Party Face Congratulations! Exploring Design Ideas to Help Sighted Users with Emoji Accessibility when Messaging with Screen Reader Users

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Emoji are a popular, expressive form of non-verbal communication. However, people often use emoji in ways that result in confusing or cumbersome screen reader output. We created two accessibility support designs: (1) Preview, which displays a basic text transcript of a message with emoji that a screen reader would narrate, and (2) Alert, which summarises potential accessibility issues caused by emoji within a message. We explored our designs using an online survey and provided participants with the option to edit messages that contained emoji, should they choose to do so. We collected 1508 modified messages from 116 sighted participants and conducted a qualitative analysis of the data to identify the strategies participants used when asked to edit a message for accessibility issues and their appreciation of each design. We found that participants preferred the Preview design over Alert since it allows for subjective interpretations of what constitutes an accessible message. We report sighted users' rewriting strategies (e.g., editing the message to move the emoji to the end) and incorrect assumptions about screen readers that would lead to using textual markers that are incompatible with screen readers. We discuss the design implications for future systems for accessible messaging.

CCS Concepts: • **Human-centered computing → Empirical studies in collaborative and social computing**; **Empirical studies in accessibility**.

Additional Key Words and Phrases: Accessibility, Computer-mediated communication, Emoji, Messaging, Screen Readers

ACM Reference Format:
Carla F. Griggio, Benjamin M. Gorman, and Garreth W. Tigwell. 2024. Party Face Congratulations! Exploring Design Ideas to Help Sighted Users with Emoji Accessibility when Messaging with Screen Reader Users. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 175 (April 2024), 31 pages. https://doi.org/10.1145/3641014

1 INTRODUCTION

Emoji are widely used as a visual means of expression in daily communication. In the context of messaging (e.g., SMS, WhatsApp, WeChat), people often use emoji to convey emotions and conversational tone (e.g., "Thank you ❤️") or even as simple decorations to their messages (e.g., "Making tacos 🌮") [7]. People have also appropriated emoji as a means to express their identities [49, 58] and intimacy within close relationships [18, 19]. However, little work has investigated sighted people's awareness of how the use of emoji can create inaccessible messages when vocalised by a screen reader, which is a device often used by blind and low vision people.

While emoji can be powerfully expressive, prior work found that the way in which emoji are used can be inaccessible to screen reader users due to sighted people focusing on the visual aspects

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ACM 2573-0142/2024/4-ART175
https://doi.org/10.1145/3641014

of emoji and not considering how emoji are interpreted non-visually [51]. The Unicode Consortium, a non-profit organisation, determines both the rough visual appearance and textual descriptions of each emoji [52]. We will refer to the textual description for an individual emoji in our paper as an *emoji descriptor*, which a screen reader vocalises when describing an emoji in a message. For example, the emoji descriptor for 😂 is *face with tears of joy*. When emoji are included as part of a sentence, such as “That’s great 😂”, the content of the vocalised screen reader output would be, “That’s great face with tears of joy”.

If sighted individuals are unaware of how screen readers vocalise emoji descriptors, their use of emoji may lead to miscommunication or an uncomfortable experience for screen reader users. For example, in an interview study with blind and low-vision people, Tigwell et al. [51] document how sighted users’ lack of awareness of emoji descriptors may cause grammatical errors when replacing words with emoji (e.g., "It is ☀️ today" would be voiced as "It is sun today", not "sunny") or produce excessively long messages due to the overuse of decorative emoji. Furthermore, emoji can often be interpreted or re-appropriated based on their visual appearance rather than their descriptors [21, 50, 55], resulting in voiced messages that fail to convey the meaning intended by the sender. For example, a sighted user may use 🙏 to illustrate a "high five" gesture, but screen readers will voice it as "pray" or "hands pressed together" [51].

These issues make emoji an interesting case study for exploring ways to enhance text-based communication between sighted and blind or low vision users. Only creating accessibility tools for blind and low vision users might not be enough to improve the accessibility of conversations with sighted users, as this excludes sighted users from understanding how their messages are interpreted at the receiving end. Therefore, our research aims to understand how to reduce the burden associated with these accessibility challenges for screen reader users by designing tools that assist sighted users in adjusting their messages with emoji to be more compatible with screen readers. To guide our design process, we had three key research questions:

> **RQ1.** In what ways do sighted users adjust their use of emoji in text messages when they are aware that the receiver is using a screen reader?
> **RQ2.** What kind of assumptions and misconceptions about how screen readers interpret emoji hinder sighted users’ efforts to improve emoji accessibility?
> **RQ3.** How can we promote the adoption of best practices for using emoji in ways that are more compatible with screen readers?

We conducted an online survey with 116 sighted users of messaging apps to collect examples of how they would rephrase a given message with emoji (e.g., "I got an A in the exam 😎😎😎") to make it more accessible to a conversation partner using a screen reader. Our participants were exposed to three different designs: (A) *No Support*—the message is shown in a typical messaging platform with no guidance, (B) *Preview Support*—the message is augmented with a text transcription of how it would be voiced by a screen reader (e.g., “I got an A in the exam smiling face with sunglasses smiling face with sunglasses smiling face with sunglasses”), and (C) *Alert Support*—the message is augmented with an alert about potential accessibility problems (e.g., “😎 emoji appears three times—emoji descriptors may be voiced consecutively”). The elicited rewritten messages allowed us to assess sighted users’ awareness of different types of potential emoji accessibility issues, their intuitions on using emoji when messaging with a screen reader user, tensions between favouring accessibility or personal expression, and their preferences between the design ideas.

Our participants used a variety of message rewriting strategies, ranging from removing emoji (e.g., rethinking the message from scratch, replacing the emoji with additional text) to adapting the use of emoji (e.g., adding verbal clarifications of the intended meaning or tone of the emoji). Through analysing these strategies, we identified incorrect assumptions and misunderstandings about how screen readers work, potentially introducing more accessibility issues instead of reducing them (e.g., replacing emoji with punctuation-based emoticons that lack screen reader support), even among participants who reported prior accessibility knowledge. Finally, we found that most of the participants preferred Preview over Alert, mainly because Preview was viewed as less constraining, allowing participants to assess accessibility issues on their own.

Our paper makes three contributions: First, we propose two designs to support sighted users in considering the accessibility of emoji they use when messaging with screen reader users. Second, we identify a range of strategies employed by sighted users to enhance the accessibility of messages that include emoji, which uncover assumptions and common misconceptions about screen readers that often result in additional accessibility issues. And third, we offer design recommendations for tools dedicated to help sighted users message in more accessible ways.

2 BACKGROUND AND RELATED WORK

2.1 Importance of Emoji in Computer-Mediated Communication

Emoji are graphic illustrations used within text-based communication that have gained immense popularity [3], in part because of the vast range of different concepts, ideas, and things that can be represented in visual short-hand with emoji [1]. For example, there are sets of emoji for emotions 🤨, people 🧑🏽‍🎤, animals 🦆, food 🥨, flags 🏴󠁧󠁢󠁳󠁣󠁴󠁿, objects 🎲, symbols ⚛️, etc., and new sets are released each year [4]. While emoji are often viewed as fun and playful [33], the significance of their role within current communication should not be underestimated [57].

Researchers from fields such as CSCW, HCI, and linguistics have been studying the ways in which emoji have become a part of how we communicate, and it is clear that emoji have become a complex language in their own right. People may use emoji to clarify or enhance the intent behind a message [7], and emoji can be repurposed to signify jokes between friends, present stories in picture form, and to support relationships [7, 18, 19, 44, 50, 55, 58]. Moreover, the inclusion of modifiers for emoji such as skin tone modifiers supports improved self-representation by users [42]. Workforce leadership using emoji in email can be viewed as more likeable, although there is a complex relationship in how this manifests depending on sender and receiver genders and workplace culture [41], and there are hesitations from new employees in using emoji in virtual workspaces until interpersonal bonds have been adequately formed and co-workers have been observed to see how they are using non-textual responses [46].

The versatility of emoji is both its strength and weakness since there can often be misunderstandings due to design, people's different interpretations of what the emoji are, or unclear intent in how some people use emoji [34–36, 43, 50], as well as considering the influence of individual factors such as cultural and personality on emoji use [22, 27, 30]. With this in mind, we need to design systems to help mitigate emoji issues and guide best practices for using emoji.

2.2 Accessibility support within collaboration and communication contexts

There are approximately 43 million people worldwide who are blind [48] and estimates for the number of people worldwide who have a vision impairment rises to 2.2 billion [54]. Therefore, it is important that communication technology and related digital services remain accessible.

One piece of assistive technology that is often used by blind and low vision people is a screen reader. A screen reader is software that will read aloud the contents on a computer display [23], for example, the items listed in a web page menu for the user to determine what they would like to access. However, for a screen reader to be able to do this, it requires the designers and developers of digital technology and services to follow certain implementation steps to ensure that the screen reader understands how to interpret the structure and features of an interface. For example, it is possible for a screen reader to read aloud what is in an image but only if the app or website creator has defined alternative text (image descriptions) within the underlying HTML when posting the image. Often digital systems and digital content are inaccessible to screen readers due to poor implementation [23, 26, 39], and this has also been observed within CSCW settings such as collaboration and communication.

First, regarding collaborative settings, research has highlighted the challenges people with vision impairments encounter during collaborative writing [8], and has explored design solutions to improve the accessibility of collaborative document editing for screen readers [9, 10, 24].

Second, regarding communication, research has demonstrated the widely used QWERTY keyboard layout is not optimised for use with a screen reader and the alternative layout of the keyboard letters can provide improved typing during text messaging [29]. In addition to keyboards, the way in which people type out their words can also be inaccessible to screen reader users. Moreover, Lee and Ashok [25] conducted a study that revealed how blind participants faced significant cognitive and interaction challenges when their screen reader encountered out-of-vocabulary words because the screen reader does not narrate the content adequately, and, as a result, the screen reader user has to access the content multiple times and in various ways to comprehend these unfamiliar terms. Therefore, casual language with elements like abbreviations (e.g., *I love you* vs *ily*), misspellings, wordplay, slang, etc. can have a detrimental impact on the comprehension and social media experience of screen reader users.

