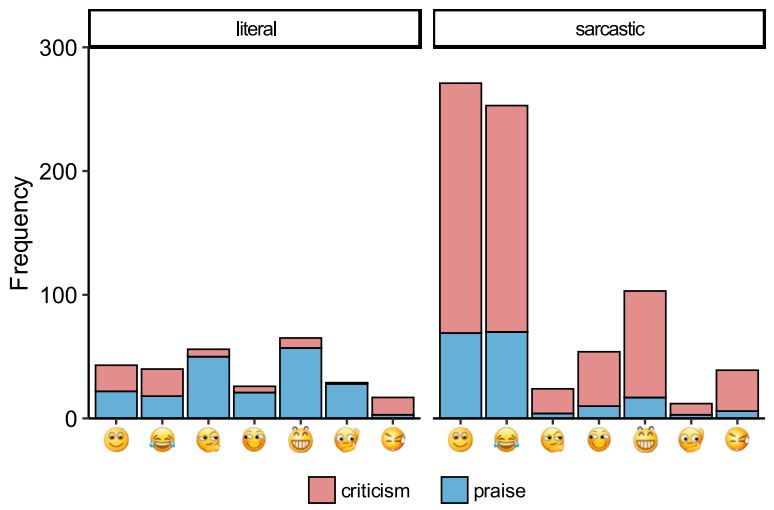

Fig. 3. Frequencies of literality and polarity for each selected emoji.

each of the three variables were demonstrated significance: *literality* ($\chi 2_{(1)} = 232.10, p < .001$), *polarity* ($\chi 2_{(1)} = 74.72, p < .001$), and *emoji* ($\chi 2_{(6)} = 512.19, p < .001$).

To break down the effect of the three-way interaction, we further conducted separate chi-square analyses at different levels of emoji. For the smiling emoji (🙂), there was a significant association between *literality* and *polarity* ($\chi 2_{(1)} = 11.91, p < .001$). This was true for other emoji, with the exception of the sweat emoji (the tears-of-joy emoji (😂), $\chi 2_{(1)} = 4.94, p < .05$; the smart emoji (😏): $\chi 2_{(1)} = 40.39, p < .001$; the smirk emoji (😁): $\chi 2_{(1)} = 28.65, p < .001$; the grin emoji (😁): $\chi 2_{(1)} = 81.94, p < .001$; hey emoji (😳): $\chi 2_{(1)} = 23.56, p < .001$; the sweat emoji (😅): $\chi 2_{(1)} = .05, p = .83$). Odds ratios indicated that the odds of selecting a smiling emoji with a criticial intention (i.e., criticism) in the sarcastic context were 3.07 times higher than in the literal context. The odds of choosing a tears-of-joy emoji for criticsm in the sarcastic context were 2.14 times higher than in the literal context. Conversely, the odds of selecting a smart emoji for praise in the literal context were 41.67 times higher than in the sarcastic context. The odds of choosing a smirk emoji being for praise in the literal context were 18.48 times higher than in the sarcastic context. The odds of choosing a grin emoji for criticism in the sarcastic context were 36.04 times higher than in the literal context. The odds of selecting a hey emoji for praise in the literal context were 84 times higher than in the sarcastic context.

In the language production task, the aforementioned split analyses revealed that the hey emoji, the smart emoji, the smirk emoji, and the sweat emoji were more commonly used in literal comments (69.93 %) than in sarcastic ones (30.69 %) (See Fig. 3). Concersely, participants demonstrated a stronger preference for using the smiling and tears-of-joy emoji to convey sarcastic intentions (69.31 % of the total data) rather than literal ones (30.07 % of the total data). Although the grin emoji appeared more frequently in sarcastic contexts, its occurrence was insufficient to establish a consistent trend among teenagers.

3. Experiment 2

The purpose of this experiment was to examine the effects of the smiling and tears-of-joy emoji (selected from Experiment 1) on the comprehension and emotional impact of sarcasm. Participants engaged in a rating task to judge the degree of sarcasm and perceived positivity of the comments in the context.

3.1. Method

3.1.1. Participants

A new sample of 361 high school students volunteered to take part in this rating task (189 females, $M_{age} = 16.27$, $SD = .75$, ranging from 15 to 18 years old). The participants were all Chinese native speakers who had no reading or learning difficulties. They gave informed consent prior to taking part, and they were free to ask questions and withdraw at any time. Each participant received a small gift as a reward for completing the task.

