Research Article

Mobile communication research in 15 top-tier journals, 2006–2020: An updated review of trends, advances, and characteristics

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Abstract

Benefiting from the smartphone turn in wireless telecommunication, studies about mobile telephony have continued to grow in the 3/4G era. To explore the growth trends in the 3/4G era, and what and how mobile media are studied, the present study analyzes patterns and trends of mobile communication research in 512 articles published in 15 top-ranked communication journals from 2006 to 2020. Findings indicate that mobile communication research has grown into a distinctive subfield or sub-discipline, defined by four main characteristics. First, the scope of mobile communication research is broader than studies of mobile media alone. Second, mobile media as global technologies have attracted international authors, although global scholarship is uneven. Third, the boundary of mobile communication has expanded from social, economic, and cultural perspectives to those of health, education, and tourism. Fourth, although mobile

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communication research is increasingly theory-informed, building distinctive theories about mobile communication remains a challenge for future growth.

Keywords
Smartphones, mobile media, mobile communication, subfield, disciplinary review

Introduction

With 5.296 billion unique mobile subscribers (GSMA Intelligence, 2021) and 6.378 billion smartphone users worldwide as of 2021 (Statista, 2021), the world has found what Donner (2008, p. 147) called "symbols of the modern and the global" in the popular mobile (cellular) phone, which has become the most rapidly diffused communication technology in history. Countries that have the largest user populations and top penetration rate include both the developed countries and the global south, such as China, India, the United States, Indonesia, and Brazil. Table 1 shows smartphone adoption in the top 20 countries.

Benefiting from the "smartphone turn" in wireless telecommunication (Campbell, 2019, p. 46), studies about mobile telephony thrived in the 3G era and continued to

Table 1. Smartphone penetration for top 20 countries by smartphone users.

Country	Countries studied	First authors' affiliations	Smartphone penetration	Smartphone users
China	20	12	63.8%	918.45M
India	6	4	31.8%	439.42M
USA	143	168	81.6%	270M
Indonesia	4	1	58.6%	160.23M
Brazil	1	0	51.4%	109.34M
Russia	1	0	68.5%	99.93M
Japan	4	4	63.2%	80M
Mexico	2	2	54.4%	70.14M
Germany	17	22	77.9%	65.24M
Vietnam	0	0	63.1%	61.37M
UK	19	26	78.9%	53.58M
Bangladesh	0	0	32.4%	53.3M
Iran	4	2	62.9%	52.81M
Turkey	5	5	61.7%	52.06M
France	6	4	77.6%	50.66M
Italy	3	8	75.9%	45.92M
Philippines	2	0	37.7%	41.31M
Pakistan	0	0	18.4%	40.59M
South Korea	46	43	76.5%	39.2M
Thailand	1	1	54.3%	37.88M

Source: https://newzoo.com/insights/rankings/top-countries-by-smartphone-penetration-and-users.

grow in the 4G era (Borah, 2017; Kim et al., 2017; Taipale & Fortunati, 2014; Zheng et al., 2016). The growing mobile communication research is marked by inaugural events and milestones (Campbell, 2019), ranging from institutional development in the 2013 launch of *Mobile Media & Communication*, the establishment of an interest group within the International Communication Association (ICA) in 2017, to handbooks on mobile communication published by Oxford University Press.

Borah (2017) found that mobile media were among the top three most studied communication technologies during the first decade of the 21st century. Now, with the 4G era about to come to a close, what is the status of state-of-the-art of mobile communication research in the past 15 years? What has changed since the popularity of smartphones —exemplified by iPhones in 2007—in terms of trends, scope, and patterns? Does the evolution of mobile media research follow Wimmer and Dominque's (2008) disciplinary developmental four-phase model (i.e., research on (a) the medium itself; (b) uses and users; (c) media effects; and (d) media improvement) in reaching its maturity? Additionally, as the mobile phone is deeply imbedded into routines from work to leisure to communication, is the mobile phone a blessing or curse? This study aims to address those questions by perusing a large-scale, updated, and comprehensive review of the studies of mobile media.

Periodic review of the state of research in a discipline is considered a productive way to map out the trends and patterns of the field, both to advance theory (Chaffee, 1991) and to assess the maturity of the field (Borgman, 1989). However, compared to thematic analyses or disciplinary reviews of Internet studies or computer-mediated communication (CMC), reviews of mobile communication research are few and far between. Also, previous reviews have been limited to a relatively small sample of studies for analysis. Additionally, past reviews have missed studies published in *Mobile Media & Communication*. Will the newly launched journal for mobile communication research be catalytic in the growth?

A large-scale review of the scope and state of mobile communication research at the dawn of 5G networks is timely. By analyzing trends and themes, with a focus on the what, who, and how of mobile media research, we aim to clarify whether studies of mobile media represent a field of their own or a mature subfield within the broad field of communications (Campbell, 2013, 2019). In either case, the review will illuminate such studies by defining key characteristics. Finally, as the smartphone and a wide range of mobile and smart devices continue to saturate the world's population in the coming 5G era, findings of this review will suggest directions for future research.

Review of reviews and research questions

The definitions of mobile communication are diverse in scope and variety but basically refer to people-to-people communication using wireless technology. Simply put, mobile communication means talking, texting, and accessing the Internet on the move. Compared to research about the plain old telephone, which has a long history but no matching scholarly enthusiasm (Katz, 1999), studies of mobile telephony, which gained popularity in the 1990s, have been on an entirely different trajectory.

Roos (1993) conducted a sociological review of adoption and popular uses of the 2G mobile phone for calling and texting in the Nordic countries. With a review of a limited number of studies about the 2G mobile phone from political, economic, and cultural perspectives, he intended to shed light on the questions of why Nordic countries were ahead of the curve in mobile phone diffusion and uses. His review provided a sociological definition: mobile phone meant a personal phone, offering mobility by virtue of perfect reachability and a perceived immediate intimacy.

Reviewing the development of the mobile phone in its early days of technological development, Srivastava (2005) called scholars' attention to the transformation of the mobile phone from a mere technological object into a key social object with far-reaching consequences for forming human identities and the evolution of social behavior. Based on an analysis of SMS (short message service or texting) data, she set an agenda for more research about the social impacts of "the pervasive mobile phone" (Srivastava, 2005, p. 111).

In 2007, when the introduction of iPhone ushered in the era of 3G smartphones, studies about mobile phones gained momentum with an increased number of articles. Donner (2008) conducted a thematic review of 200 mobile phone studies that put mobile telephony at the center of the analysis in the developing world and in different disciplines. He classified them into two concentrated streams of research: (a) mobile adoption and impacts of mobile phone use, such as whether mobile use accelerates, complicates, or otherwise interacts with the process of economic development; and (b) studies that explored what he termed "mobile interrelationships" (p. 144), the interaction between mobile technologies and users, and the uses of mobile phones in everyday life in rich local contexts.