Finally, the structure of social media platforms and how people use them has generally created access issues for screen reader users [13, 15, 37, 51]. For example, Twitter became less accessible when the platform allowed images to be posted [37], and more recent work studied the extent of this issue where very few users include embedded image descriptions for screen readers to access [13]. Furthermore, research has found a lack of alternative text for common visual media people share both privately and publicly such as GIFs [16] and memes [17].

These findings are a snapshot of a much larger issue surrounding sighted people's general lack of awareness and understanding of producing accessible content for screen readers. In summary, screen reader accessibility relies on both the creation of accessible digital systems and for people to create content in such a way that is accessible to screen reader users. In our work, we are interested in exploring the challenges surrounding emoji use in messages that will be read by a screen reader.

2.3 Emoji Accessibility

Some emoji designs are unambiguous for sighted users, such as the "thumbs up" emoji 👍, but there are examples where sets of emoji can be visually similar while having different meanings. The issues surrounding this are notable when the person receiving the wrong emoji is using a screen reader since the screen reader will read a specific emoji descriptor aloud. For example, the "face with big pleading eyes" emoji 🥺 and the "smiling face holding back tears" emoji 🥹 are extremely similar in design, and a sighted person could send the wrong one, but the emoji descriptors "face with big pleading eyes" and "smiling face holding back tears" are different.

Tigwell et al. [51] published one of the first pieces of work on emoji accessibility highlighting challenges screen reader users face, such as searching and selecting emoji, and receiving messages that are cumbersome or unclear due to how emoji are used (e.g., repetitive use of emoji, placement of emoji, replacing words with emoji and the emoji descriptor causing grammatical errors).

Selecting emoji is typically a visual search task, and it can be difficult for most users due to the growing number of emoji available. There has been some prior work to improve emoji selection interaction within mobile interfaces [40], although the research did not consider screen reader users. More recently, Zhang et al. [56] explored emoji search for people with vision impairments, but rather than rely on touch interaction, their solution utilised voice commands. Audio cues have also been used to facilitate picking emoji [38] and to enhance the Facebook emoji react feature [5].

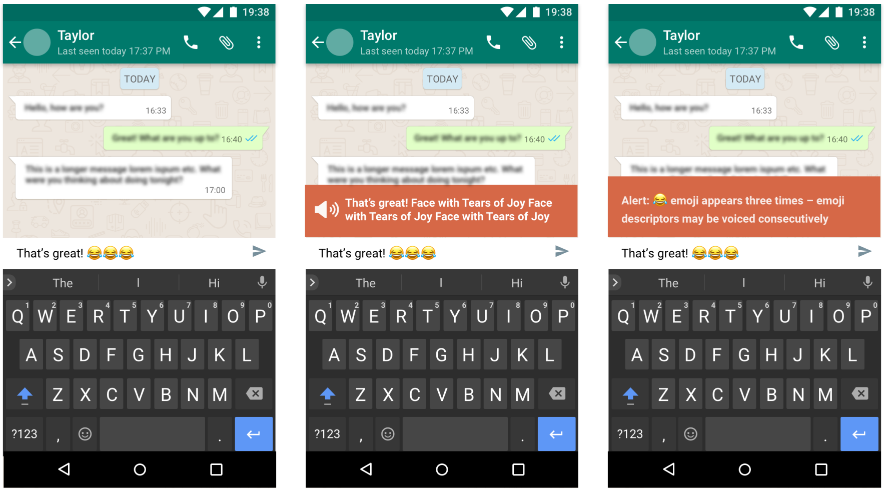
Tigwell et al. [51] did provide recommendations for using emoji in more accessible ways, such as avoiding long repetitions of emoji (e.g., So funny! 😂😂😂" vs. "So funny! 😂), placing decorative emoji at the end of sentences (e.g., It is ☀️ today." vs. "It is sunny today ☀️"), and being explicit about the intended meaning of the emoji in the text in case the emoji descriptor differs from how the sender interprets its visual design (e.g., Oh? 🧐 vs Oh, I'm intrigued 🧐). However, Tigwell et al.'s paper did not collect data from sighted users about their awareness of emoji accessibility issues and they did not explore how best to provide sighted users with accessibility recommendations when writing messages with emoji.

3 QUESTIONNAIRE - METHOD

To understand how to provide accessibility writing support to sighted users when using emoji, we ran an online questionnaire, with people who did *not* self-identify as having a vision impairment. An online questionnaire allowed us to collect a much larger dataset from a more diverse group of participants than would have been likely with an in-person lab study on a university campus.

3.1 Materials

We divided our questionnaire into three parts. The initial section focused on general demographics, including age, gender, and emoji usage. The second part involved a design evaluation task, where participants were presented with example messages in three different designs (see Figure 1). Participants were given the option to edit each message they read before sending. If participants chose to edit, then they were asked to type out the edited message. Finally, we concluded the questionnaire with closing questions that focused on participants' preferences regarding the accessibility support designs.



That's great! Face with Tears of Joy Face with Tears of Joy Face with Tears of Joy

Alert: 😂 emoji appears three times – emoji descriptors may be voiced consecutively

That's great! 😂😂😂

A) No Support B) Preview Support C) Alert Support

Fig. 1. Examples of the images shown within the design probe for each prompt for message 1_A_2: A) No Support, B) Preview, and C) Alert. The screenshots are based on WhatsApp and use iOS emoji.

3.1.1 Accessibility Support Designs. We used Sketch (sketch.com) to recreate a WhatsApp interface (whatsapp.com). We chose WhatsApp as the basis for our message platform because it is a widely used application for communication across different contexts. WhatsApp has its own set of emoji designs, which are used on both iOS and other platforms. However, since the WhatsApp designs are based on iOS emoji, we decided to use iOS emoji in our message prompts for simplicity. We designed three probes for our study: No Support, Preview, Alert support (details below)[1]. Within each design, the current message thread would be blurred to draw attention to the message being "typed" and to provide context that it was part of an ongoing message thread. We also made clear that the message was being sent to Taylor, the persona in our scenario who uses a screen reader.

3.1.2 Design Rationale.

A) **No Support**: This design provided no specific accessibility support and resembled the default appearance of WhatsApp. We included this to understand sighted people's initial assumptions and attitudes towards editing messages when considering their conversational partner is a screen reader user.

B) **Preview**: This design provided a basic text transcript a screen reader would relay displayed above the message entry box. We chose to represent the transcription in the simplest form, without any additional edits by the screen reader software (e.g., some screen readers may add the word emoji or simplify repeated emoji — *three face with tears of joy*). An example is shown in Figure 1.B, with a message that has the "Face With Tears of Joy" emoji repeated three times, resulting in the full message reading as "That's great! Face with Tears of Joy Face with Tears of Joy Face with Tears of Joy".
Before being presented with the message prompts with this design, participants were presented the following: "The next seven questions will show a 'Preview' box above the message draft for Taylor. This Preview box will display each message in the way that Taylor will hear it from their screen reader. Similar to the previous questions, it is up to you to send each message as it is or to edit it before sending it to Taylor."

C) **Alert**: The design highlighted potential accessibility challenges within the messages using an alert box above the message entry box, following the guidelines outlined by Tigwell et al. [51]. For instance, in Figure 1.C, since the Face with Tears of Joy is presented three times, the alert shows "Alert 😂 emoji appears three times - emoji descriptors may be voiced consecutively".
Before being presented with the message prompts with this design, participants were presented with the following: "The next seven questions will show an 'Alert' box above the message draft for Taylor. This Alert box will warn you about potential accessibility issues. Similar to the previous questions, it is up to you to send each message as it is or to edit it before sending it to Taylor."

3.1.3 Emoji Message Prompt Sets. We collaboratively developed the messages for the prompts. We started with three categories of issues caused by emoji in messages, which are based on the guidelines introduced by Tigwell et al. [51]. Each of the categories have sub-issues, and we had three messages for each sub-issue. This resulted in three sets of messages. Our final categories were:

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[1] We based our designs on how VoiceOver—a popular screen reader—spoke aloud at the time. Since completing our work, VoiceOver has received an update to narrate emoji in a concatenated way, e.g., saying "three grinning face", however, older versions of VoiceOver still say "grinning face, grinning face, grinning face."

Table 1. Our final prompt message sets organized by emoji sub-issue. The three categories of issues caused by emoji are based on the guidelines introduced by Tigwell et al. [51]. The three categories are: 1) Number of emoji, 2) Placement of emoji, and 3) Purpose of emoji.

Emoji sub-issue	**Prompt Set 1**	**Prompt Set 2**	**Prompt Set 3**
1.a) Three duplicate emoji	I got an A in the exam 😎😎😎	I don't think I can do this 😭😭😭	That's great! 😂😂😂
1.b) Two emoji pairs	Congratulations! 👏👏🎉🎉	School starts tomorrow 😞😞😰😰	Looking good 💯💯👌👌
1.c) Three related emoji	I miss you too 😘💕🥰	Starting university next week 📚🎒🤓	Out of office is on ✈️🌎🌮
2.a) Emoji within sentence	What a sunny ☀️ day!	It's her birthday 🎂 today	I booked a dentist 🦷 appointment
2.b) Emoji at beginning of sentence	😯 What happened?	🥳 Congratulations on your 10th anniversary!	🥰 I'd really appreciate that
3.a) Potentially ambiguous emoji	It's so cute 🥺	I know right 💁‍♀️	How did last night go? 👀
3.b) Unintended long emoji descriptor	Good luck 🤞🏾	I can't believe they did that 🤦🏻‍♀️	We'll be there! 👫🏾

1) Number of emoji - The number of emoji within a message leads to long or repetitive spoken output by a screen reader: **a)** Repeating one emoji, **b)** Repeating a sequence of emoji, and **c)** A sequence of different but related emoji.

2) Placement of emoji - The placement of emoji within the message such as within a sentence or where it disrupts a coherent voiced output by a screen reader: **a)** Within a sentence, and **b)** At the beginning of the sentence.