3.1.2. Materials and design

Sixteen scenarios were constructed, each comprising a context followed by a short conversation between two characters (see Table 3 for an example). Character A sent a message to Character B, and Character B responded with a final comment, which could be a text followed by an emoji (*text & emoji*), a text without any emoji (*text alone*), and a stand-alone emoji (*emoji alone*). Based on distinct contexts (either positive or negative), the final comments were likely to be perceived as either *literal* or *sarcastic*, as *praise* or *criticism*. Thus, the experiment consisted of a 2 (literality: literal vs. sarcastic) × 2 (polarity: criticism vs. praise) × 3 (response: emoji alone vs. text alone vs. text & emoji) mixed design. In this design, *literality* and *polarity* were between items and within subjects, while *response* was within items and within subjects. Participants saw 16 scenarios, each with three types of comments—*text & emoji*, *text alone*, and *emoji alone*. Participants were exposed to only one type of emoji (🙂 or 😂). There were eight versions of the questionnaire such that each participant saw each item in only one of the eight conditions (2 literality × 2 polarity × 2 emoji) (see Fig. 1c).

Two 7-point rating scales followed each scenario. The first was about speaker intention (e.g. "How sarcastic do you think Character B's response was?" 1 = *Not sarcastic at all,* 7 = *Very sarcastic*). The second was about speaker attitude (e.g. "What do you think of Character B's response?" 1 = *Very negative,* 7 = *Very positive*). Speaker intention tapped into the participants' perceived sarcasm of the

Table 3
Example materials of Experiment 2 (see the Chinese version in Appendix 4).

Context: A agreed to clock in everyday, but didn't go to the gym for a month.
A：I'm a persistent person.
$B_{1(\text{emoji alone})}$: 🙂/😂
$B_{2(\text{text alone})}$: You are really persistent.
$B_{3(\text{text \& emoji})}$: You are really persistent 🙂/😂

speaker's comments. Speaker attitude tapped into the perceived positivity of the comments delivered by Character B.

3.1.3. Procedure

Participants were randomly allocated to one of the eight questionnaires, with 176 participants assigned to the smiling emoji condition and 185 participants to the tears-of-joy emoji condition. They each received a consent form, instructions, and basic demographic information about their age, gender, and their use of emoji ("Will you often use emoji in your daily life?" – *Yes/No*), followed by the rating task. The rating task lasted about 15 min.

3.1.4. Statistical analysis

The data were analyzed by means of linear mixed effects models (lmerTest package) in R (Version 4.0.2; R Core Team, 2020). The first step was to establish an appropriate random effects structure for the analysis of the perceived sarcasm and the emotional impact of the comments, respectively. The full model failed to converge; therefore, the random effect structure had to be simplified. To obtain convergence, we first trimmed the overfitting random slopes in the full model. Once the random effect structure was established, the second step was to perform a series of likelihood ratio tests to compare the fit of the model with progressively simpler fixed-effects structures to reach the simplest model for our data. We only reported the significant fixed effects in the mixed effects model (see Table 4).

The third step was to compare three types of responses for each emoji using a chi-square test. Since there were interactions between *literality*, *polarity*, and *response*, the analysis was divided into categories based on *literality* (literal or sarcastic) and *polarity* (criticism or praise). The differences with regard to the perceived sarcasm and the perceived positivity of the three responses for each emoji are displayed in Tables 5 and 6. This step was conducted to detect whether the two emoji could alter the perceived sarcasm and the perceived positivity of the text in language comprehension process.

The last step was to compare the two emoji to determine which one was more sarcastic and which one was more negative. To calculate the score for each emoji in each condition, we subtracted *text alone* from *text & emoji* followed the procedure of Filik et al. [12]. This was done to determine whether the degree of sarcasm and perceived positivity of the emoji was affected by the text and context.

Table 4
Summary of the significant fixed effects parameters in the linear mixed effects model.