In this interdisciplinary literature review, Donner (2008) identified major themes or pivotal issues which included diffusion studies, regulatory frameworks and industry structures, the mobile divide and universal access, and impacts of mobile phone use in terms of promoting economic growth or well-being. In synthesizing what he called "interrelationship" studies, he underscored the wide diffusion of the mobile phone in the global south as a symbol of modernity and globalism.

In the 3G/4G era, studies about mobile communication have emerged as a well-recognized area (Campbell, 2019). Reviews became more regular, extensive, and quantitative in nature. Taipale and Fortunati (2014) reviewed 66 studies about mobile media in 5 top-tier journals from 1999 to 2012. With a focus on methodological trends, they assessed the state of mobile communication research employing various methodologies and approaches. They pointed out that the lack of cumulative results and cross-national analyses was a major limitation for scientific research of mobile communication.

Asian countries have had the world's largest mobile population (Lim & Goggin, 2014), hence they are a fertile ground for conducting studies about communication via mobile phones and devices. Qiu (2010) reviewed Asian mobile communication research from the mid-1990s to the early 2000s. He suggested that the Asian characteristics in embracing mobile telephony and the heterogeneity of Asian mobile communication research, which included a range of differences in research traditions, theoretical perspectives, and contexts. The heterogeneity reflected well the sociopolitical, economic, cultural, and religious diversity of Asian countries.

In another review of 120 articles with a focus on scholarship in Asia from 1995 and 2014, Zheng et al. (2016) reported a 10-fold increase in scholarly output concerning Asian mobile communication among the 18 journals included in the review since 2006. They argued that the growing literature became an important part of the global scholarship. On the other hand, they uncovered a few deficiencies in Asian mobile communication—the lack of a unified theoretical framework (e.g., half of the studies were not informed by any theory), an overemphasis on East Asian countries, and reliance on one-shot research designs.

A more recent and comprehensive review of the global mobile communication research was attempted by Kim et al. (2017), who analyzed trends and patterns of mobile communication research published in 10 communication journals from 1999 to 2014. Findings of the review were consistent with previous works (Taipale & Fortunati, 2014; Zheng et al., 2016). The number of studies of mobile communication had increased. They examined themes or topics such as adoption and diverse uses, characteristics of users, and the effects of mobile media on everyday life. Quantitative methods were the most applied. However, the application of theories or models was infrequent. In fact, a lack of conceptual advances and theory-building was found in new media research in general and in mobile communication in particular (Borah, 2017).

Informed by the above review of past reviews concerning the trends, themes, and scope of mobile communication research, we raised the following research questions to further explore the progress in such research:

RQ1: Regarding publishing trends, (a) what is the trajectory of mobile communication research within the global communication literature? (b) How have scholars of mobile communication defined the scope of their studies and conceptualized mobile media? (c) Which countries were studied the most, by whom? And (d) are countries studied the most and first author's affiliation related to the smartphone penetration of those countries?

RQ2: What are the most studied themes, subjects, and issues in the fast-growing literature of mobile communication research?

RQ3: What is the pattern of the studies in (a) theory application, (b) methods used, (c) and populations of study? And (d) what are the limitations mentioned in these studies?

Method

We conducted a content analysis to address the 3 research questions concerning the status and progress of global mobile communication over the 15-year span from 2006 to 2020. Content analysis is an appropriate and commonly used quantitative method in analytic literature reviews and syntheses of research in a field. As Chaffee (1991) noted, synthesis is a valuable study in itself, which facilitates theory building.

The first generation of Apple's iPhone was launched in 2007, a pivotal event in accelerating the diffusion of smartphones worldwide during the analytic time frame. The articles sampled were selected from 15 top-ranked communication and new media journals.

Eight general communication journals included *Journal of Communication*; *Communication Research*; *Human Communication Research*; *Journal of Broadcasting & Electronic Media*; *Journalism & Mass Communication Quarterly*; *Journal of Applied Communication*; *Media Psychology*; and *Mass Communication & Society*. New media journals included *New Media & Society*; *Journal of Computer-Mediated Communication*; *Mobile Media & Communication*; *Social Media + Society*; *Telematics and Informatics*; *Information, Communication & Society*; and *Cyberpsychology, Behavior & Social Networking*.

Considering that original research constitutes the primary literature of a field, we focused on original research articles. We first searched for 10 general keywords that are frequently used in mobile communication studies: mobile communication, mobile media, mobile phone, cell phone/cellphone, cellular phone, smartphone/smart phone, iPhone, mobile, mobility, and wireless. Based on these keywords, we conducted a full-text search in Web of Science, including title, keywords, abstract, and main body, among articles published in the 15 journals over the 15-year time frame. To make our analysis comparable to previous reviews, we selected only original articles; that is, the article must have theory, method (qualitative or quantitative), data, and findings sections. As a result, we identified a total of 787 articles; we then manually conducted a second round of selection by reading the articles' titles, keywords, and abstracts. Articles that contained the keywords but did not focus on mobile media as a major variable were eliminated ($n = 224$). For example, a number of articles only mentioned that "smartphones developed rapidly in recent years" in their introduction or treated smartphone development as the background of the study. In the coding stage, 2 trained coders read the main bodies of the 563 articles. Other types of articles and those that did not focus on mobile media or mobile communication were further excluded. Articles that were too short (e.g., 5–6 pages or even fewer) were also excluded. The final sample totaled 512 articles published from 2006 to 2020. Figure 1 shows that the PRISMA flow chart (Page et al., 2021), which demonstrates the process and quality check in systematic selection.

Coding scheme and categories

The coding scheme comprised general information of the selected articles (e.g., title, type, and publication years) and other details in 10 broad categories, which included:

