(In press, 2018). *LinguaPax Review 2017*. THIS IS A PREPUBLICATION VERSION.

Emergent Forms of Computer-Mediated Communication and their Global Implications

Susan C. Herring

Department of Information & Library Science and Department of Linguistics
Indiana University, USA

Abstract

For languages with an internet presence, computer-mediated communication (CMC) has transformed the ways in which people communicate. Meanwhile, digital communication technologies continue to evolve and innovate. In this essay, I describe several emergent trends in CMC, including interactive multimodal platforms, graphical CMC (including emoji-mediated communication), and telepresence robot-mediated communication. I consider the potentials and risks associated with adoption of each as communication media, as well as global trends that can be discerned at this stage of their development and use. From questions of mode choice, to the effects of technological mediation on discourse and social interaction, to design considerations, these emergent trends open up new vistas for communication in a globalized, networked world.

Introduction

According to Wikipedia (2018), 8.3% of the approximately 7000 languages spoken in the world have an Internet presence, based on population estimates and language use on websites. While this percentage may seem unimpressive, it represents over 4.1 billion people from around the world,[1] many of whom engage in computer-mediated communication (CMC) via email, web forums, media-sharing sites such as YouTube, blogs, microblogs, and social network sites. When texting and instant messaging on mobile phones are added to this list, it should be evident that CMC has had a major impact on communication within and across many cultures. While this impact has been felt especially in urban areas in the developed world and by speakers of large, majority languages, it is also felt in a number of minority language communities, where CMC contributes to language preservation efforts,[2] as well as supporting economic, legal, health, and educational endeavors.[3]

The rapid global spread of CMC over just a few decades[4] should teach us never to take for granted that communication in the future will look anything like it does today. We need not be caught entirely unawares by new developments, however, because the seeds of the future are evident in the present, if one knows where to look. In this essay, I spotlight several emergent CMC technologies that are starting to make their appearance on the world stage, and which have the potential to shape global communication in the future. I focus on three phenomena: interactive multimodal platforms, graphical CMC (including emoji-mediated communication), and telepresence robot-mediated communication. Although varied in their technological properties, all three phenomena mediate human-to-human communication, support social as well as task-related communication, and involve multiple modes or channels, and thus fit within an expansive conceptualization of multimodal CMC (Herring, in press).

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[1] Internet World Stats, https://www.internetworldstats.com/emarketing.htm, retrieved March 8, 2018.
[2] See, e.g., Cazden (2003); Ungerleider (2011).
[3] See, e.g., Cunliffe and Herring (2005); Dyson (2011).
[4] The internet was developed in the United States in the 1960s and 1970s and started spreading globally in the mid-1990s. In 1995, only 0.4% of the world's population was estimated to use the internet. As of December 2017, that number had grown to 54.4%. Source: Internet World Stats, https://www.internetworldstats.com/emarketing.htm, retrieved March 8, 2018.

These three phenomena are of special interest, moreover, in that each represents a paradigm shift in the way digital technology mediates human-to-human communication. On interactive multimodal platforms, people can communicate via – and switch between – multiple modes of CMC on the same platform and even within the same conversation. Telepresence robots provide communicators with mechanical "bodies" that are remotely navigable in physical space. And graphical CMC challenges the definition of language itself. These are not the only emergent developments in CMC, nor necessarily even the most likely to enjoy widespread global adoption. To the extent that they become widely adopted, however, they could give rise to strikingly new patterns of human communication.

The effects of these emergent communication technologies are not yet fully understood, although research is being conducted in all three areas. Even less is known about their uses in different cultural contexts. Nonetheless, some cultural variation is already evident at the present stage of development and use of each technology. In the remainder of this essay, I describe and illustrate each emergent phenomenon, identify issues that it raises, summarize key research findings, and discuss global trends. I conclude by considering the future outlook for each technology.

Emergent CMC Technologies

Interactive Multimodal Platforms

The most established and best known of the three communicative technologies are interactive multimodal platforms, or IMPs (Herring 2015; Herring & Demarest, 2017). IMPs arise out of the confluence of two broad trends in digital communication media: media convergence and "Web 2.0." The Web 2.0 era[5] is characterized by dynamic content, user participation, and social sharing, and by platforms such as blogs, microblogs, media-sharing sites, and social networking sites. Media convergence can be traced back to web browsers, which allowed previously disparate CMC modes such as email, group chat, and discussion forums to be accessed through a single tool, the browser. The inclusion of text commenting on platforms like news sites, photo sharing sites, and multiplayer online games represents a further development, and today it is common for several CMC modes to be available on a single platform.

The social networking site Facebook is a popular example of a highly converged platform that supports real-time text chat, asynchronous messaging, audio- and video chat, status updates, threaded discussion, and media sharing, among other forms of communication. Facebook can be considered an IMP in the broadest sense, in that it is a web-based platform that supports multimodal user interaction. WhatsApp is a popular example of a mobile IMP, in that it lets users employ text, graphics, and video in the same conversation. Figure 1 shows a portion of a WhatsApp conversation carried out via text, graphical elements, and video clips.[6] In addition to IMPs such as these whose primary purpose is conversation, media sharing IMPs feature multimedia content around which multimodal user interaction is focused; an example is YouTube, where users can respond to videos posted to the site via text comments or by creating videos of their own (e.g., Pihlaja, 2011). Multiplayer online games in which players can chat via text and/or voice while engaging in game play also belong to this subtype (e.g., Newon, 2011). Figure 2 shows an example of multimodal interaction in the online multiplayer game Fortnite, as live streamed through the platform twitch.tv, which allows for an overlay of video (middle left) and text chat (not shown) on the three-dimensional game play and text chat (lower left) in the game itself.[7]

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[5] Different dates can be ascribed to the beginning of Web 2.0. The term was coined in 2004, but some platforms that exhibit Web 2.0 characteristics date back to 2000 or the late 1990s (Herring, 2013).

[6] Source: https://gadgets.ndtv.com/apps/news/whatsapp-finally-gets-mentions-feature-for-group-chats-1464281, retrieved March 8, 2018.