3) Purpose of emoji - When the descriptor of the emoji may not match the intended purpose: **a)** Ambiguous emoji that can be interpreted differently between individuals or cultures, and **b)** Unintended long emoji descriptors, especially in the cases of emoji with modifiers (e.g., gender, skin tone), where the base emoji is often simple (e.g., "Woman Facepalming" 🤦‍♀️), but users may be unaware of the extra descriptors that will be voiced when customising the emoji or how those additional details are placed within the full description (e.g., "Woman Facepalming: Light Skin Tone" 🤦🏻‍♀️, where it may be more natural for someone to voice "light-skinned woman facepalming").

The content of the messages were then further inspired by some of the examples discussed by Cramer et al. [7], Tigwell et al. [51], Weissman and Tanner [53], and Wiseman and Gould [55]. In total, we had three message prompts for each sub-issue, and these are presented in Table 1.

3.2 Procedure

3.2.1 Design Evaluation Task. Participants were provided the following that explained the scenario:

"Imagine you're chatting with Taylor, a friend of yours who is blind. Taylor uses a screen reader to listen to a spoken version of the messages you exchange in your favourite messaging app. Next, we will show you a set of messages with emoji and ask about whether and how you would edit them before sending them to Taylor. You may or may not want to use emoji in your edited messages, this is totally up to you. In case you do, and are currently using a computer, you can open an emoji menu with the following commands while you're typing on a text field:
Mac: Control + Command + Space, Windows: Windows key + ; (semi-colon) or Windows key + . (period). If you're using a mobile device, you can access emoji from your mobile keyboard."

As a form of quality control, we also asked participants to demonstrate that they were able to type emoji on the device they were completing the survey from. The question showed an image of a message that read "I can type emoji 👍" with the text: "Please re-type the following text (including the thumbs up emoji) to make sure that you can type emoji:".

Our evaluation task had participants evaluate 21 total message prompts. For each of the three designs, each participant evaluated a set of seven message prompts. All participants started with Prompt Set 1 (Table 1) with *no support*. Since both Preview and Alert could potentially teach participants about accessibility problems, we counterbalanced their order across participants using a Latin square. Here, we want to emphasise that the study is *not* an experiment but a qualitative survey. However, the survey asks participants to describe how each design helped them write more accessible messages as well as which one they preferred, so we presented them in a balanced order across participants to minimise the potential impact of recency effects. To generate a more diverse range of responses and opinions, we also alternate the combination of Preview and Alert with Prompt Set 2 and Prompt Set 3. The prompts can be seen with their support format in Table 2, Table 3, and Table 4 where 1_A_1, refers to category 1, issue A and prompt set 1.

For each message prompt participants were shown the following message: "Imagine you have drafted this message to your vision impaired friend, Taylor. Here is what it might look like on your device", and then a screenshot for that message/design was displayed as shown in Figure 1. Participants were then asked: "Considering the recipient is your vision impaired friend, Taylor, which of the following would you like to do?" and given the options to either "Send the message as it is", "Edit the message before sending it" or could respond with "I'm not sure". If participants chose to edit, they were asked to re-write the message with the changes that they thought were necessary to make it more accessible to a friend with a vision impairment.

We chose not to ask participants why they edited a message as we anticipated that probing into the reasons for their edits might be perceived as an extra burden by participants, potentially considerably extending the duration of the survey and affecting the overall quality of their responses. Our primary interest was in understanding participant strategies employed when attempting to make the message more accessible to their friend with a vision impairment rather than going into the specific reasons behind employing those strategies.

The final message sets and text are provided in Appendix A (Tables 2, 3, and 4).

3.2.2 Closing Questions. On completing all message prompts, participants were asked to rank each design option in order of preference that they felt informed them the most about the potential issues that Taylor may experience when receiving the messages. Participants were then asked to list specific aspects of what helped and what didn't help about each of the design options.

We then captured closing demographics relating to prior experience with accessibility, assistive technologies, and whether they had messaged someone before who had a significant vision impairment (i.e., low vision, blind). Finally, we asked participants if they consciously adapted their messaging approach based on their knowledge of that person's vision impairments and were asked to explain how with some examples. We included the questions regarding accessibility knowledge at the end to minimise the effect of participants who might be tempted to do more reading about screen readers before completing the design evaluation task (i.e., we wanted to capture their approach to the study with their current knowledge).

3.3 Participants

Ethical approval was obtained from our IRB. We distributed the survey through social media (e.g., Facebook, Instagram, Twitter), Reddit (r/SampleSize), and university mailing lists. Admin permission was sought in all cases where we were outside of a group space. The survey was open from 07/2022 and our last response was collected on 30/01/2023.

In total, 200 participants completed our online questionnaire. Eighty-four participants were removed from our analysis—reasons for removal were: 32 participants consented but then did not continue, 11 participants did not demonstrate they could enter emoji, and a final 41 participants were excluded because they responded to a few message prompts and then quit.

We had 116 participants remaining. Participants completed the online questionnaire on a variety of desktop and mobile devices. All participants reported using emoji within the week before taking part in our questionnaire. None of our participants had a significant vision impairment.

3.3.1 *Age & Gender.*

Our participants were aged between 18-60 years-old (Mode=24; Mean=30.46; SD=8.80). Our participants' gender distribution[2] was: Man (97 participants), Woman (59), Non-binary (15), Prefer not to disclose (1), Prefer to self describe (4), and No response (5). Text responses included: Me (1), Genderfluid (1), Gender nonconforming (1), Genderqueer (1).

3.3.2 *Platform Usage.*

We asked participants to indicate which messaging apps they use (multiple responses were allowed): Whatsapp (67 participants), Facebook Messenger (65), Instagram (DMs) (59), iMessage (iOS SMS) (45), Discord (42), Messages (Android SMS) (41), Slack (35), Signal (20), Telegram (18), Snapchat (17), Line (11), Twitch (9), TikTok (DMs) (9), and WeChat (2). Twenty-six participants (22.41%) also indicated other responses, which included email clients, mobile apps, video conferencing/communication platforms, and social websites.

3.3.3 *Geographic Range.*

Our participants resided in the following countries: USA (37 participants), UK (25), Japan (9), France (6), Switzerland (5), Canada (4), Australia (3), Germany (3), Czech Republic (2), Finland (2), Spain (2), Argentina (1), Denmark (1), Hungary (1), Ireland (1), Israel (1), Mexico (1), Netherlands (1), New Zealand (1), Portugal (1), Russian Federation (1), South Korea (1), and Turkey (1). Six participants did not respond.

3.3.4 *Educational Experience.*

The educational experience of our participants was varied. Responses for the highest completed education were: University (Graduate or Postgraduate) (56 participants), University (Undergraduate) (31), High school or equivalent (13), Community college or preparatory school (pre-university) (8), Apprenticeship (3), Associate's degree (1), Professional degree (1). Three participants provided other responses that included: Some college (P35), Currently enrolled in undergraduate (P61), PhD (P85).

We asked participants to indicate if their education included any technical subjects because we wanted to gauge whether they might have learned about accessibility. All participants responded to the question and 70 participants (60.34%) indicated yes. Responses for this were categories as follows: Computer Science (52), Engineering & Math (12), and Other (14).

Please note there are participants that were grouped under two categories based on their responses. Furthermore, some of the responses refer to full degrees, while other times, responses indicate a small part of a degree or class within a course. Only one person explicitly mentioned accessibility, while other people listed programs/courses that might cover accessibility (e.g., HCI).

We asked our participants some further demographic questions after they completed the study:

3.3.5 *Accessibility & Assistive Technology Experience.*

Although many participants indicated that their educational background was not related to accessibility, we had 94 participants (81.03%) who indicated that they had prior experience with accessibility, while 18 participants (15.52%) had no prior knowledge of accessibility, and four (3.45%) did not respond to the question. Participants could

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[2] We allowed multiple responses and followed the recommendations of Scheuerman et al. [45].

provide information in an open text field to explain more, and 81 participants chose to provide details. We looked at whether the participants provided specific details on their prior experience that would be most relevant to our study (e.g., indications of knowledge on emoji accessibility issues, knowledge about screen readers, and learnt about access needs by communicating with people with vision impairments). Nineteen participants shared knowledge and/or experiences relevant to our study, 54 participants were less specific, and we cannot tell how much relevant knowledge and/or experiences they had (e.g., P4 said "*My job is in digital accessibility*"), and eight participants made it clear they had prior experience with accessibility but in a different subdomain (e.g., P113 said "*I knew about physical accessibility*").

We also asked participants the assistive technologies and features they were aware of (multiple responses allowed), and found: Text-to-speech (107 participants), Hearing aid/devices (105), Screen readers (102), Closed captioning (98), Magnifiers (94), High contrast mode (90), Braille input devices (69), Reduced motion blur (44), and Switch access (14). Four participants provided no response. Fourteen participants included other responses: Voice control (3 participants), Speech recognition software (2), Braille output device (1), Colour blind filter (1), Home button (1), One handed mode (1), Question unclear but knew of them (1), Reduced animation mode (P31), and one tags (1).

Finally, we asked our participants if they had messaged someone with a significant vision impairment. There were 29 participants (25.00%) who had messaged someone with a significant vision impairment, while the majority of our participants responded with no (62 participants; 53.45%), 21 participants were unsure, and four participants did not respond. Out of the 29 participants who had messaged someone with a significant vision impairment, 24 participants provided further information. We found that 19 participants would adapt their messaging style, while two participants did not, and three participants mentioned the person with a vision impairment they spoke to did not require them to adapt their messaging style. The adaptions reported included aiming for clear messages that were shorter and could be broken into multiple messages. There was a tendency to reduce or remove visual media such as emoji and GIFs, avoid poor emoji placement or multiple use of emoji, and describe images if they are going to be used or avoid images. Some participants would aim for more punctuation (e.g., P60 said "*yes, I have never used emojis when messaging the visually impaired student I work with. I use correct punctuation more often in case it affects the screen reader's tone.*") or using ASCII emoticons in place of emoji, and to avoid creative messaging practice (e.g., P76 said "*At the time keysmashes (i.e. hsgjskdjdndhdj) were very popular, and that person specifically said that they didn't want people to do that a lot because of their screenreader. Mostly we just followed whatever they requested.*").