1. **Themes,** which refer to the primary focus of the study or the main subject that the study examined. Specifically, we adapted the themes used by Wimmer and Dominique (2008) in their four-stage evolution model of mass media research, which provides a long view of media growth and development in clarifying the scholarly agenda in relation to the different stages of media evolution (i.e., phase 1: mobile technologies as emerging media—for example, a study of the mobile handset ecosystems; phase 2: uses and users of mobile media; phase 3: effects of mobile media—for example, social implications of smartphone use; and phase 4: improvement of mobile media—for example, a study on 5G). Studies that investigated the use and users of mobile media and
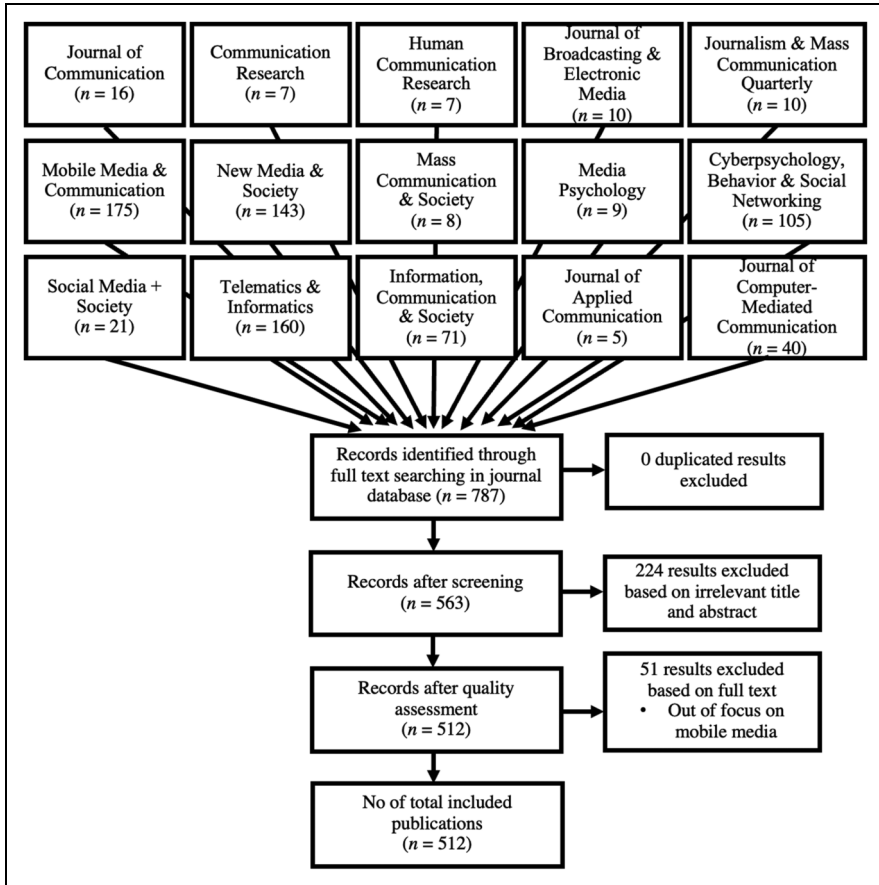
Figure 1. PRISMA Flow Chart of Publications of Mobile Communication Research in 15 Top-tier Journals.

purposes of use were coded (i.e., informational use, relational use, and as a meta medium). In addition, among studies that examined the effects of mobile media, the types of effects were coded as well (i.e., positive, negative, or mixed).

2. **Key issues of concern,** which refers to the concrete topics of the study or the specific issue studied (e.g., individual's everyday life, mobile economy, mobile education, mobile tourism).

3. **Domain or broad research subarea**, which refers to the area of study in the broad field of communication research. Adapted from Qiu (2010), So (2010), and Zheng et al. (2016), they included mass communication, political communication, health communication, etc.

4. **Theories, models, or frameworks applied,** which included a wide spectrum of perspectives, ranging from diffusion of innovations/adoption theory, TAM (technology acceptance model), appropriation theory, use and gratification (U&G), theory of reasoned action, critical theory, collective action, and engagement, to economic development and entrepreneurship, combined theories applied, multiple theories applied, no theories applied, etc. In addition, for U&G studies, the motivations studied were coded as well. They were entertainment, information facilitation, accessibility, and social utility.

5. **Research methods,** which included both quantitative and qualitative methods. They were survey, secondary data analysis, experiment, content analysis, in-depth interview, discourse analysis, focus groups, ethnography, diary/log data, historical review and/or critique, law-policy analysis, and case study. The research paradigm of the study was coded as well (i.e., quantitative, qualitative, mixed).

6. **Smartphone or technology studied**—that is, if a study investigated issues related to smartphones, this was first coded, followed by coding of other types of mobile technologies examined in the study (e.g., smartphone only, social media, information and communications technology (ICT) or information technology (IT), the Internet, etc.).

7. **Country or region** that the study examined and the affiliation of the first authors.

8. **Population** of the study, which refers to the types of samples or the unit of analysis. The categories included general population, children and adolescents, college students, specific purpose or case of mobile phone users (e.g., doctors, midwives, elderly people), and non-human.

9. **Mobile affordances** employed by the study as (part of) its theoretical framework or mentioned by the study, which included portability/mobility, accessibility/perpetual contact, location-based, multimodality/multifunction, personalization, reciprocity/interactivity.

10. **Limitations** of the study, which included generalizability, population, and internal consistency, among others.

Two trained graduate students were employed to code the 512 articles. The reliability of coding was checked with 10% of the sampled articles. Sufficient reliability scores were achieved for major categories. The inter-coder reliability of coded variables ranged from 0.79 to 1.00 (Scott's pi). To be specific, the reliability of themes was .97, key issues .79, domains .88, theory .88, and methods .87.

General patterns of research and issues studied

Publishing trends and themes

RQ1a concerned the trajectory of mobile communication studies published in communication and new media journals from 2006 to 2020. Of the 512 articles in the sample, an average of 34 articles was published per year in the 15 selected journals. Figure 2 shows that in the sample of this study, there was an accelerated growth in scholarly output in mobile communication over a period of 15 years. Between 2006 and 2012, the total
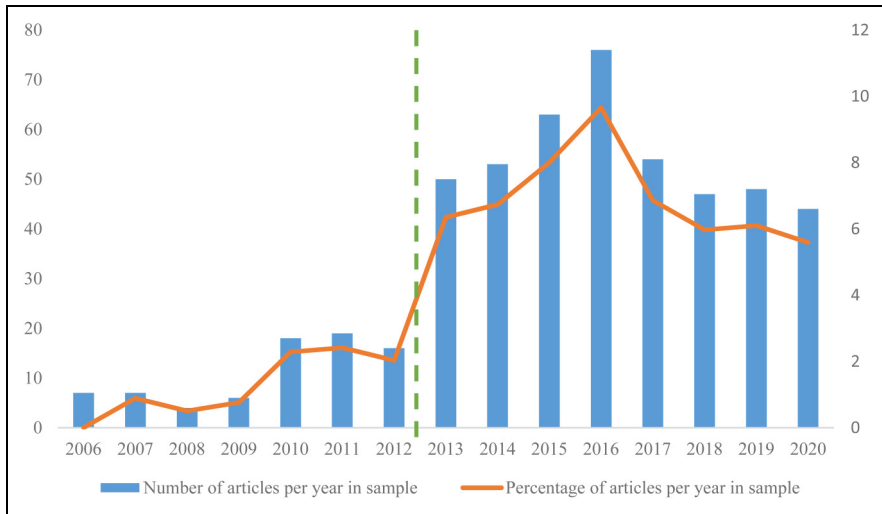
Figure 2. Trends in Publishing Mobile Communication Research, 2006–2020.
Note. The green demarcation line marks the steep curve before and after 2013. This trend might be explained by the widespread adoption of 3G smartphones and the launch of *Mobile Media & Communication*.

number of articles hovered around 10 to 20. Then, there was a sharp increase between 2012 and 2013, reflecting the widespread adoption of 3G smartphones and the concurrent scholarly attention to mobile media (also, the launch of *Mobile Media & Communication* in 2013 may contribute to the curve). It continued to grow and then peaked in 2016 with a total of 76 articles. Thus, the number of articles in mobile communication increased more than 10-fold from 2006 to 2016. This remarkable growth reflected the trend that smartphones had become the choice for going online among an increasing number of users. Broadly, the growth is consistent with that in the field of communication over the 15-year time frame.