Emoji	Fixed effects	b	SE	t	p
a:	(Intercept)	5.19	.11	45.36	.001[a]
🙄	response: text + emoji	.77	.13	5.71	.001[a]
	literalityliteral:responsetext	−1.96	.14	−14.37	.001[a]
	literalityliteral:responsetext + emoji	−1.67	.14	−12.24	.001[a]
	polaritypraise:responsetext	−.41	.14	−3.00	.01[b]
	polaritypraise:responsetext + emoji	−.37	.14	−2.75	.01[b]
	literalityliteral:polaritypraise:responsetext + emoji	.84	.19	4.36	.001[a]
a:	(Intercept)	4.29	.12	36.83	.001[a]
😂	polaritypraise	−.38	.10	−3.84	.001[a]
	responsetext	1.02	.14	7.23	.001[a]
	responsetext + emoji	.97	.14	6.89	.001[a]
	literalityliteral:responsetext	−2.05	.13	−15.42	.001[a]
	literalityliteral:responsetext + emoji	−1.55	.13	−11.67	.001[a]
	polaritypraise:responsetext	−.36	.13	−2.70	.01[b]
	literalityliteral:polaritypraise:responsetext + emoji	.57	.19	3.02	.01[b]
b:	(Intercept)	3.12	.09	33.86	.001[a]
🙄	polaritypraise	.23	.09	2.58	.05[c]
	responsetext	.29	.10	3.07	.01[b]
	responsetext + emoji	−.30	.10	−3.11	.01[b]
	literalityliteral:responsetext + emoji	.26	.12	2.21	.05[c]
	polaritypraise:responsetext	−.39	.12	−3.32	.001[a]
	polaritypraise:responsetext + emoji	.24	.12	2.02	.05[c]
	literalityliteral:polaritypraise:responsetext	1.58	.17	9.50	.001[a]
b:	(Intercept)	3.65	.09	41.60	.001[a]
😂	polaritypraise	.33	.09	3.60	.001[a]
	responsetext	−.42	.10	−4.15	.001[a]
	responsetext + emoji	−.28	.10	−2.79	.01[b]
	literalityliteral:polaritypraise	−.23	.12	−1.98	.05[c]
	literalityliteral:responsetext	−.27	.12	−2.35	.05[c]
	literalityliteral:responsetext + emoji	.28	.12	2.40	.05[c]
	polaritypraise:responsetext	−.47	.12	−4.04	.001[a]
	polaritypraise:responsetext + emoji	.27	.12	2.33	.05[c]
	literalityliteral:polaritypraise:responsetext	2.33	.17	14.11	.001[a]

Note: "a" represents perceived sarcasm, "b" represents perceived positivity.
[a] $p < .001$.
[b] $p < .01$.
[c] $p < .05$.

3.2. Results

3.2.1. Degree of sarcasm for the three responses

A three-way interaction was found between literality, polarity, and response. When presented with the smiling emoji, comments accompanied by an emoji (*text & emoji*) were perceived as more sarcastic than those without an emoji (*text alone*) in literal criticism (χ^2 (1, $N = 176$) = 60.01, $p < .001$), literal praise (χ^2 (1, $N = 176$) = 224.20, $p < .001$), sarcastic praise (χ^2 (1, $N = 176$) = 35.98, $p < .001$), and sarcastic criticism conditions (χ^2 (1, $N = 176$) = 33.26, $p < .001$). Intriguingly, a stand-alone emoji (*emoji alone*) was perceived as more sarcastic than *text & emoji* in the literal criticism (χ^2 (1, $N = 176$) = 53.00, $p < .001$) and literal praise (χ^2 (1, $N = 176$) = 12.43, $p < .01$) conditions. By contrast, *text & emoji* was perceived as more sarcastic than *emoji alone* in sarcastic praise (χ^2 (1, $N = 176$) = 10.02, $p < .01$) and sarcastic criticism (χ^2 (1, $N = 176$) = 38.33, $p < .001$) conditions. *Emoji alone* was also perceived as more sarcastic than *text alone* in the literal criticism (χ^2 (1, $N = 176$) = 250.87, $p < .001$), literal praise (χ^2 (1, $N = 176$) = 417.79, $p < .001$) and sarcastic praise (χ^2 (1, $N = 176$) = 14.46, $p < .001$) conditions, but not in the sarcastic criticism (χ^2 (1, $N = 176$) = .37, $p = 1.00$) condition.