3.4 Analysis

Positionality and epistemological stance. We are three sighted researchers. Two of us have experience conducting research at the intersection between HCI and Accessibility, while the other specialises in HCI and Social Computing. We designed this study with a qualitative mindset and conducted the analysis with a constructivist perspective, acknowledging that the reported results are the product of our interpretation and that the knowledge we contribute is a construction, not a discovery [12]. This is reflected in our analysis process in a number of ways: First, multiple coders annotated the data set to enrich the analysis with diverse viewpoints, and not as a means to increase the reliability of our interpretations, since we acknowledge the subjectivity that we bring into the research without considering it a 'bias' that needs to be controlled [6]. Second, we treated coding disagreements as an opportunity to enrich the interpretation of a response, generating notes about surprising insights, reconsidering the scope of a code or creating new ones; we did not keep track of our consensus and did not report an IRR since these practices do not align with the epistemological stance in which we positioned ourselves [32]. Third, we do not report counts or quantitative measures since we designed and deployed the survey with the purpose of generating diverse responses (e.g., from participants with different cultural and socio-economic backgrounds, in response to different prompts) rather than measuring or quantifying behaviour. In line with this, our analysis approach prioritised the identification of a range of insightful patterns in the ways that sighted users attempted to make messages with emoji more accessible rather than the exhaustive computing of frequencies for these patterns. For example, for each edited message, we assigned up to two codes describing how participants were attempting to make the message more accessible, prioritising the most representative codes and discarding less salient ones.

Data cleaning. We excluded 19 entries where participants described what they would change instead of rewriting the message (e.g., *"I think I'd reduce the emoji to a single one, otherwise it's going to be annoying for them"*, P32); 46 entries where participants indicated that they would correct the message but left the correction field blank; six entries where the rewritten message was exactly the same as the prompt; and one entry where the participant explained that they did not understand the meaning of the prompt message ("Out of office is on ✈️🌎🌮").

Coding process. We conducted a qualitative, open-coding analysis on all valid rewritten messages (1508). The codes described changes in the syntax and typographical features of the rewritten messages compared to the original prompts without considering the potential intention behind such changes. For example, codes included "Remove duplicates", "Remove all emoji", "Move emoji to the end", "Replace emoji with punctuation marks", and "Change order of emoji".

One author initially coded the first two-thirds of the data set and developed a set of initial codes. The other two authors then utilised these codes to analyse the remaining two-thirds of the data set individually, ensuring that each entry was coded by two authors. During the coding process, we also marked surprising or complex responses as "interesting" to later discuss with the entire team. We then conducted a series of meetings where we revisited the data set together, using code disagreements and "interesting" responses as shortcuts to discussing the most surprising patterns in the data, the definition and scope of each code, the creation of new codes, mistakes and contradictions across responses, and initial thoughts on implications for design.

During these discussions, we wrote down analysis notes on a shared document, which we used to inform and structure the main results of the study. One author grouped codes into larger categories of rewriting strategies for making a message more accessible to a screen reader user, which the team discussed and agreed on in the last meeting of this series. All notes about mistakes and contradictions across responses (e.g., cases where the rewritten message was *less* accessible to a screen reader user) were also grouped into three larger categories and discussed in a meeting.

Last, one author read all free-text responses to the question, "Please list specific aspects about what helped and what didn't help about each of the three designs", noting surprising or insightful opinions with accompanying quotes about what was perceived as helpful or confusing about each probe. These notes were discussed by the team, reflecting on how participants' explanations for their preferences, in addition to the rewriting strategies and misunderstandings about screen readers, pointed to implications for the design of tools for helping sighted users compose more accessible messages in conversations with a screen reader user.

4 RESULTS

We present the results of our analysis based on three main aspects: 1) Strategies to make messages more accessible, 2) Misunderstandings and incorrect assumptions about screen readers, and 3) PREVIEW vs. ALERT: what aspects of the designs were perceived as helpful to make messages more accessible?

Through detailed exploration using participant examples and quotes, we provide a comprehensive understanding of the strategies employed, misconceptions held, and preferences expressed by participants. We provide examples of different types of rewritten messages that our participants submitted, without emoji (Appendix B) and with emoji (Appendix C). We present the rewritten messages, and the participant quotes verbatim from the typed responses to the survey.

4.1 Sighted users' strategies for attempting to make messages more accessible

Participants applied diverse strategies attempting to enhance the accessibility of the given messages, which uncover patterns in their assumptions about how screen readers interpret emoji. We grouped these strategies into two overarching categories: those that avoid the use of emoji completely and those that attempt to use emoji in ways that may be more compatible with a screen reader.

4.1.1 ***Avoiding the use of emoji.*** Some of the most common strategies relied on rewriting messages so that they would not include any emoji. Although we lack data about the reasoning behind each message rewrite, we speculate that these strategies may feel more reliable, where sighted users take control over the words that the screen reader will pronounce. These strategies may also imply a belief that sending emoji to a screen reader user is problematic or meaningless. We identified four ways in which participants avoided the use of emoji:

Removing all emoji. The most common pattern among rewritten messages was to leave the original message as it was and simply remove all emoji (see Appendix B, Table 5 for examples). We speculate that this strategy was often adopted as a quick fix, however, it sacrifices the non-verbal aspect of the message conveyed by the emoji.

Rethinking the message from scratch. This strategy suggests an intention to convey the prompt's meaning through text alone, compensating for the non-verbal aspect of the removed emoji in writing (see Appendix B, Table 6 for examples).

In the case of decorative emoji, which are often used to "produce a larger effect on the recipient" [7], some participants "translated" them into phrasings that emphasised an aspect of the message. P57 rewrote "What a sunny ☀️ day! " into "What a beautiful sunny day!", emphasising a positive tone. In the case of the prompt "We'll be there! 👫🏾", P76 changed it to "We'll both be there!" and P51 to "We're coming for sure", translating the redundancy of the decorative emoji into a phrasing that conveys extra certainty.

In the case of emoji that conveyed emotions [7], the rewritten messages often included onomatopoeia or explicit descriptions of the emotion. For example, for "It's so cute 🥺", P39 wrote "Its so cute im going to cry! Squee", and P70 "Awww so cute". Another resource was to use special word spellings to manipulate the "attitude" or tone of the sentence (which we revisit in Section 4.2.2). For example, P111 rewrote "I know right 💁‍♀️" as "I know righttt", and P112 changed "I got an A in the exam 😎😎😎" into "So, guess what... Ya boy aced the exam", expressing some anticipation and a show-off attitude.

Some participants completely changed the message into what would seem a more personal way of expressing the same idea. For example, P51 changed "Congratulations! 👏👏🎉🎉" into a short and simple "woot!", and P8 into "Congratz".

Replacing the emoji with additional text. A large proportion of participants replaced the emoji in the prompt for text (e.g., an extra phrase, punctuation marks, and other textual markers), keeping the main content of the message the same as if they assumed the role of an "emoji translator" for the screen reader (see Appendix B, Table 7 for examples). Many replacements were extra phrases describing the feelings and actions evoked by an emoji (e.g., P89 replaced 🤞🏾 for "Keeping my fingers crossed for you") or verbalising emotional reactions (e.g., P63 replaced 😲 with "Oh no!").

Others seemed to more explicitly replace an emoji for a descriptor, typically indicating it as a separate part of the message in the form of a parenthesis or label, such as with different variations of brackets, the hash symbol, asterisks or dashes. Some descriptors featured wordings close to what a screen reader would voice, e.g., P87's "#birthdaycake" for 🎂or P26's "(facepalm)" for 🤦🏻‍♀️. However, descriptors were rarely the official ones; participants came up with their own. For example, P5 changed "I know right 💁‍♀️" into "I know right? (Kinky emoji)", and P53 into "I know right! <sassy hair flip emoji>". An interesting quality of these self-made descriptors is that they focus on describing the participants' interpretation of the emoji's intent (e.g., a "sassy" tone), or even a new, preferred intent (e.g., a "kinky" tone) rather than a strict description of how they look like.

A similar approach was translating emoji into actions of a similar tone, expressing them in the form of self-described "autonomous staged directions" [59]. When doing this, participants switched from their first-person perspective as message senders to describe their actions in third-person, bounded by asterisks. For example, P56 rewrote "I got an A in the exam 😎😎😎" as "I got an A in the exam *drops mic*", inviting the receiver to imagine them dropping a mic, a popular gesture signaling that one has just said or done something particularly impressive. P49 replaced 👏👏🎉🎉 for "*throws confetti*". These stage directions are popular in Internet culture as text-based, non-verbal cues to describe the situational context of the message. While these stage directions typically appear within bounding asterisks, some messaging platforms offer dedicated functionality for third-person action descriptions (e.g., IRC platforms and Discord offer users a "\me" command that they can type before a message to italicise it and indicate it as an autonomous stage direction). P26's rewriting of "I know right 💁‍♀️" as "I know right /sass" reminds us of such commands, indicating /sass as an invitation to imagine the sender saying the message with a "sassy" intonation.

Another way of conveying the tone expressed by emoji with just text was to use punctuation marks instead. Some participants used repeated question marks and exclamation marks as a resource to emphasise the surprise, worry, excitement or curiosity intended in a message. For example, P53 rewrote "😲 What happened?" as "What happened????", and P82 changed "Congratulations! 👏👏🎉🎉" into "Congratulations!!!".

Last, a few participants replaced the emoji for their "ASCII emoticon" equivalent, e.g., P87 replaced 😲 with ":-O", and P79 replaced 😂😂😂 with ":D". Here, we find it interesting that participants may assume that just because these expressions are composed of text characters they are screen-reader friendly. Unfortunately, this greatly depends on the screen reader settings of the receiver, and in most cases it may fail to convey what the sender means.

Most of these examples show very interesting attempts at compensating the non-verbal information of the emoji in text, but unfortunately, using punctuation marks to indicate intonation or to denote a parenthesis, a staged direction, or an emoticon is generally not suitable for making messages more accessible to a screen reader user. We analyse this in more detail in Section 4.2.2.

Replacing the emoji with alternative media. Only one participant used this strategy, but it shows an interesting approach to conveying non-verbal cues in the modality of the receiver (audio) rather than the sender (text) (see Appendix B, Table 8 for the example). P15 changed "Congratulations! 👏👏🎉🎉" into "Congratulations! https://youtu.be/nYwAHURPQ-s", and "🥳 Congratulations on your 10th anniversary!" into "Congratulations on your 10th anniversary! https://youtu.be/nYwAHURPQ-s", pointing to a 1-second video that plays the sound of a party horn. When encountering a URL, A screen reader would typically say "link" and then vocalise the URL, it might read out the title of the link but it depends on how it was inserted into the message.