Since 2016, about 50 articles per year became the norm, doubling that of the 2006–2012 period; this indicated that mobile communication research had entered a stage of solid growth following the peak in 2016. The trend was consistent with the previous reviews of online communication in general (Borah, 2017; Gould, 2004) and mobile communication in particular (Kim et al., 2017; Zheng et al., 2016).

Where were these studies published? Further analysis of the 512 articles by journals showed that most of them appear in the 7 new-media journals (*n* = 475, 92.8%); less than one-tenth (7.2%) were published in the 8 general communication journals (*n* = 37). Figure 3 shows the diverging trends of mobile communication studies by journals, indicating that general communication journals were no longer the main outlets for publishing mobile research.

As further shown in Table 2, research found a new home in the new and specialized journals. Not surprisingly, *Mobile Media & Communication* outnumbered other journals in publishing the most articles. In its eight-year existence, it accounted for more than a
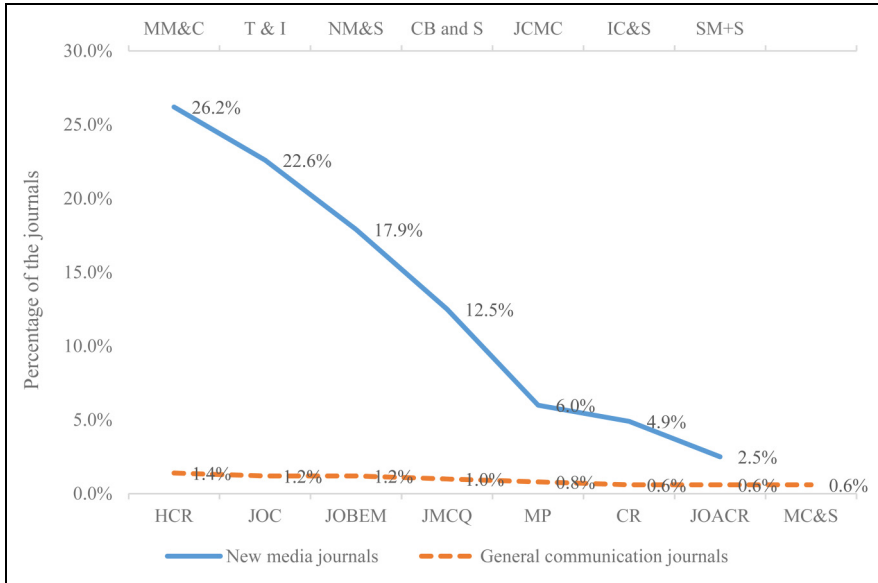
Figure 3. Publishing Trends in Mobile Communication Research by Journal

quarter (26.2%) of the total number of articles published in mobile communication research ($n = 134$), firmly establishing itself as the premium journal devoted to research about mobile media. Accordingly, it replaced *New Media & Society* as the most prolific outlet of mobile media studies. *Telematics & Informatics* published 116 articles (22.6%), followed by *New Media & Society* ($n = 92$, 17.9%) and *Cyberpsychology, Behavior & Social Networking* ($n = 64$, 12.5%). These results indicate a trend that a greater amount of scholarly research about mobile media has been published in new media-focused outlets than the established, broad-scoped communication journals.

RQ1b was further concerned with how scholars of mobile communication defined the scope of their studies in terms of conceptualizing mobile media. That is, were mobile media studied as a talking device, an artifact or an accessory? Results of frequency analysis of the 512 articles summarized in Table 3a show that more than two-third of the studies ($n=359$, 70.1%) focused on 3G/4G smartphones, indicating the role of smartphone as a catalyst of the rapid growth of mobile communication research.

However, further distribution analyses showed that mobile phones were not studied as a stand-alone technology. Instead, they were studied together with other digital media or Internet technologies, such as studies of mobile Internet, mobile social media, or mobile apps. Specifically, further frequency analyses of these 359 articles showed that only one-fifth ($n = 95$, 17.6%) of the studies examined mobile media as a stand-alone medium. As shown in Table 3a, the rest of them investigated mobile media in connection with social media ($n = 187$, 34.8%), ICT in general ($n = 89$, 16.5%), the mobile Internet or personal computer (PC) ($n = 74$, 15.3%), the landline telephone, and various forms of mass media (e.g., TV, radio, newspapers, or e-publishing).

Table 2. Number of Mobile Communication Studies Published in Selected New Media Journals from 2006 to 2020.

Journal	Number of articles by year															Total	%
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
MM & C	-	-	-	-	-	-	-	34	16	20	19	7	16	10	12	134	26.2
T and I	-	-	-	-	-	2	5	6	17	16	17	25	9	11	8	116	22.7
NM & S	5	4	4	3	8	13	5	4	6	5	12	7	9	5	2	92	18.0
CB and S	-	-	-	-	2	1	4	1	5	11	12	5	7	10	6	64	12.5
JCMC	0	3	0	1	3	1	0	2	7	4	2	1	1	2	4	31	6.0
IC & S	-	-	-	1	2	0	0	0	1	3	3	4	3	4	4	25	4.9
SM + S	-	-	-	-	-	-	-	-	-	0	5	3	1	0	4	13	2.5
Total																475	92.8

MM & C: Mobile Media & Communication; T and I: Telematics and Informatics.

Table 3a. Scope of Mobile Communication Studies and Conceptualization of Mobiles

	N	%
Smartphones		
Yes	359	70.1
No	153	29.9
Total	512	100.0
Tech studied		
Mobile phone studied alone	95	17.6
Mobile phone in connection with social media	187	34.8
ICT or IT	89	16.5
Internet/PC	74	15.3
TV	26	4.8
Landline telephone	21	3.9
Radio	17	3.2
Newspaper/e-publishing	16	3.0
Others	5	.9
Total	538*	100.0

Note. Some articles studied several technologies. For example, a paper may study mobile phones, the Internet, and e-newspapers. The total is greater than 512.
ICT: Information and communications technology; IT: information technology; PC: personal computer.

Table 3b. Frequency and Type of Mobile Apps Studied

Mobile apps	Frequency	Percentage
Mobile apps investigated	282	55.1
Mobile apps not investigated	230	44.9
Total	512	100.0
Facebook	165	31.8
Twitter	84	16.2
WhatsApp	41	7.9
Instagram	35	6.7
YouTube	30	5.8
WeChat	16	3.1
Snapchat	14	2.7
Google	14	2.7
Line	12	2.3
Weibo	6	1.2
LinkedIn	6	1.2
Foursquare	6	1.2
Grindr	5	.9
Others (fewer than 5 times)	85	16.3
Total	519	100.0

Note. Some articles studied several apps. The total is greater than 512.