[7] In this still image captured from publicly-available video, the player in the video window, BishopGP, is directing the viewers' attention to what is going on in the gameplay, and in the text chat, user Nukepennythe4th is typing comments to other players in the game. Source: https://www.youtube.com/watch?v=3NmrDElnbMo, retrieved March 8, 2018.

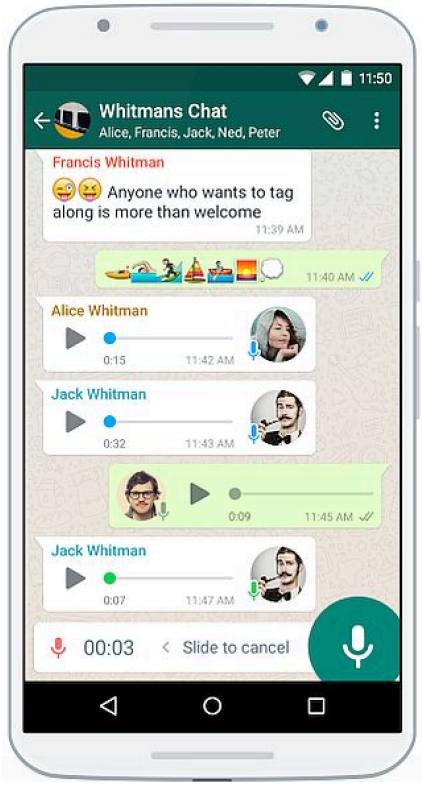

Figure 1. A multimodal instant messaging conversation on WhatsApp

Figure 2. Multimodal interaction in an online multiplayer game

While much communication research has analyzed popular web platforms like Facebook and YouTube, and to a lesser extent mobile platforms like WhatsApp, few studies as yet have specifically addressed the *multimodality of the conversations* taking place on those platforms. IMPs raise new questions about how users choose modes for communication and switch between them (Sindoni, 2012, 2014), how mode choice affects their language use and social interaction (Herring & Demarest, 2017), and how they manage conversations that take place via multiple modes (Rosenbaun, Rafaeli, & Kurzon, 2016). Media sharing IMPs, in particular, raise questions about how users cognitively and physically manage

media co-activity (engagement in activities in different media on the same platform), especially when the interaction is synchronous, taking place in near-real time (cf. Jucker et al., in press). More generally, the addition of audio and video to online communication increases its "richness" (Daft & Lengel, 1984), while also making online communication potentially less anonymous and private. What effects do media richness and "nonymity" (Zhao, Grasmuck, & Martin, 2008) have on how people behave and communicate through IMPs?

The available research points to three main findings as regards multimodal conversation. First, IMP users communicate differently in different modes. Some of the reported findings concern the persistent use of text, which remains important even in IMPs, despite predictions since the mid-1990s that online audio- and video-chat would supplant text.[8] Text is the most frequently-used mode in some IMPs, such as Voicethread.com – a web-based application that supports asynchronous commenting around multimedia content via text, audio, and video (Herring & Demarest, 2017). This may be due to text being more familiar to online communicators, as compared to asynchronous audio or video. Text is also the mode in which users communicate most negatively and sarcastically in IMPs.[9] Non-textual modes, in contrast, are associated with more positive emotion,[10] more overall emotional expression,[11] and greater sociability,[12]but also greater self-consciousness[13]and more hierarchically structured discourse.[14] The second main finding is that IMP users switch between modes strategically. For example, in video chat, they may switch between video (speech) and text (writing) "to be more specific, to avoid or bypass trouble caused by technical problems deriving from the medium, to repair misunderstandings or to increase opportunities for asking for the floor without being impolite" (Sindoni, 2014, p. 85). Third, although responders tend to use the same mode as initiators in video chat (Sindoni, 2014), interlocutors on some IMPs engage in ongoing cross-modal exchanges, where some participants communicate through video, others through audio only, and others through text. This takes place, for example, in public video chats on Google Hangouts (Rosenbaun et al., 2016) and on twitch.tv, when a gamer narrates a game in progress via video or audio chat and viewers comment via text chat, as in Figure 2. Relatedly, gesture and gaze play increasingly important roles in IMP interaction, as do switches in orientation between the user's physical context and (different levels of) virtual spaces (Jucker et al., in press; Licoppe & Morel, 2012).

Researchers have also investigated the social effects of decreased online anonymity, or *nonymity* (Zhao et al., 2008) associated with the rise of audio- and video CMC and the trend toward posting self photographs, or "selfies," on social media. On one hand, these trends have led to a greater interest among many, especially young, social media users in self-presentation,[15] where they must contend with the complexity of multiple layers of representation and the management of identity in multiple modes (e.g., Jones, 2004). On the other hand, nonymity exposes members of vulnerable populations to increased identity-based harassment (e.g., Herring & Stoerger, 2014). Online harassment and incivility have become major problems in many countries in recent years (e.g., Antoci et al., 2016; Kim & Herring, 2018), although this trend is not due solely to the nonymity of multimodal CMC.

[8] Herring (2004).
[9] Bourlai and Herring (2014) for GIFs on Tumblr.com; Herring and Demarest (2017) for comments on Voicethread.com.
[10] Bourlai and Herring (2014); Herring and Demarest (2017).
[11] Bourlai and Herring (2014).
[12] Herring and Demarest (2017).
[13] Herring and Demarest, 2017; Sindoni (2012) for videochat.
[14] Newon (2011) for voice chat in a multiplayer online game.
[15] E.g., Kapidzic and Herring (2014); Zhao et al. (2008).

Global Trends for IMPs

IMPs are popular around the world in the form of social network sites, most of which now offer multiple modes of communication.[16] There is some specialization of sites by geographical region: QQ, Qzone, and Sina Weibo are used almost exclusively by Chinese speakers, for example. However, except in China and in Russia (where V Kontakte and Odnoklassniki are most used), US-based platforms[17] dominate. Facebook is the most popular IMP in the world, especially in the Americas and Europe, but also in Asia, the Middle East, and large parts of Africa.[18] Between 2017 and 2018, Facebook overtook several African nations, making it the leading social network site in 152 (91%) of the 167 countries analyzed by Cosenza (2018). The second-most popular platforms in each country are more diverse, but with the exception of Odnoklassniki in Russia, they also all originate in the U.S. (Cosenza, 2018). Native-grown social network sites exist but are not as popular.