4.1.2 *Adapting the use of emoji.*

These are strategies where participants chose to either keep the original emoji in the message or include others, and modify other aspects of the message to make them more accessible to a screen reader user (e.g., changing their placement in the message, changing the text so that the emoji descriptor fits better).

Shortening the overall length of the voiced message. Most of the examples in this strategy preserved the verbal content of the message and tried to reduce the words dedicated to emoji descriptors (see Appendix C, Table 9 for examples). For example, a common pattern was to remove duplicate emoji: P2 changed "Congratulations! 👏👏🎉🎉" into "Congratulations! 👏🎉", and P13 changed "I don't think I can do this 😭😭😭 " for "I don't think I can do this 😭". While repeating emoji usually emphasises an emotion, when considering a screen reader user as the receiver, these participants chose to avoid that redundancy.

Some also chose to reduce the number of emoji to one. In the cases of prompts that had different emoji in a row, we speculate that participants chose the emoji that best represented the emotions or situational meaning conveyed by the set. For example, P30 rewrote "School starts tomorrow 😞😞😰😰" as "School starts tomorrow 😰", and P3 rewrote "Starting university next week 📚🎒 🤓" as "Starting university next week 📚". When reducing the number of emoji, some chose different emoji from the ones in the prompt message as a personal approximation to the meaning that the whole sent expressed (e.g., P22 changed "I miss you too 😘💕🥰" into "I miss you too ❤️").

Overall, this strategy illustrates an effort to preserve the expressive quality of emoji as non-verbal cues without overwhelming the screen reader user with voiced descriptors. Besides reducing the number of emoji, some added text (similar to Section 4.1.1) to reinforce the meaning of the emoji in their message. For example, P5 rewrote "I got an A in the exam 😎😎😎" as "I got an A in the exam 😎 how cool is that?!". As an opposite example of adding text, P74 decided to rewrite "I can't believe they did that 🤦🏻‍♀️ " by removing all text and simply responding a 🤦🏻‍♀️ emoji. Last, others changed an emoji with a skin tone modification to the same emoji in its default, yellow version, resulting in a shorter descriptor.

Clarifying the meaning or tone of emoji. This strategy represents cases where participants tried to "help the screen reader user" by clarifying the intended meaning of the emoji with text (see Appendix C, Table 10 for examples). For example, a few participants added their own descriptors next to the emoji: P18 rewrote "Congratulations! 👏👏🎉🎉" as "Congratulations! 👏👏🎉🎉 (claps & streamers)", and P19 changed "I got an A in the exam 😎😎😎" into "I got an A in the exam 😎 [person with sunglasses emoji]". The clarifying text might suggest that the participants did not know that emoji are voiced by screen readers, or perhaps they wanted to make sure that their intended meaning was explicit regardless of how the emoji was pronounced. In either case, the screen reader will voice both the emoji and the clarifying parenthesis, potentially making the message even longer, redundant, or complex.

Others added punctuation marks, likely in an attempt to clarify the meaning of the message by manipulating its intonation (see Section 4.2.2), or added text preceding the emoji, expecting the screen reader to "complete the sentence": P110 appropriated "I got an A in the exam 😎😎😎" into "I got an A in the exam, I'm feeling like a 🦚".

Last, as a different approach to clarifying the intended meaning of an emoji, some participants chose to swap the prompted emoji for another one with a less ambiguous descriptor. For example, in the case of an ambiguous emoji such as in "I know right 💁‍♀️", P18 changed it for 😬, P22 for 😉, and P116 for 😕, where each adopted their own interpretation of "the right" message to send.

Isolating the emoji to distinguish it from the main message content. For message prompts with emoji in the beginning or middle of a sentence, many participants moved emoji to the end, in line with prior recommendations [51] (see Appendix C, Table 11 for examples). By repositioning the emoji, participants prioritised a clear understanding of the main message, which also contextualises the meaning of the emoji. Three participants thought of more explicit ways of marking a separation between the verbal part of the message and the emoji: P13 proposed to split “😯 What happened?” into two messages: one for 😯, and the second for the text. And P11 and P19 explicitly “announced” the emoji at the end of the sentence, e.g., “I can’t believe they did that [Emoji] 🤦🏻‍♀️”.

4.2 Misunderstandings and incorrect assumptions about screen readers

Participants’ rewritten messages often introduced new accessibility issues, signaling misunderstandings and incorrect assumptions about how screen readers work. Two key issues were identified: participants lacked knowledge about accurate emoji descriptions, and used textual markers that were incompatible with screen reader functionality.

4.2.1 *Unknown emoji descriptors*.

Selecting similar-looking emoji. Some rewritten messages suggested accidental selections of different emoji from the ones in the original prompt. For example, P2 rewrote "What a sunny ☀️ day! ” as "What a sunny day! 🌞", replacing the sun emoji ☀️ with the “sun with face” emoji 🌞. We cannot be certain about whether these differences were deliberate or not, but they helped us reflect on scenarios where a sighted user may not consider or notice a subtle difference in the design of two emoji, unaware that their descriptors may convey different emotions when voiced. For example, in the case of the prompt "School starts tomorrow 😞😞😰😰", P18 rewrote it as "School starts tomorrow 😩😨”. The emoji look very similar, where 😞 and 😩 both have closed eyes and a downward-curved mouth, and 😰 and 😨 both have blue foreheads, though the first one also has downward-curved eyebrows and sweat. The original message uses emoji to convey a feeling of disappointment and anxiety, while the rewritten one conveys distraught and fear.

We believe it is important to support the deliberate and conscious selection of emoji and to avoid situations of accidentally choosing a visually similar emoji, since voiced descriptors may leave less room for interpretation than the visual representation of the emoji (e.g., "Fearful face with blue forehead"). Similar examples include P7’s "School starts tomorrow 😞😢", swapping 😰 for the crying emoji 😢, and P16’s "School starts tomorrow 😔😓", swapping 😞 for the “sad pensive” emoji 😔 and 😰 for the “downcast face with sweat” emoji 😓.

Replacing emoji for others with longer descriptions. In Section 4.1.2, we illustrate how some participants changed the emoji in the prompt to clarify the intent of the message (according to their interpretation). We observed a few examples where, in doing so, they selected emoji with very long descriptors. For example, P50 changed “I know right 💁‍♀️” to “I know right 💅🏻” using an emoji that VoiceOver, for example, reads as “Nail Polish Being Applied To Fingers with Light Skin Tone”. Most of these cases were related to the use of skin tone modifiers. For example, P36 changed “Congratulations! 👏👏🎉🎉” to “Congratulations! 👏🏻🎉” (“Clapping Hands With Light Skin Tone”), and P26 changed “ Looking good 💯💯👌👌” to “Looking good 👌🏻” (“Ok Hand With Light Skin Tone”). Emoji are often used as a way of expressing identity [7, 18, 49], however, it can feel overly repetitive to voice a skin tone modifier for every emoji that has one. We speculate that some participants had customised their emoji keyboard to apply a particular skin tone modifier to all emoji that afforded it, or that they chose some of the emoji from their recently used list. While it is up to each user to decide whether this is an issue for them or not, we believe it is important that sighted users are aware of the extra words added by modifiers (e.g., gender, skin tone) so they can choose to do this deliberately rather than by accident.

4.2.2 ***Textual markers that lack screen reader support***. Some strategies replaced emoji for textual markers to convey the tone or emotional expression of the original message, such as exclamation marks (e.g., changing “It’s so cute 🥺” to “It’s so cute!” (P29)) or capitalised words (e.g., “TEARS OF JOY!” (P51)). As described in Section 4.1.1, we believe that these strategies aim at translating visual, non-verbal cues (i.e., the emoji) to purely verbal expressions. However, some examples suggest that participants were often unaware that they used text in visual, non-verbal ways that screen readers either ignore or misinterpret. For example, while sighted users may interpret the all-caps and exclamation mark in “TEARS OF JOY!” (P51) as a scream of excitement, VoiceOver voices it in a plain way, the same as “tears of joy” in lower case with no exclamation mark. Other misunderstandings regarding how textual markers are (or are not) voiced included:

Repeating question and exclamation marks. Screen readers typically have a flat intonation. For example, VoiceOver uses the same type of falling intonation to pronounce “I know right.” and “I know right!”, and adds an extremely subtle rising intonation for “I know right?”. However, many participants used exaggerated punctuation as a way of indicating an exaggerated intonation in the text, which usually makes no difference to the screen reader. If a sighted user means to convey non-verbal information in a message about its tone, including an emoji, e.g., “I know right 😉” would be a more accessible approach to repeating punctuation marks, e.g., “I know right??” (P64).

Using ASCII emoticons. A few participants replaced emoji for ASCII emoticons, however, not all screen readers interpret emoticons as such, or may depend on customisations to indicate how to pronounce them. In general, punctuation marks are ignored. For example, the default configuration of VoiceOver would read the happy emoticon “:D” as the name of the character “D” (“dee”), and the smile emoticon “:)” may not be pronounced at all.

Elongating words. Some participants attempted to convey the intended intonation of a message by “stretching” a word, e.g., typing “noooo” instead of “no” (P77) for a dramatic effect. However, screen readers do not interpret word elongations as a tone indication. In the case of “noooo”, VoiceOver pronounces it as “noo” (as in “noon“). Similarly, P112’s example “Soooo... how did last night goooo?” is voiced as “Soo [pause] how did last night goo?”.

Separating the main text from text representing non-verbal cues with punctuation. Many rewritings were based on replacing emoji for a descriptor invented by the participant, e.g., “It’s so cute (googly eyes)” (P51), or for an autonomous stage direction describing an action performed by the sender, e.g., “I got an A in the exam *drops mic*” (P56). We find it interesting that the text replacing the emoji is typically separated from the rest by punctuation marks such as different types of brackets, asterisks, etc., to mark a difference between “the main message” and its “non-verbal complement”. However, these markers will most likely not be pronounced by the screen reader or pronounced quite literally, which may not match the effect the sender intends. For example, VoiceOver pronounces “I can’t believe they did that (facepalm)” (P26) as “I can’t believe they did that facepalm”, and in the case of “I got an A in the exam *drops mic*”, it pronounces “I got an A in the exam star drops mic star”.