When presented with the tears-of-joy emoji, participants rated *text & emoji* as significantly more sarcastic than *text alone* in literal praise (χ^2 (1, $N = 185$) = 95.68, $p < .001$) and literal criticism (χ^2 (1, $N = 185$) = 9.43, $p < .01$) conditions. The difference between *text & emoji* and *text alone* in sarcastic criticism (χ^2 (1, $N = 185$) = .10, $p = 1.00$) and sarcastic praise (χ^2 (1, $N = 185$) = .20, $p = 1.00$) conditions was not significant. *Text & emoji* was perceived as significantly more sarcastic than *emoji alone* in sarcastic criticism (χ^2 (1, $N = 185$) = 55.81, $p < .001$) and sarcastic praise (χ^2 (1, $N = 185$) = 31.04, $p < .001$) conditions. However, in the literal criticism condition, *emoji alone* was perceived as significantly more sarcastic than *text & emoji* (χ^2 (1, $N = 185$) = 20.12, $p < .001$). In the literal praise condition, there was no difference between the two response conditions (χ^2 (1, $N = 185$) = 3.98, $p = .18$). In the sarcastic criticism (χ^2 (1, $N = 185$) = 21.27, $p < .001$) and sarcastic praise (χ^2 (1, $N = 185$) = 20.83, $p < .001$) conditions, *text alone* was perceived as significantly more sarcastic than *emoji alone*. On the contrary, in the literal context, *emoji alone* was perceived as significantly more sarcastic than *text alone* (literal criticism: (χ^2 (1, $N = 185$) = 51.43, $p < .001$); literal praise: (χ^2 (1, $N = 185$) = 138.36, $p < .001$)).

We conducted one sample *t*-tests to calculate the perceived sarcasm of the two emoji. The mean score of the standalone smiling emoji was significantly higher than 4 (the middle point on the rating scale from 1 to 7) ($t(175) = 10.65$, $p < .001$, $d = .80$), which was also the case for tears-of-joy emoji ($t(184) = 2.09$, $p < .05$, $d = .15$). This indicates that both the smiling and tears-of-joy emoji convey sarcastic meaning when presented alone, with the smiling emoji demonstrating a stronger effect size (see Table 5).

3.2.2. Perceived positivity of the three responses

Our results showed that for smiling emoji, participants perceived *text & emoji* as more negative than *text alone* in literal praise (χ^2 (1, $N = 176$) = 195.23, $p < .001$), literal criticism (χ^2 (1, $N = 176$) = 12.37, $p < .01$) and sarcastic criticism (χ^2 (1, $N = 176$) = 37.02, $p < .001$) conditions. The difference between *text & emoji* and *text alone* was not significant in the sarcastic praise (χ^2 (1, $N = 176$) = .12, $p = 1.00$) condition. Meanwhile, *text & emoji* was perceived as more negative than *emoji alone* in the sarcastic criticism (χ^2 (1, $N = 176$) = 11.41, $p < .01$) condition but not in the other three conditions (literal criticism: (χ^2 (1, $N = 176$) = .20, $p = 1.00$); literal praise: (χ^2 (1, $N = 176$) = 2.23, $p = .54$); sarcastic praise: (χ^2 (1, $N = 176$) = .45, $p = 1.00$)). In the literal praise (χ^2 (1, $N = 176$) = 222.92, $p < .001$), literal criticism (χ^2 (1, $N = 176$) = 9.37, $p < .01$), and sarcastic criticism (χ^2 (1, $N = 176$) = 8.61, $p < .05$) conditions, *emoji alone* was perceived as more negative than *text alone*. In the sarcastic praise condition, there were no significant difference between the two response types (χ^2 (1, $N = 176$) = .96, $p = 1.00$).

Results for the tears-of-joy emoji showed that *text alone* was perceived as more negative compared to *text & emoji* in sarcastic praise (χ^2 (1, $N = 185$) = 68.45, $p < .001$) and literal criticism (χ^2 (1, $N = 185$) = 42.07, $p < .001$) conditions. *Text & emoji* was perceived more negative than *text alone* in literal praise condition (χ^2 (1, $N = 185$) = 71.78, $p < .001$), and there was no significant difference between *text alone* and *text & emoji* conditions in the sarcastic criticism condition (χ^2 (1, $N = 185$) = 1.65, $p = .79$). When comparing *emoji alone* with *text & emoji*, the difference was not significant in literal criticism (χ^2 (1, $N = 185$) = .00, $p = 1.00$) and sarcastic praise (χ^2 (1, $N = 185$) = .01, $p = 1.00$) conditions. *Text & emoji* was more positive than *emoji alone* in literal praise condition (χ^2 (1, $N = 185$) = 7.24, $p < .05$), but was more negative in sarcastic criticism condition (χ^2 (1, $N = 185$) = 8.43, $p < .05$). *Text alone* was perceived as more negative than *emoji alone* in sarcastic criticism (χ^2 (1, $N = 185$) = 18.05, $p < .001$), literal criticism (χ^2 (1, $N = 185$) = 49.29, $p < .001$), and sarcastic praise (χ^2 (1, $N = 185$) = 81.32, $p < .001$) conditions. In the literal praise condition, participants perceived *emoji alone* as more negative than *text alone* (χ^2 (1, $N = 185$) = 138.91, $p < .001$).