Technologies are not value-neutral (Winner, 1986). Therefore, one might ask whether, and if so to what extent, IMPs such as Facebook transmit Western (U.S.) cultural practices and values. If so, does this differ qualitatively from the globalizing effects of the internet more generally, which have been much debated but seem incontrovertible as regards the acceleration of the global spread of Engish,[19] and at least arguable as regards the spread of flaming, trolling, and other forms of online incivility?[20] Furthermore, what effects do the technological affordances of IMPs have on online communication? Given that audio and video communications tend to be more positive in tone than text (e.g., Herring & Demarest, 2017), the increasing availability of audio and video CMC could promote more civil communication.[21] That would be a benefit, certainly. Conversely, the complexity of IMP communication, with its multiple layers and diverse types of overlapping communicative events (Jucker et al., in press), makes competing demands on users' attention and may have a less desirable impact in cultures where measured, linear communication is traditionally valued.[22]

It is possible that IMP users will tend to prefer a particular mode or modes, in keeping with their cultural values and practices. For example, video might be favored in cultures where gesture plays a key role in face-to-face communication and disfavored in cultures that place religious or other constraints on the display of the face. This would add an additional layer of complexity to cross-modal exchanges in cross-cultural communication. Nonnative speakers might also prefer one or another mode depending on whether they feel more comfortable communicating in speech or in writing, and depending on whether the available modes are synchronous or asynchronous. These scenarios assume equal, full access to multiple modes, which is not always the case with current IMPs, but which is more likely to obtain in the future.

These and other possibilities are ripe for study. Although some IMP researchers are located in countries outside the U.S., culture was not considered as a variable in any of the research surveyed in this essay. Clearly, a great deal more research is needed to arrive at complete understandings of the roles played

[16] As of January 2018, the platforms with the highest number of active accounts, ranked in descending order, were Facebook, YouTube, WhatsApp, Messenger, WeChat, QQ, Instagram, Tumbler, Qzone, Sina Weibo, and Twitter (Statista.com, 2018).
[17] Twitter, Instagram, Reddit, and Facebook (Cosenza, 2018).
[18] Part of Facebook's global spread is due to the availability of 'localized' versions of the interface in languages other than English. At the time of this writing, Facebook users could select from 169 language options, including real languages such as Aymara and Uzbek, as well as playful varieties such as Fake Arabic and Pirate English. Most of the minority language versions were created not by the company, however, but by users of the platform who have volunteered their labor as part of collaborative grassroots efforts. See Lenihan (2011) on the case of Irish.
[19] For debate on this point, see Dor (2004), Paolillo (2007), and Pimiento, Prado, and Blanco (2009).
[20] See, e.g., Kim and Herring (2018).
[21] Of course, audiochat and videochat work best with a small number of interlocutors. For this reason, they are unlikely to replace text in large public forums.
[22] As, for example, the Athabaskan Indians whose turn-taking practices are described in Scollon and Scollon (1980).

by different platforms and how they affect what modes are available, how frequently they are used, where, by what kinds of people, by how many users at a time, and in the conduct of what sorts of activities – in short, of their technological affordances, their users, their cultures of use, and their wider social impacts. In the meantime, the research thus far suggests some intriguing possibilities for how the future spread of IMPs could impact human communication on a global scale.

Graphical CMC

The first integration of graphics into CMC was arguably the ASCII emoticon, familiarly referred to as the sideways smiley face :), which was a user innovation introduced in 1982 in an early discussion forum (Krohn, 2004). Graphical icons, or *graphicons* (Herring & Dainas, 2017) did not enter social media in large numbers, however, until emoji, the colorful graphical successors to emoticons, were made available on mobile phones and in Unicode[23] around 2010 (Novak et al., 2015). Soon after that, popular platforms like Facebook Messenger began offering ready-made sets of emoji, then stickers (basically, larger, more complex emoji), and most recently GIFs (short animated sequences) that can be accessed through menus, bringing these graphicons into widespread use. These trends corresponded temporally with the rise in popularity of image macros (photographic images overlain with (usually) humorous text)[24] in social media (Börzsei, 2013; Shifman, 2014).

These and other developments in graphical media have given rise to what I will call graphical CMC (GCMC), or digital communications made up partly or entirely of graphical icons. These graphicons often appear together with text, although graphical elements may stand alone, and graphical enhancements of photographs and video chat in which no text is present are found on photo-sharing sites like Instagram and through third-party applications. What distinguishes GCMC from the use of graphics in social media more generally is that the graphics in GCMC can communicate propositional content; that is, singly or combined in sequences, they can substitute for verbal language (although it may not always be easy to translate them into words). Present-day GCMC includes animated GIFs, image macros, emoticons, emoji, and stickers.[25] Figure 3 shows a post from the multimodal microblogging site Tumblr in which an animated GIF (the man in the image, the American comedian Jon Stewart, is pounding his fist) explicitly expresses a proposition, namely that the situation described at the beginning of the post is 'unacceptable.'[26]

The meanings of graphicons may also be implicit and open to interpretation to varying degrees. The intended meaning of the emoji sequence in Figure 4a. ("Go to hell") is relatively transparent despite the inverted order of its constituents relative to normal English word order, whereas the sequence in Figure 4b., although preserving English word order, is more difficult to decipher. (This example was taken from a 2015 U.S. automobile advertisement and translates as: 'It's the best new thing since sliced bread for stylish and socially connected people.')[27]

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[23] As of June 2018, 2823 emoji are encoded and assigned standard descriptions in Unicode, the international encoding standard for different languages and scripts. See: http://www.unicode.org/reports/tr51/index.html.

[24] Such image macros are often referred to as *memes*, although technically, an image (or video or saying, etc.) is not a meme until it has spread widely (Burgess, 2004).

[25] Avatar-mediated communication, in which users interact via graphical avatars in virtual worlds, is yet another mode of GCMC (Herring, in press). It raises a separate set of issues and, due to space limitations, is not discussed further here.