Technologically, mobile apps and smartphones have symbolic relations. The smarter the phone, the greater the number of apps; likewise, the more apps for the smartphone,

the greater the popularity of the smartphone. We found as many as 243 articles that examined smartphones together with mobile apps. A chi-square test showed a significant relationship between studies that discussed smartphones and studies that were concerned with mobile apps [$\chi^2(1, n = 512) = 77.21, p < .001$]. Accordingly, we further analyzed mobile apps as a separate variable. As Table 3b shows, more than half examined mobile apps ($n = 282, 55.1\%$). Among the apps that were studied in these 282 articles, Facebook was studied the most frequently ($n = 165, 31.8\%$), followed by Twitter ($n = 84, 16.2\%$), WhatsApp ($n = 41, 7.9\%$), Instagram ($n = 35, 6.7\%$), and YouTube ($n = 30, 5.8\%$). Other popular but non-western apps that were subjects of scholarly inquiry were WeChat ($n = 16, 3.1\%$), Line ($n = 12, 2.3\%$), and Weibo ($n = 6, 1.2\%$). In total, there were 13 apps that were studied no fewer than 5 times in the 282 articles.

We further conduct a cross-tab analysis between the published years and the number of articles investigated/not investigated mobile apps. Results (see Figure 4) show that at the beginning of the 15-year period, most mobile communication studies did not investigate mobile apps. Around 2013, the number of studies on mobile apps exceeded that of studies that did not investigate mobile apps. After 2013, mobile apps became the major topic of mobile communication studies.

Based on Figure 2, the number of mobile communication studies increased rapidly after 2013, which might be explained by the widespread adoption of 3G smartphones and the launch of *Mobile Media & Communication*. Putting together the findings shown in Figures 2 and 4, it is possible to suggest that the shift of academic attention
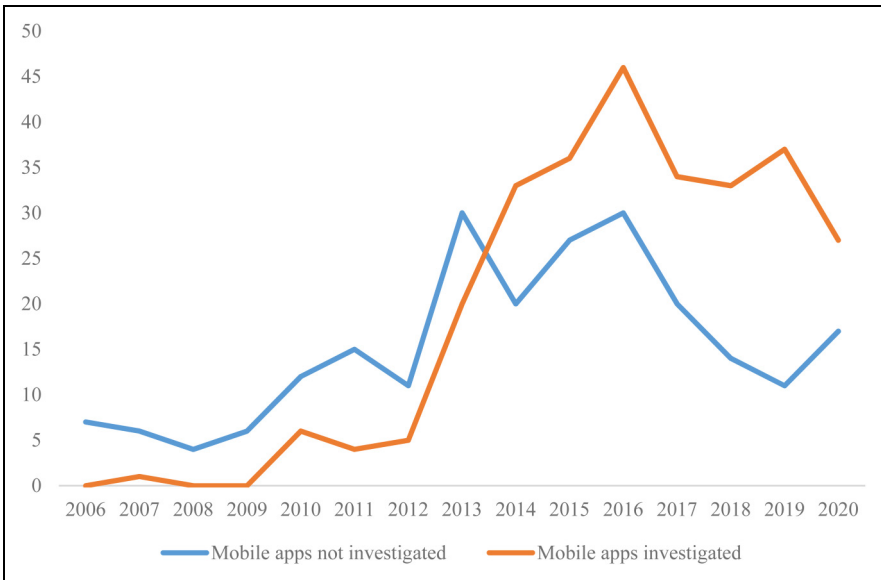

Figure 4. Publishing Trends of Studies (Not) Investigated Mobile Apps by Year

towards mobile apps after 2013 also contributed to the growth of mobile communication studies.

Together, these results suggest that the scope of mobile communication research is broader than studies of mobile media alone. So were the studies of mobile apps of various types. With a conceptualization of mobile media in relation to social media or mobile Internet, most of the studies fall under CMC, which refers broadly to "multimodal interpersonal social interaction mediated by information and communication technologies (ICTs)" (Meier & Reinecke, 2021). Further, the broad scope and hybrid conceptualization underscore the unique attribute of the mobile telephone—the multi-modularity of the mobile phone as an all-in-one meta media that fulfills people's need for social interaction and communication through diverse forms of interpersonal message exchange and mass (personal) communication or mass media use (Hall, 2018).

In addition, among the 130 articles that focused on how individuals accessed, adopted, and used the mobile phone and devices, more than half of them treated mobiles as a meta medium ($n = 68$, 52.3%), which means people used their mobile phones and devices for everything, both task-oriented informational use (28%, e.g., information seeking) and relational use or social interaction (34%, e.g., social media, chatting, texting, posting).

Who studied mobile media, and where?

To examine whether scholarly attention to a country reflects its penetration rate of mobile phones, RQ1c explored which countries were studied the most. Reflecting the mobile phone as a global technology, the published studies between 2006 and 2020 also covered the globe. However, the distribution of continents and countries was highly uneven. As Table 4 shows, North America ($n = 152$, 29.7%), Asia ($n = 147$, 28.7%), and Europe ($n = 117$, 22.8%) accounted for almost all of the articles. Despite the fast growth in mobile phone adoption in these regions, Africa ($n = 19$, 3.7%) and South America ($n = 6$, 1.2%) were the least studied continents in the sampled publications on mobile communication.

At the individual country level, as shown in Table 5, the United States, with a total of 143 articles, received the most attention (27.9%). South Korea was second ($n = 46$, 9.0%) and China was third ($n = 20$, 3.9%), followed by the United Kingdom ($n = 19$, 3. 7%), Australia ($n = 18$, 3.5%), Germany ($n = 17$, 3.3%), and Taiwan ($n = 16$, 3.1%). Scholarly attention paid to other Asian and European countries was scarce. For example, each of the 9 countries in Asia drew fewer than 5 articles, and, in total, these 9 Asian countries drew no more than 23 articles. In addition, the number of articles that focused on 2 countries or 3 countries totaled 24 respectively, accounting for less than 5% (4.7%). These additional results suggest that a single-country study of mobiles dominated the research design and selection of populations to study. Incidentally, the 512 sampled articles showed a high percentage (72.9%, $n = 373$) match between countries of the first author's affiliations with the countries in which their studies were conducted. As shown in Table 4 (the third column), the most frequent match was between first authors' affiliations and studies conducted in the United States ($n = 130$).

Table 4. Countries or Regions Studied and First Authors' Affiliations in Mobile Communication Research.

	Countries/regions studied		First authors' affiliations		Matching between country and author	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
North America						
The US	143	27.9	168	32.8	130	25.4
Canada	6	1.2	10	2.0	5	1.0
Mexico	2	.4	2	.4	2	.4
Cuba	1	.2	-	-	0	-
Total	152	29.7	180	35.2	137	26.8
Asia						
South Korea	46	9.0	43	8.4	38	7.4
China	20	3.9	12	2.3	9	1.8
Taiwan	16	3.1	16	3.1	15	2.9
Israel	10	2.0	12	2.3	10	2.0
Hong Kong	8	1.6	11	2.1	6	1.2
Singapore	8	1.5	16	3.1	7	1.4
India	6	1.2	-	-	3	.6
Malaysia	5	1.0	-	-	4	.8
Turkey	5	1.0	5	1.0	5	1.0
Others	23	4.5	19	3.7	10	2.0
Total	147	28.7	134	26.1	107	20.9
Europe						
The UK	19	3.7	26	5.1	14	2.7
Germany	17	3.3	22	4.3	14	2.7
Spain	11	2.1	14	2.8	10	2.0
Netherlands	10	2.0	13	2.5	9	1.8
Belgium	9	1.8	8	1.6	8	1.6
Denmark	9	1.7	12	2.3	9	1.8
Finland	9	1.7	10	2.0	8	1.6
France	6	1.2	-	-	4	.8
Norway	6	1.2	5	1.0	4	.8
Sweden	5	1.0	12	2.3	5	1.0
Others	16	3.1	31	6.1	14	2.7
Total	117	22.8	153	3.0	99	19.3
Oceania						
Australia	18	3.5	30	5.9	18	3.5
Others	3	.6	1	.2	1	.2
Total	21	4.1	31	6.1	19	3.7
Africa						
South Africa	5	1.0	7	1.3	5	1.0
Others	14	2.7	4	.8	4	.8
Total	19	3.7	11	2.1	9	1.8
South America						
All combined	6	1.2	3	.6	3	.6