4.3 Preview vs. Alert: what aspects of the designs were perceived as helpful to make messages more accessible?

When asked to rank each design option in order of preference, most participants ranked the Preview design first (88 participants). Only 12 participants ranked the Alert design first, 11 preferred having no support, and five participants did not respond. Next, we provide some insights into those preferences.

4.3.1 Seeing the emoji descriptors. The design aspect that helped participants the most was being able to read the emoji descriptors. Preview always displays the descriptors, but Alert only did it for selected prompts. We had expected participants to have some degree of familiarity with emoji descriptors, for example, from emoji shortcodes [11] in apps like Discord, Teams or Slack (e.g., “:heart:” or “(heart)” for ❤️) or searching with keyboards in an emoji menu. However, many seemed to *“have no idea what the emojis are actually ‘named’”* (P91). P92 said: *“ For the first and second set of questions, I had no idea how emojis were described. So only used fairly simply happy / sad expressions so as not to confuse Taylor.”* One participant even thought that the emoji descriptors shown in each prompt were our own invention, disagreeing with the meanings *we* had chosen: *“The preview was the most literal, but most of them were wrong in identifying the meaning of the emoji. You should put more efforts in being accurate regarding the most common and average meaning.”*(P54). We discuss more examples of this in Section 4.2.1. Especially when prompted with a message using Preview, most participants felt that they knew “exactly” how it would be voiced by the screen reader. Participants often explained the advantage of Preview as a tool that let them know *“exactly what it will sound like”* (P84) or “exactly how Taylor will hear it” (P107), *“which made spotting potential issues very straightforward”* (P30). P11 explained: *“In preview, one can really see the impact of the way we type and insert emojis. It’s a sort of WYSIWYG [What You See Is What You Get] mode.”* We believe that seeing the emoji descriptors in context, visualising how they modified the entire message without having to imagine it, is the main factor that made Preview the favourite choice. However, we want to emphasise that the perceived accuracy in the translation of a message with emoji into “screen reader language” is not really as it seems, and may not help sighted users to realise that the voice they hear when reading the Preview message is simply how *they* read it “in their heads”, leading to mistakes as those discussed in Section 4.2.2. For example: *“The third was very helpful reading exactly as Taylor would hear the message, this encouraged me to avoid emojis all together and use punctuation instead”* (P92).

Last, participants with experience in emoji accessibility and screen readers also appreciated that they could read the descriptors, noting that they sometimes forget or ignore the descriptors of particular emoji. Even experts may miss the difference between an emoji with a skin tone or gender modifier and its default version. For example, P30 said: *“I forgot that some screenreaders will take an exceptionally long time to read out emoji with skin tone modifiers until I got reminded by the preview method later on.”* Moreover, even though experts would know how to “test” their message before sending it, seeing the descriptors in the context of the typed message can promote a more immediate messaging experience:

> “For the most part I understand how screen readers work and the need to limit emojis for access, so the most helpful thing for me is to see how each one will actually be read out to save me from needing to test it myself with the screen reader option on my phone or looking it up. I don’t personally need advice on other stuff like limiting unnecessary emojis, I just need to be able to make sure the emoji name matches intended meaning (P14)”

4.3.2 Recognising potential problems by oneself instead of “being told what to do”. A strong pattern among the participants that preferred Preview was that they felt Preview was letting them “empathise” with the screen reader user and understand what would make a message more clear or less “annoying”. For example, P51 explained: *“ communicating the exact experience (rather than having it described) seems a stronger way to build empathy”.*

We find it particularly interesting that some participants felt very strongly about having complete control over their expression and their choice of whether a message needed to be improved for accessibility, even though the task was to rewrite messages that were not originally their own: *“I liked the alerts less, because I feel like it took away from my judgement as to what I was actually trying to communicate”* (P53). P38 showed this by framing Alert and Preview as opposites in this regard: *“[Preview] also invites the user to decide for themselves if the message is accessible, whereas the alert could be seen as telling the user what to do.”* The accessibility problems that Alert indicated were often perceived as a form of reprimand instead of a helpful pointer, which triggered defensive, negative attitudes among some: *“The alert has an annoying hectoring quality: I would avoid using emoji, or avoid texting Taylor altogether”* (P17).

> “Alert is unclear and confrontational. It feels like you’re being told off. (...) I get bored reading it and I feel detached and personally more likely not to change my message in defiance. ‘Don’t tell me what to do’ vibes.” (P112)

Ultimately, being able to judge accessibility problems by themselves and how to address them points to a more subjective understanding of accessibility in the context of messaging with a screen reader user. For example, P1 characterised Alert as "babying", as *“as people who use a screen reader can still understand the deeper meaning of emoji”*. Other participants liked repurposing the accessibility issues presented in Tigwell et al. [51] as opportunities for sending funny messages, also suggesting more subjective perspectives on what is accessible and what is not:

> “It also allows some creativity as sometimes infringing the rule can be done on purpose to use emojis creatively to convey meaning. So I might choose to type 2 emojis consecutively to create a fun voice effect.” (P11)

> “I use emojis for satire, so I removed emoji uses that were serious. I kept some of them because I found their text to speech versions even funnier than the regular emoji ones (eg the 💯💯👌👌 one is already satirical and funny because nobody actually writes like this, but it is much funnier when you hear a robot voice taking 15s to read it out).” (P24)

4.3.3 Considering a different perspective on what can be experienced as an accessibility issue. On the other end of the participants who saw Alert as confrontational or hectoring, others highlighted its value in warning about potential accessibility issues that seemed less trivial to them:

> “The alert method is useful, too, but is maybe a bit too abstract. It may not be immediately obvious whether a message is going to be truly bothersome to Taylor just from the description alone. However, it did alert me to problems I didn’t consciously consider before, such as emoji immediately at the start of the message being confusing.” (P30)

> “The preview gave a special insight into what Taylor would be receiving that the alert did not but the alert flagged up problems I would have never considered even with the preview (i.e the description that was too long) so they both have their benefits.” (P69)

In line with taking a more subjective perspective on emoji accessibility, some reflected on potential individual differences across messaging users. For example, P33 pointed out that *“(Both sighted and blind) people have different preferences based on the chat context, the alert might not always be proper”*, challenging the idea of having general guidelines about how to use emoji with screen reader users. P53 went as far as imagining customisable designs where a sighted user and blind friends could define their own “alerts”:

> “I also wonder though if people texting with this plugin would have the chance for their blind friends to input their preferences for different emoji behaviors (in the form of a quick questionnaire or something) and then when texting individuals, it could give you the heads up like "*remember that Anne hates emoji so like seriously stop it*" or "*Raj likes the impact of emoji, fire away in most cases, just keep them after the message because they’re confusing before or in the middle of sentences*"” (P53)

5 DISCUSSION AND IMPLICATIONS FOR DESIGN

Our work focused on understanding how to help sighted users consider the accessibility of emoji when messaging a screen reader user, and we approached this by exploring support designs that could promote the adoption of Tigwell et al.’s recommendations [51].

5.1 Summary of Findings

Our study addressed three research questions related to the awareness, adjustments, and assumptions of sighted users regarding emoji accessibility for screen reader users. We found that participants employed various strategies when rewriting messages, ranging from removing emoji altogether to adapting their use by clarifying meaning or isolating emoji within the message. Despite some prior awareness of accessibility, participants held misconceptions about screen readers, as evidenced by their use of ineffective descriptors and use of unsupported textual markers.

Furthermore, our findings demonstrate a preference for PREVIEW over ALERT, as it allowed participants to independently assess the accessibility of each message. Our findings provide insights into the importance of raising awareness among sighted users, promoting adjustments in messaging practices, and dispelling misconceptions to enhance emoji accessibility for screen reader users.

5.2 Sighted Users' Messaging Practices

Tigwell et al.'s guidelines [51] were grounded in survey and interview data with a focus on screen reader users and proposed that people who use emoji should be mindful of the number of emoji in a row, the placement of emoji in sentences, and that emoji descriptors may not match sender's intent. Our analysis of how sighted users try to make messages with emoji more accessible extends and challenges these recommendations (as well as similar resources such as [28, 47]) in the context of messaging, providing insight into how to design tools that can enhance sighted users' understanding of how their messages are received by a screen reader user.

First, some of the rewriting strategies were aligned with Tigwell et al.'s recommendations especially those focused on shortening the overall voiced message, such as removing duplicates, reducing the number of emoji, and isolating the emoji from the rest of the message so that they are voiced at the end. Replacing an emoji for another one in cases of messages with ambiguous emoji also aligns with such recommendations. However, most participants explained that without knowing the emoji descriptors it is challenging to understand whether a message has accessibility issues or how it should be adjusted to be compatible with a screen reader. This was the case even for expert users who know about how emoji can interfere with screen readers. Based on these results, we argue that sighted users could greatly benefit from situated and interactive support for writing messages that are compatible with screen users, and that it is crucial to uncover emoji descriptors for promoting the adoption of any guidelines for authoring content (e.g., writing a message) with non-verbal cues intended for screen reader users.

Second, we found that the most common approach to improving the accessibility of messages with emoji was simply to remove the emoji entirely. This strategy suggests a prevailing perception that sending emoji to a screen reader user might be unhelpful. Unfortunately, the result is a message that lacks any form of non-verbal communication, and we do not want to encourage the avoidance of using emoji. In some cases, participants chose to omit emoji from their messages but cleverly rephrased the content to retain the emotional, situational, or emphasising function that the emoji was conveying, but, in doing so, this approach led to the use of other non-verbal, text-based expressions that could be considered inaccessible. These included elongating words, using all caps, repeating questions and exclamation marks, and denoting emotions or actions with parenthesis or bounding asterisks. These insights suggest that messaging recommendations for sighted users should be careful not to discourage the use of emoji, while also offering guidance on alternative non-verbal means of communication. It is important for sighted users to be aware that even though these alternatives rely on text, they are still visual in nature and, most often, incompatible with screen readers.