[26] In this case, the word 'unacceptable' is superimposed over the image, but text is not always present in GIFs that function in this way. Source: Bourlai, E., & Herring, S. C. (2014). Multimodal communication on Tumblr: 'I have so many feels!' Powerpoint presentation at *WebSci'14,* Bloomington, IN, June 25.

[27] Source: http://www.businessinsider.com/chevy-just-put-out-a-press-release-entirely-in-emoji-2015-6, retrieved March 8, 2018.

Figure 3. A microblog post with an animated GIF that conveys propositional content

a.

b.

Figures 4a. and 4b. Emoji sequences

Clearly, one set of issues raised by GCMC concerns the interpretability of graphicons and the potential for misunderstanding caused by their use. Another question is whether, and if so to what extent, sequences such as those in Figures 4a and 4b indicate that emoji are evolving into a separate linguistic system. If so, how universally understandable is it? Will it replace text? More generally, who uses graphical CMC, and for what purposes? What effects does it have on the nature of communication?

Research on GCMC shows that emoji are currently by far the most popular graphicon type.[28] Emoji express (typically positive) emotion[29] and playfulness,[30] and people tend to use them when they are in a good mood, especially with socially close or intimate addressees.[31] Emoji fulfill a range of pragmatic and interactional functions as well, including modifying the tone of textual utterances[32] and softening

[28] E.g., Chen et al. (2017); Herring and Dainas (2017); Ljubešic and Fišer (2016).
[29] E.g., Danesi (2016); Kelly and Watts (2015); Novak et al. (2015), and many others.
[30] E.g., Kelly and Watts (2015); Pohl, Domin, and Rohs (2017).
[31] Konrad et al. (in preparation).
[32] E.g., Herring and Dainas (2017); Kelly and Watts (2015); Novak et al. (2015).

their illocutionary force[33] (both functions they share with emoticons), illustrating portions of text,[34] expressing virtual actions,[35] conveying private meanings,[36] and opening and/or closing conversations.[37] Some emoji sequences function like complete verbal utterances, as in Figures 4a and 4b;[38] the same or semantically-similar emoji are also often repeated for emphasis.[39] In contrast, because of their size, the larger, more complex graphicons (stickers, GIFs, image macros, video clips) typically stand alone and convey complete propositions. Aside from tone modification, stickers share many functions with emoji, but users consider them more intensely emotional and playful ("over the top").[40] As for image macros and GIFs, they are used to express emotional reactions and to riff playfully on previous messages in social media.[41]

GCMC – especially emoji use – is popular with young users (Konrad et al., in prep.). Usage patterns also show gender preferences: Emoticons and emoji are used more and in different ways by females (Chen et al., 2017; Sugiyama, 2015; Wolf, 2000), and emoji and stickers are described by some users as feminine or "girly," although men also use them (Konrad et al., in prep.; Sugiyama, 2015). In contrast, image macros are very popular in some male-predominant online contexts, such as the image board 4chan (Stryker, 2011).

Athough it is controversial, there is support for the claim that emoji are evolving into a visual language. They form a logographic writing system (Pohl et al., 2017), as evidenced by the fact that emoji and combinations of emoji can substitute for words in textual messages (e.g., Dürscheid & Siever, 2017). Emoji phrasebooks exist online, and the classic American novel *Moby Dick* has been translated (for humorous effect) into emoji as *Emoji Dick* (Radford et al., 2016). Emoji have semantics, pragmatics, and grammar, although the relationship of icons to one another in emoji sequences is often more conceptual than rule-governed (Danesi, 2016). Moreover, some emoji sequences exhibit emergent syntactic properties such as word order patterning (Danesi, 2016; Steinmetz, 2014). At the same time, emoji currently lack grammatical markers and icons that express abstract concepts and hierarchical relations, which constrains their expressive potential (Dürscheid & Siever, 2017;[42] Ge & Herring, under review). Nevertheless, social media users are employing emoji in creative ways to address these gaps;[43] consider, for example, the use of an arrow in example 4a to express the grammatical relation encoded in English as the preposition 'to.' Given this trend, it seems probable that emoji will become even more like a verbal (written) language in the future. Already emoji are used in place of text in some contexts, such as the advertising message in example 4b.

That said, language units must be interpretable by both producers and receivers in order for communication to take place, and a number of studies have found that users often disagree on the meaning of emoji, whether presented in isolation or embedded in a message (Dainas & Herring, in prep.; Miller, Kluver, et al., 2017; Miller, Thebault-Spieker, et al., 2016). The differences in interpretation have been attributed to factors such as emoji renderings that differ across platforms, inherently ambiguous forms (such as the grimace face emoji 😬), meanings that are pragmatically contextualized rather than fixed, and the receiver's familiarity with the sender and the culture of the social media platform where emoji are used (e.g., Miller, Thebault-Spieker, et al., 2016). Pohl et al. (2017) argue that the flexibility and ambiguity of emoji are part of their appeal and enhance their

[33] Herring and Dainas (2018); cf. Dresner and Herring (2010), who describe a similar function of emoticons.
[34] E.g., Cramer, de Juan, and Tetreault (2016); Herring and Dainas (2017).
[35] E.g., Herring and Dainas (2017).
[36] Cramer et al. (2016); Kelly and Watts (2015); Wiseman & Gould (2018).
[37] E.g., Kelly and Watts (2015).
[38] E.g., Danesi (2016).
[39] McCulloch and Gawne (2018).
[40] Konrad et al. (in prep.).
[41] Bourlai and Herring (2014); Herring and Dainas (2017).
[42] For example, Dürscheid and Siever (2017) assert that communication via emoji with people who speak a different language "will always be restricted to the exchange of rudimentary information" (p. 6).
[43] Ge and Herring (under review) also find examples of this in emoji sequences in Chinese.

expressive potential. However, the evidence that even people from the same culture understand emoji differently suggests that they are not a universal language.