We conducted one sample *t*-tests to calculate the perceived positivity of the two emoji. The mean score of the standalone smiling emoji was significantly lower than 4 (the middle point on the rating scale from 1 to 7) ($t(175) = -9.90$, $p < .001$, $d = .75$), which was also the case for tears-of-joy emoji ($t(184) = -3.45$, $p < .01$, $d = .25$). This indicates that both the smiling and tears-of-joy emoji conveyed a negative emotional tone (see Table 6).

3.2.3. Comparison of the two emoji

Based on the aforementioned calculation, we found that both the smiling emoji and the tears-of-joy emoji marked sarcastic intent, but they seemed to have disparate effects on comments that were literal or sarcastic. The aim of this step was to assess which emoji was perceived as more sarcastic. To accurately determine the increase in sarcasm and emotional impact, we subtracted *text alone* from *text & emoji,* as reported by Filik et al. [12]. The subtraction did appear to take the context into consideration. Positive values indicate that the emoji enhances perceived sarcasm and perceived positivity of the text, whereas negative values represent that the emoji mitigates these indices of the text. We conducted *t*-tests to compare the meaning of the two emoji.

Table 5
Degree of sarcasm.

Emoji type	Literality	Polarity	*Emoji alone*		*Text alone*		*Text & emoji*	
			M	SEM	M	SEM	M	SEM
🙄	literal	criticism	5.05	.11	2.99	.11	4.13	.12
		praise	5.01	.11	2.39	.09	4.58	.11
	sarcastic	criticism	5.20	.11	5.14	.10	5.99	.09
		praise	5.01	.11	4.49	.10	5.38	.10
😂	literal	criticism	4.36	.10	3.30	.13	3.79	.10
		praise	4.20	.10	2.53	.10	3.93	.10
	sarcastic	criticism	4.29	.10	5.30	.10	5.26	.09
		praise	3.91	.10	4.57	.10	4.63	.10

Table 6
Degree of positivity.

Emoji type	Literality	Polarity	*Emoji alone*		*Text alone*		*Text & emoji*	
			M	SEM	M	SEM	M	SEM
🙄	literal	criticism	3.01	.09	3.30	.08	2.96	.08
		praise	3.34	.09	4.83	.09	3.47	.10
	sarcastic	criticism	3.11	.09	3.42	.09	2.81	.10
		praise	3.34	.10	3.27	.09	3.30	.11
😂	literal	criticism	3.67	.08	2.98	.08	3.65	.08
		praise	3.78	.08	4.94	.09	4.05	.09
	sarcastic	criticism	3.65	.08	3.23	.09	3.37	.09
		praise	3.98	.08	3.09	.09	3.97	.09

The results of subtracting the perceived sarcasm of *text alone* from that of *text & emoji* showed that the two emoji differed from each other in the amount by which they increased the perceived sarcasm of the text under different conditions (see Table 7). The smiling emoji increased the perceived sarcasm significantly more than the tears-of-joy emoji did in cases of sarcastic criticism (χ^2 (1, $N = 361$) $= 33.89, p < .001$), sarcastic praise (χ^2 (1, $N = 361$) $= 27.43, p < .001$), literal criticism (χ^2 (1, $N = 361$) $= 17.28, p < .001$), and literal praise (χ^2 (1, $N = 361$) $= 24.44, p < .001$; see Fig. 4a). These findings suggest that compared to the tears-of-joy emoji, the smiling emoji could enhance the perceived sarcasm of texts regardless of the context and the surrounding text.

As for the emotional impact, the results of subtracting the perceived positivity of *text alone* from that of *text & emoji* showed that the two emoji differed from each other in the amount by which they increased the positivity of the text in different conditions (see Table 7). Specifically, the smiling emoji significantly reduced the perceived positivity of the text to a greater extent than the tears-of-joy emoji across all conditions (i.e., sarcastic criticism (χ^2 (1, $N = 361$) $= 27.81, p < .001$), literal criticism (χ^2 (1, $N = 361$) $= 50.41, p < .001$), literal praise (χ^2 (1, $N = 361$) $= 10.10, p < .01$), and sarcastic praise (χ^2 (1, $N = 361$) $= 34.03, p < .001$)) (see Fig. 4b).