Third, our results illustrate a subjective view on whether and how a message is more accessible to a screen reader user. This challenges the notion of promoting guidelines as generalised principles to follow, since the concept of accessibility may be informed by individual perspectives. For example, some of the emoji accessibility issues identified by Tigwell et al., such as repeating the same emoji multiple times, can be appropriated as a source of humour or teasing among users. This indicates that what may be considered inaccessible in one context could be perceived as a dedicated joke in another. Moreover, even when provided with explicit warnings about accessibility, sighted users may still "disagree" with them. Given the diverse strategies we found for making a message with emoji more accessible without losing its tone, situational meaning, or emotional connotations, we believe that this subjective perspective on accessibility may stem from prioritising personal expression over adhering to generalised guidelines. Many participants expressed a preference for the PREVIEW approach over ALERT, especially because PREVIEW's proactive nature allowed them to assess accessibility issues on their own. In some cases, this assessment was based on previous interactions with blind friends. The flexibility of PREVIEW avoided imposing restrictions on personal expression. In contrast, ALERT was seen as constraining, prescribing issues out of context and potentially making the sender feel limited in expressing themselves freely. This calls for adaptable approaches that consider individual perspectives when guiding sighted users about accessibility in messaging practices.

5.3 Implications for Supporting Messaging Accessibility

These insights point to implications for the design of tools to support sighted people when messaging screen reader users. First and foremost, emoji descriptors should be visible during emoji selection. For instance, descriptors could be displayed in emoji menus or as part of keyboard autocomplete suggestions. This approach would assist sighted users while composing messages, enabling them to ensure that their intended message is accurately conveyed since prior work has found people tend to replace words with emoji, and this can result in grammatical errors [51]. We believe that this preemptive visibility of descriptors could be more user-friendly than simply pointing out potential accessibility issues after the message is written. By having access to descriptors during selection, users can make more deliberate choices regarding whether a long descriptor is appropriate for a particular message, or if the descriptor aligns with the desired emotional or situational context they wish to express. Additionally, seeing the descriptors in the context of the composed message may also help to identify potential issues related to the placement of emoji.

One of our participants shared a link to audio in their rewritten messages, which raises the question of whether research should look into supporting auditory-based solutions to improve the accessibility of emoji use. Gleason and colleagues have explored both alt text descriptions and audio descriptions to improve the accessibility of GIFs and memes [16, 17], which are other popular visual media used in communication, especially on social media platforms. For GIFs, it was recommended that the content producers create the audio descriptions [16], whereas the idea explored for memes involved the meme creator using templates and placeholders, which are then populated using an established database of meme templates [17]. However, it is worth acknowledging that, unlike GIFs and memes, emoji are already part of an established process for development through the Unicode Consortium, which means there is more control over the emoji that exist and what the given text description is. Therefore, it may not be necessary to develop databases and templates, but there could be an opportunity to collaborate with the Unicode Consortium to identify whether audio alternatives are possible beyond the already established emoji descriptor. Considering the continued growth of social media and challenges related to social media accessibility [15], and also acknowledging the use of emoji within the space of social media, there is a need for more future work to help to make social media spaces more accessible [14].

In addition to guiding sighted people in making messages more accessible, there may be a need to further explore how screen readers can be programmed to manage common accessibility issues. Prior work did find that screen readers can support custom settings to address emoji issues (e.g., avoid voicing a string of emoji), but those settings are not always known and could be unique to specific screen readers [51]. There is also the challenge when software, such as screen readers, is running on different versions. We mentioned in Section 3.1.1 that VoiceOver had received an update for narrating emoji in a concatenated way, meaning newer versions of VoiceOver will say "three grinning face", while older versions of VoiceOver say "grinning face, grinning face, grinning face." Therefore, we still need to provide guidance to sighted people, especially for more complex scenarios where it might be best to allow a sighted person to design how best to convey the message they want to send and not rely on the software corrections.

Moreover, in messaging apps, where the sender and receiver are well-known, there is an opportunity for designs tailored to specific contacts, unlike social media platforms where communication is broadcast to unknown recipients. For example, messaging apps could enable co-customisations [18, 19] for allowing screen reader users to display their accessibility preferences in the conversation interface with all or some of their contacts, encouraging them to be mindful of their writing style. Additionally, this presents an opportunity to incorporate specific screen reader mechanics and settings into the design of tools such as PREVIEW. For example, displaying the descriptors used by the receiver's screen reader and transcribing a preview exactly as their screen reader would voice it, or even enabling co-customisation options for sender and receiver to define how they prefer certain emoji, emoticons, or other textual markers to be voiced.

We can foster more inclusive and effective communication experiences within messaging apps by combining descriptor visibility during and after emoji selection with tailored design features and co-customisations for screen reader users and their sighted communication partners.

6 LIMITATIONS AND FUTURE WORK

An inherent limitation of our message prompt rewriting task is the uncertainty surrounding the extent to which certain strategies would emerge if participants were in fact communicating with a screen reader user, particularly in cases where participants replaced emoji with their own descriptors. The subjectivity and varying interpretations of emoji may impact the accuracy and effectiveness of these descriptions for screen reader users. However, our approach was appropriate for this study as we were primarily interested in assessing sighted people's willingness and strategies to edit messages. Now that we know the type of design that sighted people prefer as well as the types of misunderstandings they have about how screen readers interpret their messages, we can start to explore new, grounded designs for adjusting message accessibility.

Furthermore, a second limitation of our study is that we did not inquire about participants' specific reasons for editing messages or the underlying rationale behind their editing choices. This study choice was made to accommodate a shorter questionnaire, limiting the insights about participants' rationale of what makes a message with emoji more accessible to their explanations of what design probe they preferred. To overcome this limitation, future research should explore the rationale behind different editing strategies in greater detail, preferably through longitudinal deployment studies of the probes (or future design iterations) in the wild with pairs or groups of sighted users and screen reader users. This approach can increase the ecological validity of observations about what factors inform sighted users' attempts to write accessible messages (with or without emoji) in the context of real conversations with screen reader users.

A third limitation to acknowledge concerns the "Alert" messages. We included two alert warnings for long-voiced output (3_B_2 and 3_B_3). The long descriptors included gender and skin tone details, which can be information that a sighted person and/or screen reader user values. Prior work demonstrates the importance of considerations for and representations of different aspects of identity (e.g., race, gender, disability) [2, 20, 31]. We even observed some of our participants would add a skin tone modifier to emoji they included in their rewritten messages, further reiterating this valuable aspect of emoji customisation. Future work must investigate how to adapt warnings based on conversational partner needs so that there is more nuance in how warnings are applied.

Last, while our study solely focused on sighted users, the survey and the designs we employed as probes are based on Tigwell et al.'s study with screen reader users [51], which offers recommendations on how sighted users can use emoji in more accessible ways. However, to further improve the effectiveness of these designs, future design iterations should involve participatory design activities with both sighted users and screen reader users. This approach will provide a more comprehensive understanding of the needs, preferences, and challenges of both groups when communicating through a screen reader. Specifically, recruiting friends, relatives, or romantic partners who have established messaging practices will provide valuable insights and perspectives to ensure the development of designs that truly meet the needs and preferences of all users involved.

7 CONCLUSION

Emoji are a powerful form of expression when used within text-based communication, however, they can cause challenges for individuals who depend on screen readers. In this work, we conducted an online survey with 116 sighted individuals to understand how sighted users may adapt messages when they are aware the other conversation partner is using a screen reader. We used three accessibility support designs as probes in our survey: "No Support" (provides no accessibility support), Preview (provides a transcription of the screen reader's output), and Alert (highlights emoji-related accessibility problems). Our findings demonstrated that participants often remove emojis and replace them with text, but these alternatives may not be accurately conveyed by screen readers and so are not always accessible. Participants preferred the Preview design, which allows for subjective interpretations of accessibility.

Our work makes three key contributions to the fields of CSCW and HCI. First, we provide valuable insights into how sighted users adapt their non-verbal expressions when communicating with screen reader users. Through a detailed analysis of the modified messages generated by sighted participants, we shed light on the specific changes and adaptations made to accommodate the accessibility needs of screen reader users.

Second, we identify and address misconceptions and misunderstandings held by sighted users regarding screen readers. By conducting a qualitative analysis of the modified messages, we uncover assumptions and misconceptions that can impede sighted users' efforts to improve the accessibility of their messages. This understanding paves the way for correcting these misconceptions, fostering a more inclusive and informed approach to messaging design.

Third, our research offers implications for designing messaging platforms that facilitate more accessible writing for sighted users without overly restricting their personal expression. The Preview and Alert designs that we developed serve as potential solutions to assist sighted users in crafting messages that are compatible with screen readers. The findings from our online survey, which demonstrate the preference for the Preview design, provide valuable insights into promoting subjective interpretations of accessibility and enhancing users' understanding of how their messages are received. By emphasising the importance of striking a balance between accessibility and personal expression, our work informs the development of messaging platforms to create more inclusive and user-friendly experiences.

ACKNOWLEDGMENTS

We thank Jesallyn Alvina for her participation in the first discussions about the design of this study. We used ChatGPT 3.5 to assess and improve the clarity of some paragraphs of this paper, asking it to generate alternative articulations of our original writing and partially adopting some of its suggestions. We also used ChatGPT 3.5 to check the correct use of some linguistic vocabulary related to participants' rewriting approaches, such as "word elongations", or "textual markers".

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A MESSAGE PROMPTS WITH EMOJI

Table 2. No support message material. C_ID, refers to the category of emoji condition, where the number refers to the type of issue and the letter refers to the sub-category.

C_ID	**No Support Message**
1_A_1	I got an A in the exam 😎😎😎
1_B_1	Congratulations! 👏👏🎉🎉
1_C_1	I miss you too 😘💕🥰
2_A_1	What a sunny ☀️ day!
2_B_1	😲 What happened?
3_A_1	It's so cute 🥺
3_B_1	Good luck 🤞🏾

Table 3. Alert Text material. C_ID, refers to the category of emoji condition, where the number refers to the type of issue and the letter refers to the sub-category.