Global Trends for GCMC

Unlike IMPs, which originated in the U.S., emoji and stickers originated in Japan and have spread westward.[44] In Asia, where they continue to be extremely popular, there is some conflation of the two graphicon types with each other and with emoticons; in some works by Asian scholars, all three types of graphicons are referred to as "emoticons" (see, e.g., Ma, 2016). On the popular Chinese social network platform Weibo, both emoji and stickers can be animated and can include textual characters (Ge & Herring, under review). Weibo has its own set of emoji which are not Unicode based. Two examples of emoji sequences from Weibo are shown in Figure 5.

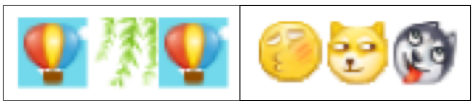

Figure 5. Chinese emoji sequences

The first sequence in Figure 5 means something like "float with the breeze" (i.e., let go [of your troubles] and relax), in the context in which it was used. The second sequence is in response to a video of a female celebrity doing a yoga pose, and means something like "no way (slapping the side of one's face) for me (first dog head) and my friends (second dog head) [to do that]." These interpretations are not readily accessible to most Western social media users, however.

Even the same Unicode emoji have different uses in different cultures. Emmons et al. (2017) give as an example the Unicode bandaged face emoji, which means 'sick' in the West and 'doctor' in some other cultures, and the Unicode hands folded together emoji, which is used to mean 'thank you' in some cultures and praying hands in others. Emmons et al. (2017) propose to create an emoji translator that replaces emoji used by the sender with emoji that are more culturally relevant to the receiver in cross-cultural communication. Meanwhile, the emoji subcommittee of the Unicode Consortium in recent years has vetted and approved for inclusion an increasing number of culturally-relevant emoji, such as a woman wearing a hijab, a Japanese tanabata or 'wish tree, and a person in a sauna.[45]

In a large cross-cultural study of Unicode emoji sent from mobile phone users in 212 countries, Lu et al. (2016) found significant differences across countries and geographical regions in amount of emoji use and most-used emoji. Users from France used emoji in a higher percentage of message than users from any other country in the sample. Lu et al. also found associations between the sentiment of the most-used emoji and Hofstede's (1980) dimensions of culture. For example, users from France, a country high in Individualism, use more positive emoji than users from Columbia, a country low in Individualism.

Cultural differences in usage notwithstanding, studies do not always find cultural differences in how people *interpret* Unicode emoji. Jaeger and Ares's (2017) findings for social media users in China seem similar to those for Western users, for instance. This suggests that mutual understanding may be achieved even when there are differences in use; Yuhui et al. (2016) find support for this in the use of emoji in cross-cultural business communication in Southeast Asia. To the extent that Unicode emoji are mutually understandable, it may not be necessary to "translate" them into more culturally-relevant versions. That is, Unicode emoji may serve as a graphical lingua franca, at least for expressing certain kinds of affect.

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[44] Konrad et al. (in prep) reviews and compares the evolution of emoji, emoticons, and stickers. In Asia, kaomoji, or faces made of ASCII characters and viewed straight on (e.g., 0_0), were the precursor to emoji.
[45] See, e.g., https://emojipedia.org/search/?q=sauna.

Asia also leads the world as regards the use of stickers. Stickers are extremely popular on mobile platforms such as Line, WeChat, WhatsApp, and Viber, especially among users in Japan, China, Taiwan, and Korea,[46] even though some must be purchased for the equivalent of US $1-$2 per set (Konrad et al., in prep). One reason for the popularity of stickers in Asian countries, and why users are willing to pay for them, is that the characters of some Asian languages are tricky to input digitally, and stickers save text input time and effort (Ma, 2016; Russell, 2013). Russell (2013, n.p.) speculates that "the appeal of stickers may be different in Western markets, in part because Romanic alphabets are better supported on smartphones."

Since they are typically larger and more complex than emoji, stickers tend to express more compex ideas, represent more sspecific character traits, and express emotion more intensely (Konrad et al., in prep.). And whereas stickers on Western platforms such as Facebook (like emoji on most platforms) are commercially produced, Ma (2016) reports on the existence of creative user-generated stickers in China that include customized faces and text. The use of customized stickers could lead to different interactional dynamics. Ma (2016, n.p.) notes that the user-created "Baozou" stickers were used to vent or express frustration and "to convey out-of-control, subtle, complicated, or hidden emotions."

In contrast, GIFs and image macros originated in the U.S.[47] Both are especially popular among millenials in the West, who use them to make humorous points through reference to popular and internet cultures (e.g., Buck, 2012; Dynel, 2016). Thus far little scholarship has studied either graphicon type from the perspective of national culture or language, however. Dynel (2016) claims in passing that image macros collected on English-language websites, especially ones without text, are understood and produced by internet users who speak little or no English. This raises the question of what knowledge and experience the users have of Western popular culture.

More culturally-situated research is needed on GCMC involving different graphicon types. The notion that because they are images, graphicons should be universally interpretable is clearly too simplistic. Also, it seems reasonable to suppose that as GCMC comes into more common use, it will extend beyond the humorous and playful into more serious, information-focused domains. Another fruitful area of research will be to investigate how that occurs and with what effects (e.g., Yuhui et al., 2016).

Telepresence Robot-Mediated Communication

Telepresence robotics is a sophisticated form of robotic remote control in which a human operator ('pilot') has a sense of being on location. Robot-mediated communication (RMC) is human-human communication in which at least one party is telepresent via, and remotely piloting, a robot. It is a type of multimodal CMC in which videoconferencing is supplemented by movement. As such, it shares similarities with video-mediated CMC. Moreover, in that the robot functions as an avatar, or representation, of the pilot, who remotely directs its movement, RMC shares some characteristics with avatar-mediated communication in virtual worlds, except that the robot avatar moves through physical space (Herring, 2015).