4. Discussion

The present study employed both a language production task and a language comprehension task to elucidate how Chinese teenagers use emoji to indicate sarcastic intent and interpret sarcasm in CMC. The purpose of Experiment 1 was to determine which WeChat emoji Chinese teenagers use to clarify sarcastic intentions. Our findings revealed a significant preference among Chinese teenagers for employing the smiling and tears-of-joy emoji to indicate sarcastic intentions. The constraint-satisfaction approach offers insight into this outcome, suggesting that multiple cues to ironic intent are processed simultaneously during the interpretation of irony [40]. This observation aligns with previous research that identifies the smiling emoji as a marker of irony among young Chinese [23,32,41,42]. Nonetheless, our results diverge from studies predominantly focused on Western cultural contexts, where the wink emoji is typically considered as the primary indicator of sarcastic intentions [14,15].

Such differences may stem from the cultural variability in using emoji. Researchers have shown that culture is an important factor in shaping individuals' modes of expression. People in individualistic cultures (e.g. North American and European countries) tend to express themselves more explicitly because of their emphasis on the *self*, whereas people in collectivistic cultures (such as China) are

Table 7
Mean scores and standard deviation of subtracting *text alone* from *text & emoji*.

	Perceived sarcasm				Perceived positivity			
	Tears-of-joy		Smiling		Tears-of-joy		Smiling	
	M	*SD*	*M*	*SD*	*M*	SD	M	SD
Sarcastic criticism	−.04	1.52	.85	1.34	.14	1.45	−.61	1.23
Sarcastic praise	.06	1.54	.89	1.40	.88	1.45	.03	1.11
Literal criticism	.49	1.47	1.13	1.41	.67	1.29	−.34	1.11
Literal praise	1.39	1.58	2.18	1.58	−.89	1.51	−1.36	1.71

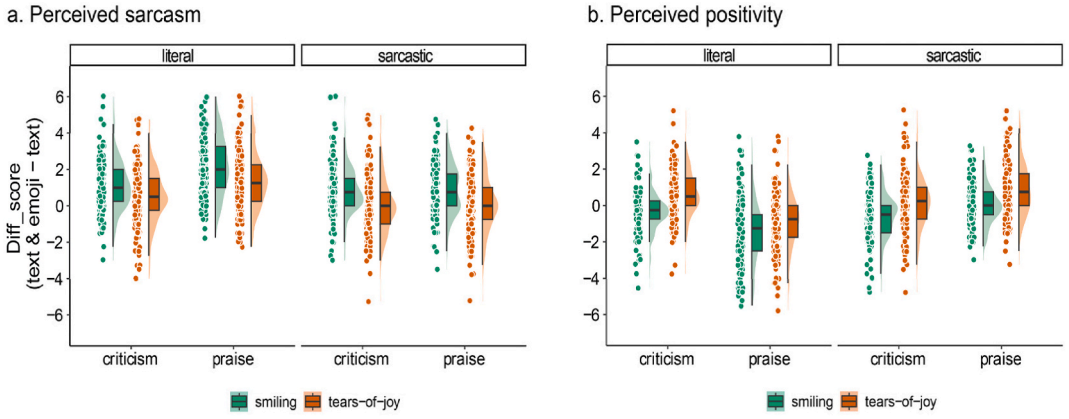

Fig. 4. The box and violin plots depict diverse perceived sarcasm between *text & emoji* and *text alone*, considering *literality* (literal vs. sarcastic), *polarity* (criticism vs. praise), and *emoji* (smiling vs. tears-of-joy). The box plots display the five-number summary of a group of data (minimum, first quartile [Q1], median, third quartile [Q3] and maximum). The violin plots illustrate the distribution and peaks in the data. The colored dots represent the data from each participant under varying conditions.

inclined to express their feelings implicitly because of their tendency to stress the importance of *shared values* [43]. This reflects the fact that people in Western cultures are more likely to express their sarcastic intentions explicitly and directly by overtly expressive emoji such as the wink and tongue-face. In contrast, Chinese cultures tend to express sarcastic intentions implicitly and indirectly with the smiling face (which is explicitly happy but implicitly sarcastic) and the tears-of-joy emoji (which embodies a complex and ambiguous expression that combined both smiling and crying). Therefore, it is essential to consider both embodied and cultural factors when exploring the ways in which people use emoji markers in CMC.