C_ID	**Message**	**Alert Text**
1_A_2	I don't think I can do this 😭😭😭	Alert: 😭 emoji appears three times – emoji descriptors may be voiced consecutively
1_A_3	That's great! 😂😂😂	Alert: 😂 emoji appears three times – emoji descriptors may be voiced consecutively
1_B_2	School starts tomorrow 😞😞😰😰	Alert: 😞 and 😰 emoji each appear twice – emoji descriptors may be voiced consecutively
1_B_3	Looking good 💯💯👌👌	Alert: 💯 and 👌 emoji each appear twice – emoji descriptors may be voiced consecutively
1_C_2	Starting university next week 📚🎒🤓	Alert: 📚, 🎒, and 🤓 emoji appear in a row – emoji descriptors may be voiced consecutively
1_C_3	Out of office is on ✈️🌎🌮	Alert: ✈️, 🌎, and 🌮 emoji appear in a row – emoji descriptors may be voiced consecutively
2_A_2	It's her birthday 🎂 today	Alert: 🎂 emoji descriptor may be voiced in the middle of the sentence
2_A_3	I booked a dentist 🦷 appointment	Alert: 🦷 emoji descriptor may be voiced in the middle of the sentence
2_B_2	🥳 Congratulations on your 10th anniversary!	Alert: 🥳 emoji descriptor may be voiced at the start of the sentence
2_B_3	🥰 I'd really appreciate that	Alert: 🥰 emoji descriptor may be voiced at the start of the sentence
3_A_2	I know right 💁‍♀️	Alert: 💁‍♀️ emoji descriptor is: "Information Desk Woman" – voiced output may not match message intent
3_A_3	How did last night go? 👀	Alert: 👀 emoji descriptor is "Eyes" – voiced output may not match message intent
3_B_2	I can't believe they did that 🤦🏻‍♀️	Alert: 🤦🏻‍♀️ emoji descriptor is "Woman Facepalming: Light Skin Tone" – may result in a long voiced output
3_B_3	We'll be there! 👫🏾	Alert: 👫🏾 emoji descriptor is "Woman and Man Holding Hands: Medium-Dark Skin Tone" – may result in a long voiced output

Table 4. Audio Preview material. C_ID, refers to the category of emoji condition, where the number refers to the type of issue and the letter refers to the sub-category.

C_ID	Message	Audio Preview
1_A_2	I don't think I can do this 😭😭😭	I don't think I can do this Loudly Crying Face Loudly Crying Face Loudly Crying Face
1_A_3	That's great! 😂😂😂	That's great! Face with Tears of Joy Face with Tears of Joy Face with Tears of Joy
1_B_2	School starts tomorrow 😞😞😰😰	School starts tomorrow Disappointed Face Disappointed Face Anxious Face with Sweat Anxious Face with Sweat
1_B_3	Looking good 💯💯👌👌	Looking good Hundred Points Symbol Hundred Points Symbol OK Hand OK Hand
1_C_2	Starting university next week 📚🎒🤓	Starting university next week Books Backpack Smiling Face with Glasses
1_C_3	Out of office is on ✈️🌎🌮	Out of office is on aeroplane globe showing Americas taco
2_A_2	It's her birthday 🎂 today	It's her birthday Birthday Cake today
2_A_3	I booked a dentist 🦷 appointment	I booked a dentist Tooth appointment
2_B_2	🥳 Congratulations on your 10th anniversary!	Party Face Congratulations on your 10th anniversary!
2_B_3	🥰 I'd really appreciate that	Smiling Face with Hearts I'd really appreciate that
3_A_2	I know right 💁‍♀️	I know right Information Desk Woman
3_A_3	How did last night go? 👀	How did last night go? Eyes
3_B_2	I can't believe they did that 🤦🏻‍♀️	I can't believe they did that Woman Facepalming: Light Skin Tone
3_B_3	We'll be there! 👫🏾	We'll be there Woman and Man Holding Hands: Medium-Dark Skin Tone!

B EXAMPLES OF REWRITTEN MESSAGES WITHOUT EMOJI

Table 5. Examples of rewriting strategies for removing all emoji.

ID	Prompt Message	Rewritten Message
P6	That's great! 😂😂😂	That's great!
P15	I know right 💁‍♀️	I know right
P38	😲 What happened?	What happened?
P60	School starts tomorrow 😞😞😰😰	School starts tomorrow

Table 6. Examples of rewriting strategies for removing all emoji and rethinking the message from scratch.

ID	Prompt Message	Rewritten Message
P8	Congratulations! 👏👏🎉🎉	Congratz
P51	Congratulations! 👏👏🎉🎉	woot!
P51	Good luck 🤞🏾	Fingers crossed!
P77	That's great! 😂😂😂	That's amazing haha!
P51	That's great! 😂😂😂	TEARS OF JOY!
P57	What a sunny ☀️ day!	What a beautiful sunny day
P51	We'll be there! 👫🏾	We're coming for sure
P76	We'll be there! 👫🏾	We'll both be there!
P90	Out of office is on ✈️🌎🌮	Officially out of office!
P112	I got an A in the exam 😎😎😎	So, guess what... Ya boy aced the exam.
P39	It's so cute 🥺	Its so cute im going to cry! Squee
P70	It's so cute 🥺	Awww so cute
P111	I know right 💁‍♀️	I know righttt
P112	How did last night go? 👀	Soooo... how did last night goooo?

Table 7. Examples of rewriting strategies for removing all emoji and replacing the emoji with additional text.

ID	Prompt Message	Rewritten Message
P89	Good luck 🤞🏾	Good luck! Keeping my fingers crossed for you.
P63	😲 What happened?	Oh no! What happened?
P77	School starts tomorrow 😞😞😰😰	School starts tomorrow noooo big sad
P5	I know right 💁‍♀️	I know right? (Kinky emoji)
P71	Congratulations! 👏👏🎉🎉	congratulations! (clapping for you right now)
P53	I know right 💁‍♀️	I know right! <sassy hair flip emoji>
P87	It's her birthday 🎂 today	it's her birthday today #birthdaycake
P26	I can't believe they did that 🤦🏻‍♀️	I can't believe they did that (facepalm)
P51	It's so cute 🥺	It's so cute (googly eyes)
P107	I can't believe they did that 🤦🏻‍♀️	I can't believe they did that - facepalm
P49	Congratulations! 👏👏🎉🎉	Congratulations! *throws confetti*
P56	I got an A in the exam 😎😎😎	I got an A in the exam *drops mic*
P26	I know right 💁‍♀️	I know right /sass
P53	😲 What happened?	What happened????
P82	Congratulations! 👏👏🎉🎉	Congratulations!!!!!
P87	😲 What happened?	:-O what happened?
P79	That's great! 😂😂😂	That's great! :D

Table 8. Example of rewriting strategies for removing all emoji and for replacing the emoji with alternative media.

ID	Prompt Message	Rewritten Message
P15	Congratulations! 👏👏🎉🎉	Congratulations! https://youtu.be/nYwAHURPQ-s

C EXAMPLES OF REWRITTEN MESSAGES WITH EMOJI

Table 9. Examples of rewriting strategies based on adapting the use of emoji by shortening the overall length of the voiced message.

ID	Prompt Message	Rewritten Message
P2	Congratulations! 👏👏🎉🎉	Congratulations! 👏🎉
P79	Congratulations! 👏👏🎉🎉	Congratulations! I'm very proud of you 😍
P3	Starting university next week 📚🎒🤓	Starting university next week 📚
P62	I don't think I can do this 😭😭😭	I don't think I can do this 😭x 3
P13	I don't think I can do this 😭😭😭	I don't think I can do this 😭
P22	I miss you too 😘💕🥰	I miss you too ❤️
P29	I can't believe they did that 🤦🏻‍♀️	I can't believe they did that 🤦‍♀️
P104	Good luck 🤞🏾	Good luck 🍀
P54	School starts tomorrow 😞😞😰😰	Schools starts tomorrow 😰😰
P30	School starts tomorrow 😞😞😰😰	School starts tomorrow 😰
P74	I can't believe they did that 🤦🏻‍♀️	🤦🏻‍♀️
P107	That's great! 😂😂😂	That's great!😂x3
P113	I got an A in the exam 😎😎😎	I got an "A" in the exam. I was thrilled.😁
P5	I got an A in the exam 😎😎😎	I got an A in the exam 😎how cool is that?!
P68	Out of office is on ✈️🌎🌮	Out of office is on ✈️🌎

Table 10. Examples of rewriting strategies based on adapting the use of emoji by clarifying the meaning or tone of emoji.

ID	Prompt Message	Rewritten Message
P18	Congratulations! 👏👏🎉🎉	Congratulations! 👏👏🎉🎉(claps & streamers)
P18	Good luck 🤞🏾	Good luck 🤞🏿(fingers crossed)
P19	I got an A in the exam 😎😎😎	I got an A in the exam 😎[person with sunglasses emoji]
P110	I got an A in the exam 😎😎😎	I got an A in the exam, I'm feeling like a 🦚
P34	How did last night go? 👀	How did last night go? 👀expressing curiosity
P110	Out of office is on ✈️🌎🌮	Out of office, in ✈️cruising the 🌎to get some 🌮
P36	It's so cute 🥺	It's so cute! 🥺
P110	I don't think I can do this 😭😭😭	I don't think I can do this... 😭
P18	I know right 💁‍♀️	I know right 😬
P22	I know right 💁‍♀️	I know right 😉
P116	I know right 💁‍♀️	I know right 😕
P33	How did last night go? 👀	How did last time go? 🧐
P42	How did last night go? 👀	how did last night go? 😉
P42	Good luck 🤞🏾	Good luck 🍀

Table 11. Examples of rewriting strategies based on adapting the use of emoji by isolating the emoji to distinguish it from the main message content.

ID	**Prompt Message**	**Rewritten Message**
P19	I can't believe they did that 🤦‍♀️	I can't believe they did that [Emoji] 🤦‍♀️
P11	I can't believe they did that 🤦‍♀️	I can't believe they did that! Emoji: 🤦🏽‍♀️
P19	🥰 I'd really appreciate that	I'd really appreciate that [Emoji] 🥰
P31	It's her birthday 🎂 today	It's her birthday today 🎂
P13	😯 What happened?	[message 1] 😯[message 2] What happened?

Received July 2023; revised October 2023; accepted November 2023