Although telepresence robots have existed since 1998 (Paulos & Canny, 1998), it has only become feasible to deploy such robots in real-world contexts since fiber optic technologies expanded Internet bandwidth in the mid-2000s. As of this writing, telepresence robots are used to facilitate remote lectures and conference attendance; participation in school and other activities by homebound children; visits to patients and the elderly by healthcare providers; and virtual tours of museums, libraries, and zoos,

[46] Y-C. Lee (2017) estimates that over one billion users worldwide send stickers via Line alone every day.
[47] For GIFs, see Buck (2012). For image macros, see Shifman (2014).

among other uses.[48] In the photograph in Figure 6, I am physically located in the United States while giving a lecture via a BeamPro telepresence robot to a group of researchers in France.[49]

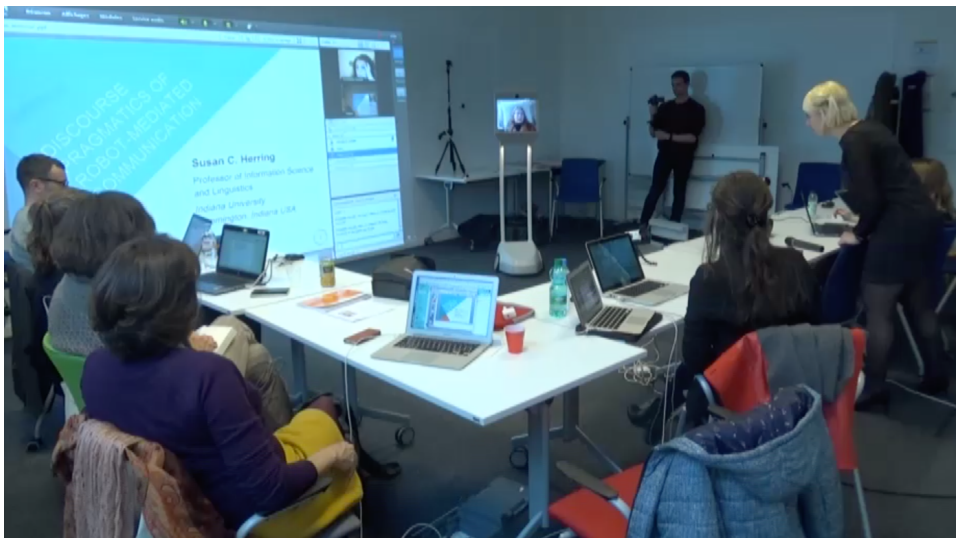


Figure 6. Lecturing abroad via a telepresence robot

Alongside the advantages of RMC, current telepresence robot technology has limitations that affect communication. Robot pilots can not hear how loud they sound to locals; their peripheral vision is limited, and camera configurations typically do not afford depth perception, making it difficult for pilots to determine how close they are to objects and people. Moreover, the robots stall when they lose WiFi connectivity (Herring, 2016). Thus one may ask about the experiences of the pilot; how locals perceive and respond to the pilot; and how interaction is negotiated and what that interaction looks like. How, for example, does a person piloting a robot make a bid for, and gain, the conversational floor? Do discourse behaviors, including identity performances, carry over from face-to-face interaction, or are they altered by the mediation of the robotic device? How does the asymmetry of most RMC (someone is communicating via a robot, others are not) affect interactional power dynamics?

Research shows that when the technology works well, RMC may be more casual and sociable than video conferencing (e.g., Lee & Takayama, 2011). Sometimes interlocutors experience the robot becoming "invisible in use," as if they were interacting face-to-face (Takayama & Go, 2012). At other times, RMC requires re-negotiation of social and interactional norms. As locals become accustomed to interacting with a telepresence robot and come to understand that behaviors of the robot that could appear rude, such as talking too loudly, standing too close, or blocking a hallway, are caused by the technology rather than the pilot, they may accommodate by providing explicit feedback to the pilot or moving the robot back into WiFi range when it loses connectivity (Lee & Takayama, 2011). Relatedly, how polite locals are toward the pilot may depend on the metaphor they have for the robot, whether they think of it as a 'machine,' a 'human,' or a 'human with disability;' for example, they may expect less of a machine and therefore be more helpful in opening doors, clearing pathways, etc., but feel less constrained by face-to-face norms of politeness (Takayama & Go, 2012). Sometimes locals play pranks on or are abusive toward telepresence robots (Rae & Neustaedter, 2017). Pilots also vary in the extent to which they experience the robot as their 'body;' some feel violated, for example, if locals touch the robot to adjust the volume, pick it up, or rest their feet on the base during interaction, while others do not (Takayama & Go, 2012).

[48] See, e.g., https://www.asme.org/engineering-topics/articles/robotics/telepresence-robots-take-over, retrieved June 30, 2018.
[49] Not visible in this photo is a KUBI telerobotic stand (https://www.revolverobotics.com) that was connecting another remote participant.

The most important component of RMC is the conversation itself. Findings as regards conversational management point to several advantages of having a robot body as compared to appearing on a screen in a videoconference. Movement of the robot can be used to signal continuing listenership, a desire to take a turn at talk, or the end of a conversation (e.g., Neustaedter et al., 2016). The ability to approach and withdraw the robot during an argument can facilitate conflict resolution in long-distance relationships (Yang, Schiphorst, & Neustaedter, 2017). The lack of arms on most (Western) robots and their relatively small screens limit the amount of gestural information that can be conveyed by the pilot, however; anecdotally, some users report making larger gestures in an attempt to compensate for this. As yet no published research has analyzed RMC discourse. A study in progress by the author and her colleagues[50] has found less mutual laughter when participants interact with an interviewer using a telepresence robot as compared to the same interviewer face to face. The participants also rated the robot interviewer as less likable, intelligent, capable, and in control than the face-to-face interviewer. Overall, RMC is not as rich as face-to-face communication, but it is richer than videoconferencing and a logical choice when physical movement at a remote location is desired or needed.