(Continued)

Table 4. (Continued)

	Countries/regions studied		First authors' affiliations		Matching between country and author	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Two countries/ regions	24	4.7	-	-	-	-
Multiple countries/ regions	24	4.7	-	-	-	-
Not identified	2	.4	-	-	-	-
Total	512	10.0	512	10.0	373	72.9

Table 5. The Key Issue of Concern in Mobile Communication Research

Key issues of concern	Frequency	Percentage
Individual everyday life	141	27.6
Psychological well-being	77	15.0
Economy, entrepreneur, or social development	54	10.5
Social, political, or civic issues	51	10.0
Gender, inequality, or digital divide	35	6.8
News/public information	30	5.9
Culture/subculture	26	5.1
Mobile health	26	5.1
Privacy and policy	16	3.1
Mobile education	15	2.9
Language relating to texting	12	2.3
Mobile tourism	4	.8
Others	25	4.9
Total	512	100.0

To investigate the relationship between the countries studied or first authors' affiliations and national smartphone penetration, the concern of RQ1d, we performed the Spearman's correlation test. Results showed that countries studied were significantly related to their smartphone penetration ($r = .66$, $p < .001$). Also, first authors' affiliations were significantly correlated to the smartphone penetration rate as well ($r = .73$, $p < .001$). The correlation between a country's mobile penetration rate and first authors was almost perfect ($r = .92$, $p < .001$). These additional results suggest that the increasing penetration of mobile technologies in a country catches media scholars' attention to mobile adoption and uses. The increased scholarly publications in the most mobile countries benefited from the robust growth in the number of mobile users. With the mobile becoming a widespread way of life that is deeply embedded into the routines of work, leisure, and personal communication, the mobile cannot be ignored.

A similar pattern was found in those who published mobile communication studies (refer to Table 5). Using the continent or country of the first author's affiliation,

authors based in North America (n = 180, 35.2%), Europe (n = 153, 30%), and Asia (n = 134, 26.1%) dominated the publications in mobile communication research from 2006 to 2020. At the country level, scholars based in the United States accounted for one-third of the 512 publications (n = 168), followed by scholars affiliated with academies in South Korea (n = 43, 8.4%), Australia (n = 30, 5.9%), the United Kingdom (n = 26, 5.1%), and Germany (n = 22, 4.3%).

What was studied in mobile communication?

RQ2 explored evolving themes and major subjects in the global mobile literature. When the 512 studies were analyzed by themes, the research agenda fitted well with Wimmer and Dominique's (2008) media developmental model in four distinctive phases, including studies on mobile technologies as emerging media (n = 54, 10.5%) in phase 1; uses and users in phase 2 (n = 291, 56.9%); effects of mobile media in society (n = 133, 26.0%) in phase 3; and phase 4—improving mobile media (n = 11, 2.1%).

However, the distribution of articles published in the past 15 years was uneven across the 4 phases. Scholars had studied uses and users the most (e.g., access, adoption and use of mobile devices, users/non-users, and digital divide), accounting for more than half of the published articles in the 15-year period. Among the 130 studies that concentrated on uses of mobile media, the majority (n = 68) treated mobile as meta media, and one-quarter (n = 34) studied uses of mobile media for relational or social use, while another quarter (n = 28) focused on informational use. It is noteworthy that for emerging media, researchers paid a great deal of attention to the consequences of mobile media use for hundreds of millions of users around the world (n = 133, 26.0%).

Among the 133 articles that examined the impacts of mobile media on society, the majority (n = 77) of them explicitly assessed whether the impacts were positive or negative. Nearly half (n = 38, 49.3%) of the articles found the consequences of mobile media use were negative, such as an increase in addiction, problematic use, or negative emotions (e.g., anxiety and stress), while positive effects, including improvement in life satisfaction, social cohesion, and quality of life, were reported in only 17 studies (22.1%). About a third of the research found both positive and negative impacts of mobile media.

RQ2 further explored key issues as major concerns of mobile communication research. Table 5 shows a diverse and wide-ranging list of issues addressed in the 512 articles. More than a quarter framed the studies as examinations into the role of mobiles in people's everyday life (n = 141, 27.6%), highlighting the mobiles as personal media. The rest of the articles explored people's psychological well-being (n = 77, 15.0%), followed by economy, entrepreneur or social development (n = 54, 10.5%), and social, political, or civic issues (n = 51, 10.0%). In addition, gender, inequality or digital divide, mobile news, culture or subculture, and mobile health also caught some attention from scholars. Our results indicate that the boundary of mobile communication has expanded from social, economic, and cultural perspectives to those of health, education, and tourism.

Table 6. Domains or Broad Research Subareas of Mobile Communication Research

Domains or broad research subareas	Frequency	Percentage
Mobile communication	269	52.5
IT in general	49	9.6
Family communication	44	8.6
Mass communication	40	7.8
Political communication	37	7.2
Social equality	36	7.0
Health communication	24	4.7
Big data/AI/VR	8	1.6
Gaming	5	1.0
Total	512	100.0

AI: artificial intelligence; IT: information technology; VR: virtual reality.

Table 7. Theoretical Framework(s) Applied in Mobile Communication Research

Theoretical framework(s)	Frequency	Percentage
Diffusion of innovations/adoption theory	19	3.7
Technology acceptance model (TAM)	19	3.7
Use and gratification approach	19	3.7
Digital divide/knowledge gap	19	3.7
Networks/social networks analysis	18	3.5
Collective action and engagement	14	2.7
Affordance theory	11	2.1
Critical theory	10	2.0
Domestication theory	9	1.8
Appropriation theory	8	1.6
Social capital	7	1.4
Theory of the niche	6	1.2
Cognitive theory	5	1.0
Theory of media richness	5	1.0
Other theories	141	27.5
Total	310	60.6
Combined theories	42	8.2
Multiple theories	17	3.3
No specific theory applied	143	27.9
Total	512	100.0

With expanding boundaries, did studies of mobile constitute a field or a subfield in communication research? Results of analyses of domains of the 512 articles suggest a subfield of study of its own. As the distribution of research areas in Table 6 shows, over half of the articles ($n = 269$, 52.5%) fell into the domain of mobile communication, which meant those studies had a specific focus on issues of mobile technologies or mobile devices. Other domains were diverse but secondary, including IT in general ($n = 49$, 9.6%), family communication ($n = 44$, 8.6%), mass communication ($n = 40$, 7.8%), political communication ($n = 37$, 7.2%), and health communication ($n = 24$, 4.70%).