Experiment 2 investigated the effects of the two selected emoji, namely the smiling emoji and the tears-of-joy emoji, on the comprehension and emotional impact of sarcastic and literal comments. Consistent with the findings of Garcia et al.'s [14] and Cui et al. [23], our study also demonstrated that the incorporation of a smiling emoji amplified perceived sarcasm in both literal and sarcastic comments, underscoring the pivotal role of emoji in interpretation sarcasm. In contrast, the tears-of-joy emoji was found to increase the perceived sarcasm of literal comments but exhibited a nonsignificant effect on sarcastic comments. This observation challenges the initial hypothesis that sarcasm-conveying emoji would amplify the perceived sarcasm of both literal and sarcastic statements. However, it aligns with the findings of Filik et al. [12] and supports Garcia et al.'s [14] assertion that context accounts for the differences observed between their study and the research by Howman and Filik [13]. The links between cues and their interpretations should be weighted to reflect the learned predictability or reliability of each cue. Consequently, we assert that both emoji and context serve as reliable cues for interpreting sarcasm, though their levels of reliability may differ. These varying levels of reliability need to be evaluated and incorporated into the framework to ensure that more reliable cues are assigned greater weight in the constraint-satisfaction process [40]. Specifically, the smiling emoji is afforded more weight than context, while context carries more weight than the tears-of-joy emoji in the constraint-satisfaction process of sarcasm.

Notable differences exist in the effects of the smiling and tears-of-joy emoji on the interpretation of sarcasm. By subtracting the rating of a standalone text from the rating of a text accompanied by an emoji, we found that Chinese teenagers perceive the smiling emoji as more sarcastic than the tears-of-joy emoji. In this case, the smiling emoji conveys a stronger degree of sarcasm, with the context exerting less effect on the interpretation of sarcasm. Conversely, the tears-of-joy emoji is associated with a lower perceived level of sarcasm, making its effect on the interpretation of sarcasm more susceptible to context. In addition, as suggested by our findings, both the smiling and tears of joy emoji can appear alone to elicit a sarcastic response to preceding statements. Due to the inherent discrepancies within these emoji, they combine both positive and negative emotions. The smiling emoji (🙂) features upward-bent lips paired with a downward gaze, while the tears-of-joy emoji (😂) merges elements of both tears and laughter. Although the present study does not directly compare the effects of emoji and emoticons on the comprehension of sarcastic statements, the disparities observed between the findings of Filik et al. [12], Howman and Filik [13] and Garcia et al. [14] suggest that emoji and emoticons exert varied effects on elucidating sarcastic intent. Compared to emoticons, ready-made colourful emoji are more visually appealing, nuanced, complex, and expressive [20,26].

Concerning the emotional impact of the two emoji on a text, the perceived positivity of an emoji may be working when it is combined with text. Some studies have shown that positive emoticons are clues to irony in user-generated content [9]. Others have suggested that neutral emoji are the most appropriate means of reducing the positivity of an otherwise positive message [31]. In our study, the negatively labelled smiling and tears-of-joy emoji made literal statements appear more negative, while the two emoji had distinct effects on sarcastic comments. Specifically, the smiling emoji increased the negativity of sarcastic criticism, whereas the tears-of-joy emoji mitigated it. Individuals perceived the smiling emoji as more negative than the tears-of-joy emoji. This may be

partially due to the difficulty in determining the sentiment of emoji. In most cases, emoji are labelled based on the surrounding text, leading to instances where an emoji carries different or even opposing sentiment labels in disparate conditions [17,44]. The smiling emoji was primarily designed to represent "a genuine smile", denoting happiness and friendliness, and it has also evolved to imply an innovative meaning as "a mysterious smile" that signals sarcasm and speechlessness [22,23]. The tears-of-joy emoji is generally associated with positive emotions, such as laughing, happiness, and amusement; however, there are cases in which its valence can be perceived as negative [45]. Similarly, our findings revealed that while the smiling and tears-of-joy emoji conveyed a negative emotional tone, their effects on verbal messages were not inherently fixed. Rather, their meanings and sentiments were open to interpretation, depending on the text and context in which they appeared.