Global Trends for RMC

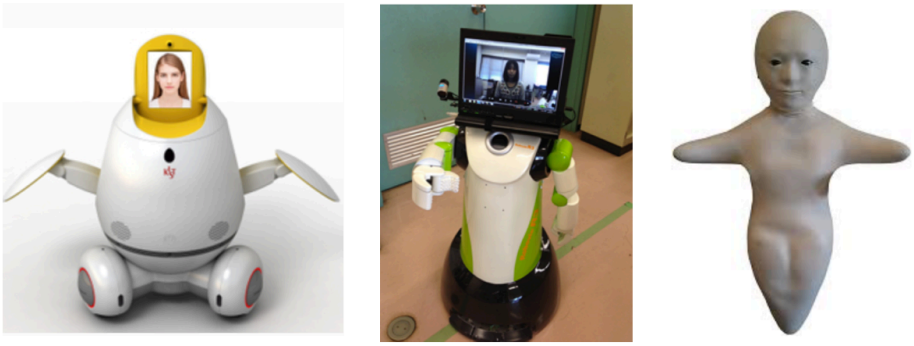
The studies reviewed above were conducted in the U.S. However, Japan leads the world in AI (artificial intelligence) and robotics, and Japanese roboticists also design and research telepresence robots. However, whereas telepresence robot design in the West mostly involves audio-video conferencing equipment mounted on a pole or stalk on a rolling base, Japanese robots tend to be anthropomorphic in form, with arms and humanoid faces. A well-known example is Hiroshi Ishiguro's 'Geminoid' telepresence robot, which was designed to be an exact replica of its designer, down to the hair and teeth (e.g., Mutlu et al., 2009) Another example is Susumo Tachi's 'telexistence' avatar TELESAR V, which lets a remote pilot control the robot's head and neck movements through the movement of his or her own body and experience sensation in the robot's "hands" through special gloves, giving the pilot a richer, more immersive experience of being telepresent in the remote location, and allowing the robot to manipulate objects in the environment, gesture, and shake hands with locals (Fernando et al., 2012). Japanese society in general is receptive to robots[51] – autonomous robots are already common in public and in work places – viewing them as potentially useful helpers and home companions as the population ages.[52]

In Europe, as well, there is a trend toward the development of home care and companion robots to support aging populations. In Sweden, for example, the Giraff robot supports remote monitoring and medical visits, as well as social interaction with family members, allowing elderly people to remain in their homes longer (Coradeschi et al., 2014). Given a worldwide trend toward more seniors, fewer caregivers, and more people living alone,[53] telepresence robots in the health and social care sectors "are poised to become one of the most important technological innovations of the 21st century" (Dahl & Kamel Boulos, 2013). Telepresence robots are also predicted to surge in adoption worldwide over the next decade in the education sector (TechSci Research, 2016). One promising application is foreign language learning, including robot-mediated visits by learners to countries where the target language is spoken.

Most current telepresence robots models are the height of a (small) adult and roll on the floor, although smaller tabletop telepresence robots (such as the KUBI mentioned in note 49) exist. Several countries have also developed child-size robots, as illustrated in Figure 7. The Korean Eng-Key robot was desgned for native speakers to be able to teach English remotely to, and interact with, children in Korea (Yun et al., 2011). Tanaka et al. (2013) adapted the child-sized Robovie-R3 into a telepresence robot

[50] Steve Whittaker, Jean E. Fox Tree, and Leila Takayama at the University of California, Santa Cruz.
[51] Tabuchi (n.d.) attributes this to Japan's native Shinto religion, which considers every object to have a spirit, blurring the boundary between animate and inanimate.
[52] E.g., https://www.reuters.com/article/us-japan-ageing-robots-widerimage/aging-japan-robots-may-have-role-in-future-of-elder-care-idUSKBN1H33AB, retrieved June 30, 2018.
[53] Yamazaki et al. (2012).

with a simple interface that could be controlled by users as young as 3 years old, and used it to connect children in Japan and Australia. The Japanese Telenoid robot was designed to be held in the arms like an infant to provide comfort, as part of Japan's efforts to design robotic companions for the ill and elderly (Sorbello et al., 2016). Child-sized robots are notably absent in the U.S., however, and are sometimes perceived as uncanny or "creepy."[54]



Eng-Key (Korea) Modified Robovie-R3 (Japan) Telenoid (Japan)

Figure 7. "Child-sized" telepresence robots

Most of the robots described in this section are research prototypes that are yet to become commercially available. Meanwhile, several countries outside Japan and the U.S., including China and Russia, have started commercially producing adult-sized telepresence robots on the Western model, some less expensive than those available in the West, making robots more globally available and affordable.[55] If telepresence robots become cheap enough, they could end up in many homes, which would change how people interact with relatives and friends who are far away.

Thus far, research on telepresence robots in non-Western cultures has not reported on the nature of communication between telepresence pilots and locals. An incidental finding in Mutlu et al. (2009) has sociolinguistic implications, however. The authors found that young Japanese women had more negative evaluations than men did of Geminoid, who looks like a middle-aged Japanese man, compared with a more mechanical-looking robot. This suggests that incorporating categories such as gender and age into telepresence robot design invokes social hierarchies and may have consequences for discourse and social interaction.

Future Outlook

All three of the communicative phenomena described above are expanding in use around the globe. In this section, I advance a few predictions as to the future directions that each might take.

Interactive Multimodal Platforms

The trend for different modes of communication to be added to web and mobile platforms will likely continue. At the same time, we can expect to see new modes, such as virtual reality (VR) and augmented reality (AR), become integrated into social media platforms. Facebook Spaces,[56] where individuals and

[54] See, e.g., https://singularityhub.com/2010/10/18/telenoid-the-creepiest-telepresence-robot-youll-ever-love-video/#sm.001xkf6wj136cczkwo42cnpisflqg, retrieved June 28, 2018.

[55] Whereas U.S.-made telepresence robots currently range in price from US$2000 to $70,000, China's Padbot U1 lists at US$697, followed by the Russian-American Endurance at US$950 and the Russian Synergy Swan at US$999. Source: http://www.franktop10.com/tag/telepresence-robots/, retrieved June 30, 2018.

[56] https://www.facebook.com/spaces. Note that this phenomenon illustrates all three of the trends described in this essay: It is a mode of communication accessed through an IMP; it is graphical (avatar-medated) communication; and its users are telepresent, albeit in a virtual world.

groups can interact as cartoonish avatars in virtual spaces with the use of a VR headset, is one forward-looking example.

The global dominance of Facebook has been increasing (Cosenza, 2018). However, if Facebook continues to lose the trust of its users as a result of recent scandals involving exposure of users' private data and the spread of propaganda and misinformation ("fake news") via the platform (Jenkins, 2018), this trend may lose momentum.