Compared to a previous review (Zheng et al., 2016) regarding the research domains of mobile communication research, the proportion of studies framed from a new media perspective or conceptualizing mobile phones as new forms of digital media has outgrown other domains such as mass communication, adolescent development, and political communication. The results indicate that mobile communication as a distinctive subfield has been well established. Scholars had framed their research problems about mobile media from a mobile perspective as compared to treating mobiles as a concern for systematic studying.

How are mobile media studied?

RQ3a explored the application of theories or analytic frameworks that served as foundations of the published articles. As the results in Table 7 show, the majority of the articles ($n = 310$, 60.6%) had a theoretical footing. The most commonly applied theories were diffusion of innovations/adoption theory, the TAM, U&G approach, and the digital divide/knowledge gap, followed by networks/social network analysis ($n = 18$, 3.5%), and collective action. Other theories included affordance theory ($n = 11$, 2.1%), critical theory ($n = 10$, 2.0%), and domestication theory ($n = 9$, 1.8%). It is interesting to note that 60.6% of the studies ($n = 310$) applied a single theory or model. The number of articles that tested combined theories or multiple theories was small but noticeable at 42 (8.2%) and 17 (3.3%) respectively. Only 143 articles (27.9%) did not explicitly apply a specific theory or situate the study within any specific theory, which is consistent with previous reviews (Borah, 2017; Kim et al., 2017).

Among the 19 U&G studies of mobile media, entertainment ($n = 25$, 23.8%), sociality ($n = 23$, 21.9%), and information facilitation ($n = 19$, 18.1%) were the most studied motivations for using mobile media and devices. The results are consistent with the expanded scope of mobile media as an all-in-one technology that entertains, informs, and facilitates social interactions. Further, the "affordance" concept was mentioned but not applied in 128 articles; only 11 articles used this concept as part of their theoretical frameworks. The most applied affordances of mobile media were personalization, multimodality, locatability, and mobility, suggesting that mobiles serve as highly personalized and hybrid media that help users to meet their communication needs anywhere, any time.

Compared to previous reviews, it is clear that some progress has been made in the theory-informed approach to study of mobile media. Similar to Internet studies, diffusion and U&G were consistently the most applied theories in studying mobile media. On the other hand, there is clearly an absence of distinctive mobile communication theory to explain the rich and diverse phenomena of imbedding mobile media in one's everyday life. This is consistent with previous reviews (Borah, 2017; Kim et al., 2017;); theorization persists as a weakness in mobile communication research.

The concern of RQ3b—commonly used research methods to study mobile media—was analyzed next (see Table 8). Consistently, survey was the dominant research method, used in one-third of the 512 articles ($n = 161$). That was more than twice as much as secondary data analysis ($n = 67$, 13.1%), which was the second most popular method. Other research methods were diverse, including in-depth interviews ($n = 46$),

Table 8. Research Methods and Paradigms Applied in Mobile Communication Research

Research methods	Frequency	Percentage
Survey	161	31.5
Secondary data analysis	67	13.1
In-depth interview	46	9.0
(Historical) review or critique, and discourse analysis	37	7.2
Content analysis	35	6.8
Experiment	27	5.3
Case study	22	4.3
Ethnography	16	3.1
Big data	14	2.7
Focus group	12	2.3
Diary/log data	5	1.0
Law/policy analysis or review	5	1.0
Combined methods	65	12.7
Total	512	100.0
Paradigms		
Quantitative	300	58.6
Qualitative	155	30.3
Mixed	57	11.1
Total	512	100.0

Table 9. Self-reported Limitations Mentioned in Affordance Studies

Limitations	Frequency	Percentage
Other predictive factors may play a role	90	24.7%
Findings may not be generalizable	66	18.1%
The study only focuses on a specific population	61	16.7%
The data have low criterion validity	26	7.1%
More in-depth study is needed	18	4.9%
Respondents may give fake or exaggerated answers	17	4.7%
Causality cannot be determined	16	4.4%
Interviews are subject to bias	6	1.6%
Items might not have enough internal consistency	3	0.8%
Not clear/not applicable	62	17.0%
Total	365	100.0

historical review or critique, discourse analysis ($n = 37$), content analysis ($n = 35$), and experiment ($n = 27$). In addition, 65 articles used 2 or more methods, which accounted for 12.7% of the sampled articles.

RQ3c was concerned with the population or sample of subjects studied in mobile communication research. Further analysis found that mobile media studies were more likely to collect data from a range of targeted groups ($n = 180$, 35.2%), such as doctors, midwives, and students, than from the general population ($n = 123$, 24.0%). It is interesting to note that 88 articles did not study any group of users. Instead, they used historical data, texts, or policy documents as objects of study.

In the past 15 years, more studies employed quantitative methods than qualitative methods. A total of 57 articles used mixed methods (11.1%). It is clear that a greater number of mobile communication studies follow the social science model than the critical or cultural approaches.

Limitations

The last aspect of RQ3d explored self-reported limitations in the 365 published studies that applied affordances as their theoretical framework. Table 9 shows the most mentioned shortcoming as a limited scope of study ($n = 90$; 24.7%), such as other potential factors or predictor variables that were not examined. Two other major limitations were lack of generalizability of findings ($n = 66$, 18.1%) and sampling only of a specific group for study ($n = 61$, 16.7%). Those are common methodological issues in positivist empirical research. Surprisingly, no study acknowledged the lack of theoretical rigor as a limitation.

Conclusion and insights

Building on previous disciplinary reviews concerning mobile media (Chib et al., 2015; Kim et al., 2017; Taipale & Fortunati, 2014; Zheng et al., 2016), we pursued an updated analysis of broad trends and advances in mobile communication research in 15 journals. Findings show that the number of articles in mobile communication increased more than 10-fold from 2006 to 2016 in the 3G/4G era, which can be considered as a golden decade of mobile communication research. The iPhone and Android-based smartphones provided the driving force in the 3G/4G era; most of the studies focused on smartphones. Riding the wave of the phenomenal adoption of smartphones around the world, the growth in studies devoted to mobile media has built momentum in scholarly publications concerning mobile communication and set the stage for its maturity.

Therefore, even though studies about mobile media and devices started to gather steam in the first decade of the 21st century, their short yet fast-growing history well reflects Wimmer and Dominique's (2008) four-stage evolution model of mass media research. Mobile communication research evolved from earlier studies about the mobile medium as a technological object in the 2G era; following this, a large amount of scholarly work focused on uses of the technology as a key social object by billions of users (Srivastava, 2005); and research then advanced to examine the broad range of impacts of living with mobile media 24/7. Research about issues involving upgrades to the technology, such as 5G and VR applications, constitutes the last phase of development.