5. Conclusion

The present study investigated emoji that can indicate sarcastic intentions among Chinese teenagers using the WeChat app, addressing this from both language production and language comprehension perspectives. The language production task (Experiment 1) focused on identifying which emoji served as indicators of sarcastic intentions, positing that the smiling and the tears-of-joy emoji were markers of sarcasm among Chinese teenagers. The results of the language comprehension task (Experiment 2) demonstrated that both emoji and context are reliable cues for interpreting sarcasm, although their reliability levels may vary. Specifically, the smiling emoji carries more weight than context, while context is given greater weight than the tears-of-joy emoji in the constraint-satisfaction process. Furthermore, both the smiling and tears-of-joy emoji can appear alone to make sarcastic responses to preceding statements. The pragmatic implications of our findings offer initial insights into the customary practices of Chinese teenagers in employing smiling and tears-of-joy emoji to signify their sarcastic intentions in WeChat communication.

The present study employed a methodology wherein participants selected emoji commonly used in their lives, a practice with inherent limitations as it may overlook other emoji capable of conveying sarcastic intentions. Furthermore, given the continuous influx of new emoji into everyday usage, it would be beneficial to examine the most up-to-date emoji in future research. Additionally, participants in the present study were restricted to selecting a maximum of one emoji in the free-response task, a departure from the typical everyday practices where multiple emoji are often employed together to convey various functions and motivations. Consequently, investigations exploring the combined usage of diverse emoji, which extend beyond the confines of the present study, are imperative for future research endeavors.

CRediT authorship contribution statement

Jing Cui: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Yu R. Dandan:** Writing – review & editing, Validation, Software, Data curation. **Bo Yang:** Visualization, Supervision, Investigation. **Youping Jing:** Writing – review & editing, Supervision, Funding acquisition.

Ethics statement

This study has received full ethical approval from the committee of the School of Foreign Languages, Southeast University, China [approval number S20240112, 2024-01-12].

Data availability statement

The data underlying this article are available in the OSM in the Open Science Framework: https://osf.io/jpme7/

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. An example scenario with four variants in Experiment 1 (Chinese version)

场景	语境与对话
Item 1	语境 1：你好友的男朋友给她送了一套“豪宅”。当你去参观的时候，却发现房子又小又偏僻。 你好友：今天太不好意思了，光临寒舍，没能好好招待你。 你：_____
Item 2	语境 1：你好友的男朋友给她送了一套“豪宅”。当你去参观的时候，却发现房子又小又偏僻。 你好友：我的豪宅还不错吧？ 你：_____
Item 3	语境 2：你好友的男朋友送她一栋别墅。你去参观的时候发现，房子不仅很大，还带有露天泳池和花园。 你好友：今天太不好意思了，光临寒舍，没能好好招待你。 你：_____
Item 4	语境 2：你好友的男朋友送她一栋别墅。你去参观的时候发现，房子不仅很大，还带有露天泳池和花园。 你好友：我的豪宅还不错吧？ 你：_____

Appendix 2. Example materials in Experiment 1 (Chinese version)

情景 3. 你朋友邀请你周末爬山。这天，他健步如飞，而你却筋疲力尽。最后还是你朋友把你扛下了山。回到家后…

你朋友：我感觉自己有点娇弱，今天居然有点爬不动。

你：_____

1.1 你的回复：_____

1.2 你会使用 emoji 吗？ A. 会 B. 不会

1.3 你会使用以下那个表情符号？

A. B. C. D.

E. F. G. H.

I. J. K. L.

1.4 你内心的真实想法是什么？ _____

Appendix 3. Frequencies of literality and polarity for 12 emoji

	Literal Praise	Sarcastic Criticism	Praise	Criticism
	22	21	69	202
	7	1	2	7
	19	22	70	182
	4	3	7	15
	49	6	4	21
	21	5	10	44
	17	1	2	5

(*continued on next page*)

(*continued*)

	Literal	Sarcastic	Praise	Criticism
	Praise	Criticism		
😁	57	8	17	86
🤯	28	1	3	9
😝	7	2	1	5
🥸	1	5	3	10
😆	3	14	6	33

Appendix 4. Example materials of Experiment 2 (Chinese version)

语境: A 下定决心每天都健身打卡，结果已经一个月没去健身房了。

A：我是个意志坚定的人。

$B_{1(\text{emoji alone})}$：🙄/😂

$B_{2(\text{text alone})}$：你意志真的很坚定。

$B_{3(\text{text \& emoji})}$：你意志真的很坚定🙄/😂

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