New tools will be created and social practices emerge in order to assess authentic content on social media and the web. At the same time, increasingly sophisticated means of "faking" digital content will be devised. Even video, which would seem to show people as they really are, can be digitally manipulated to make someone appear to be saying anything at all.[57] Developments in animation and digital modification will affect social interaction, as well. Already users of the iPhone X can animate emoji (animoji) with their facial expressions, and animation software and third-party apps will increasingly let users create and customize avatars to represent themselves in online interaction, including in video chat. Such practices could undermine the very notion of authenticity in digital communication.

Graphical CMC

The playful, over-the-top graphicons of today may be used rather conventionally tomorrow, if the evolution of emoticons and emoji serves as a model (Konrad et al., in prep.). Rather than becoming a stand-alone language (or languages), some graphicons will become conventionalized and integrated into textual CMC, and others will drop out of use. Emoji and stickers will merge – already, some Western platforms are displaying emoji in a larger format when they appear alone on a line of message, and the distinction between the two is already blurred in some Asian contexts (Konrad et al., in prep). At the same time, we can expect to see new graphicon formats emerge, perhaps including three-dimensional, manipulable icons and augmented reality overlays. There is also a trend toward social media users creating their own emoji/stickers, both in China (Ma, 2016) and on U.S.-based sites like Slack and Discord.[58] Relatedly, the uptick in propososals by internet users for new Unicode emoji will continue, although the Unicode Consortium may need to develop new protocols to deal with the growing demand.

Social media users' attention spans will become even more fragmented as they are bombarded by increasingly multimodal content.[59] I predict that videos embedded in social media will get shorter, and GIF animations will come into wider use, including as "image bites" to communicate serious messages, e.g., in advertisements and political messages. As part of the general expansion from playful/humorous to broader deployment of GCMC, personalized image macros will be used for self-presentation, reactions, and greetings – a trend already evident on photo-sharing sites such as Instagram.

Telepresence Robot-Mediated Communication

The usability of telepresence robots will improve over time, given improved WiFi and other technological advances already in the works. Robots will have new designs, forms, and abilities, including automation of burdensome tasks such as driving the robot from one location to another. Robots with "superhuman" abilities will be able to do things that normal humans can not do, for example, be in two (or more) places at once, fly, and effortessly translate conversation into many languages (Herring, 2016). As regards telepresence robotic forms, roboticists in Japan are already developing robots in the form of furrry animals (Broadbent et al., 2009). Holographic telepresence will

[57] Suwajanakorn, Seitz, and Kemelmacher-Shlizerman (2017) recently demonstrated this by creating and animating a fake video representation of former U.S. President Barack Obama.
[58] See, e.g., https://support.discordapp.com/hc/en-us/articles/207619737-Adding-Emoji-Magic
[59] Some (more?) people will also choose to withdraw from social media, although it will become harder to do so given the ubiquity of smart phones.

be another focus of future development; its feasability was demonstrated by the late Stephen Hawking speaking in real time last year as a three-dimensional hologram to an audience in Hong Kong.[60] Such radically different forms will inevitably affect the nature of RMC.

Closing Thoughts

In this essay, I have explored three recent technological trends that advance CMC beyond email, texting, videoconferencing, and "Web 2.0" into new convergent and multimodal domains. These emergent phenomena open up new vistas for research and communication in a globalized, networked world, from questions of mode choice, to the effects of technological mediation on discourse and social interaction, to design considerations. Of course, these are not the only emergent developments in CMC technology. Another very recent phenomenon involves AI and digital voice assistants such as the Amazon Echo, Google Home, and Apple HomePod, also known as smart speakers. Smart speaker-mediated communication takes place when people use these devices not just to listen to music or ask about the weather, but to call or leave messages for other people. This phenomenon is too new to have attracted research attention yet, but inasmuch as smart speakers are starting to be used for human-to-human communication, that communication can and should be studied as a new form of multimodal CMC. Moreover, given the increasing ubiquity of these devices in people's homes and their integration of artificial intelligence, it is important to understand their effects on human communication.

More generally, we may ask: Will the effects of these emergent technologies be for good or for ill? IMPs are deeply engaging; they provide sensory and social stimulation and encourage media co-activity. Yet multitasking can impair people's memory and ability to focus and can increase stress (Dzubak, 2008), and constant stimulation can be addictive. Graphicons are playful and enhance the emotional expressivity of text, but they are severely limited as a communication system; if all communicators had were emoji – the most language-like of graphicons – the expression of complex ideas would be impossible. Telepresence robots extend the ability of people who cannot or do not wish to travel to be telepresent and interact in remote locations; moreover, a reduction in travel reduces greenhouse gas emissions and is good for the planet. But communicating as a robot risks dehumanizing the individual – robots tend to be treated with less respect than physically present persons (Rae & Neustaedter, 2017) – and robots afford new means of surveillance. Surveillance is also a concern with in-home smart speakers, along with a concern that barking commands (and sometimes verbal abuse) at a virtual assistant will teach children to treat humans the same way and further erode civility.[61] At the same time, smart speakers are undeniably convenient and helpful. In short, there are both risks and opportunities inherent in this brave new technological landscape.

Finally, these are first-world technologies, originating in technologically-advanced nations. Robots, smart speakers, and even computers and internet access are beyond the reach of most of the world's population at this time. It is not clear to what extent, or how, the technologies discussed here will be adopted by speakers of minority languages, for instance. Nonetheless, it is probable that many people around the world will use these technologies increasingly to communicate in a variety of contexts, within and across cultures, including in ways not yet envisioned. For better or for worse, humans will rely more on digital communication in the future, and scholars of language and communication must be forward-looking in addressing the developments and consequences that result.

[60] http://www.dailymail.co.uk/wires/afp/article-4347906/Stephen-Hawking-appears-hologram-Hong-Kong.html
[61] But see, e.g., https://www.fastcompany.com/40588020/the-case-against-teaching-kids-to-be-polite-to-alexa, retrieved June 30, 2018.

Acknowledgement

This essay is an expanded version of a plenary talk I gave at the LinguaPax 2017 conference: *World language diversity, old and new frontiers, emerging scenarios*. I am grateful to the organizers for inviting my participation in the conference and in the published proceedings.

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