The implications of the evolution and advances are that mobile communication research has established itself. In other words, studies about mobile media and devices have gone far beyond the novelty stage and have matured in the past 20 years. As a newly emerged subfield of research within the field of communication, mobile media study stands alongside other mature and established subfields or fields in communication research (e.g., organizational communication, mass or political communication).

Compared to a past review (Zheng et al., 2016) regarding the research domains of mobile communication research, studies that conceptualized mobile phones as new forms of digital media have outnumbered other domains such as mass communication, adolescent development, and political communication. This is a major indicator of its development in the 15-year period.

In addition, an important but diverging trend emerged in scholarly works about mobile communication in the sampled journals. Most of the published works found their way into several newly launched or specialized media journals, including *Mobile Media & Communication* and *New Media & Society*, while general and established communication journals no longer represented the main outlets for publishing such research. With a newly found home in dedicated journals, the trend lends support to the conclusion that mobile communication has developed into a mature subfield.

More importantly, findings also indicate that while mobile communication research has grown into a distinctive subfield, it is not an independent field on its own because only a small number of studies have focused solely on researching the mobile phone or devices. In terms of domain, only half of the studies had a specific focus on issues of mobile technologies or mobile devices, such as people's general use of their mobile devices, the consequences of mobile use, users' social ties and social interaction, and mobile news. The rest of the published works featured the conceptualization of mobile media in relation to social media or mobile Internet; they treated mobile media as an element in the systematic study of CMC, social media, or apps. In addition, if theory is indispensable to the emergence of an independent field of scholarly inquiry, there are no explicit theories to describe or explain mobile communication.

As a well-established subfield, mobile communication research appears to have the following distinguishing characteristics: first, the scope of mobile communication research is broader than studies of mobile media alone. The boundary of mobile communication research cuts across other fields or subfields such as CMC, Internet studies, social media, health communication, and tourism. Further, the broad scope and hybrid conceptualization underscore the unique attribute of the mobile telephone—the multi-modularity of the mobile phone as an all-in-one meta-media.

Second, mobile media as a global technology have attracted international authors but the global scholarship is uneven. Despite the fact that mobile phones have the most users in Africa and in Asian countries such as India, scholarship of mobile communication is lopsided in favor of western countries. Findings show that countries with the top diffusion rate (e.g., the United States, Germany, the United Kingdom, and South Korea) attracted more scholarly attention than countries with a low rate of adoption. North America, Asia, and Europe were studied the most, benefiting from the robust growth in the use of mobile phones and devices. The same uneven pattern was also found in authorship of published works on mobile media. Most authors of the 512 articles in the sample were from the same economically advanced countries; they have benefited more from the growing number of mobile users than their peers in the global south have.

Third, the boundary of mobile communication has expanded from social, economic, and cultural perspectives to those of health, education, and tourism. Issues of mobile media in people's everyday life caught scholars' attention more than any other issue, followed by articles exploring people's psychological well-being. Overall, the impact of

mobile media in society is found to be paradoxical, including both positive and negative. For instance, in the early stage of its diffusion, people embraced what Katz (2006) described as "magic in the air." As the mobile phone saturated society, improper, problematic use and addiction were on the rise; these were the commonly studied negative impacts. The paradox of mobile media fits that of computer-mediated communication in general (Meier & Reinecke, 2021).

Fourth, mobile communication research is increasingly theory-informed, demonstrated by the theoretical footing featured in the majority of the studies. Compared to previous reviews of the state of mobile communication research (Borah, 2017; Kim et al., 2017), it is clear that progress has been made in theory-informed study of mobile media. However, the theories applied tend to be borrowed from ICT research, such as diffusion of innovations and technology acceptance model, or new media studies, such as U&G or digital divide. There is a lack of distinctive theory that is uniquely mobile to explain the rich and diverse phenomena of mobile media in one's everyday life. To advance as a distinctive subfield of research, theory-building will be a challenge.

Last but not the least, in terms of the research methods, mobile communication research is diverse and has multiple approaches to follow. The choice of methods includes both quantitative and qualitative approaches, but the social scientific paradigm tends to prevail. Additionally, an increasing number of studies in the past 15 years have employed multiple or mixed methods, including quantitative (e.g., surveys or log data) and qualitative methods (focus groups or in-depth interviews). That is an encouraging trend. As mobile media become intertwined with ubiquitous computing, computational data analytics are momentous and should be part of the research tools for mobile communication scholars.

In summary, this updated review leads to the conclusion that mobile communication research has developed into a distinctive subfield of research in the field of communication. Mobile communication scholarship likely will benefit from the development of 5G networks now on the horizon and new generations of smarter phones. The growth trend is likely to continue.

On the other hand, several issues that surfaced from this review need to be addressed for future research in the coming 5G era. First, similar to the phenomenon in mobile diffusion, a clear divide exists in mobile communication scholarship and authorship between advanced rich countries and countries in the global south. International collaborations, or team-based comparative projects involving multiple countries, will be needed to narrow the divide. Second, theory-building specific to mobile communication will be another challenge. Establishing some fundamental yet uniquely mobile-focused theories is the priority to advance the subfield. Mobile affordances, for example, hold some promise to evolve into such a theory.

Third, and related to theory-building, scientific rigor for developing general theories or models is needed. For example, future research needs to go beyond studying segments of user populations. Targeting general populations for data collection will facilitate developing general theories concerning communication via mobile media.

There are a few limitations of this review. Although they constitute a significant part of the global and primary literature of the field, books and manuscripts, yearbooks, and

encyclopedias devoted to mobile media and communication were excluded. Future research should consider a wider selection of journals to broaden the scope of the literature review. The 15 selected journals represent leading publications in the field of communication and media studies but the sample is by no means comprehensive. Journals from other disciplines, such as technology-focused or psychologically oriented ones, e.g., *Computers in Human Behavior*, were not included. As mobile communication has become an increasingly interdisciplinary field of studies, future review studies should expand to journals from other fields of social science that publish mobile communication research.

Although a full-text search based on keywords is frequently used in disciplinary reviews, we might have missed articles that were concerned about mobile communication but did not contain any of our 10 keywords. Also, whether the fast-growing mobile communication research in newly established journals suggests a distinctive subfield cannot be properly addressed with a publication analysis like this one. Future reviews should consider conducting citation analysis of in-field versus out-field citations to assess the status of mobile communication as a field or a subfield. Finally, the review covered only English-language sources.

To conclude, our updated review analyzed the strengths and weaknesses of the state of knowledge about mobile communication The literature has grown increasingly cross-disciplinary and complicated due to the multi-modularity in Internet-supported mobile communication, especially the rise of app ecosystems dominated by a handful of powerful platform media (e.g., Apple, Google, Facebook, Baidu, and WeChat). To advance the literature, surveys that span disciplines must address fundamental conceptual questions of the field, such as the meaning of mobile in an era of ubiquitous mobile apps that shift to platforms. Methodologically, future reviews and critiques of the expanding literature will benefit from different research tools, including computational analyses such as topic modeling and bibliometric analysis, to broaden the scope into the examination of app ecosystems to uncover underlying themes in the literature that may be outside communication but are overlooked within the field.

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