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From the Editor in Chief

THE APPARATGEIST OF THE MOON LANDING

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Fifty years ago, a decade that was revolutionary in human development in many ways was drawing to a close. This period in the world's history was as famous for love as for war, but also for big and small technological innovations. Consumers became acquainted with acronyms such as ATM, CD, LASER, LED, and UNIX—not to mention the mind-expanding LSD or the less dramatic medical innovation marketed as Valium, the “Mother’s Little Helper” epitomized by the Rolling Stones’ song available for purchase on the recently invented cassette audio tapes. Medical care took a huge step forward when, in April 1969, a mechanical heart was transplanted into a human. And, in the nascent computer field, the first message between two computers on the ARPANET was sent. This event, a half century ago, provided the roots for technological advances that eventually led to the modern-day Internet and World Wide Web (see, e.g., Drummer, 1997, pp. 185–202; Lindop, 2010, pp. 45–54).

Perhaps the most ambitious technological innovation of the 1960s was space travel, with the first human in space being cosmonaut Yuri Gagarin of the Soviet Union in 1961. The space race between the Union of Soviet Socialist Republics (USSR) and the United States of America made the Americans determined to go to the moon before the Soviets and by the end of the decade. That ambitious vision, placing a man on the moon, was fulfilled in July 1969. The small step that astronaut Neil Armstrong took from the lunar lander onto the surface of the moon signified the giant leap forward for human innovation—the grand finale of the 1960s’ technological progress that simultaneously closed a major chapter of the technopolitical rivalry of the Cold War.

One can certainly debate the many technological advances that have made greater immediate and long-term impact on humankind (e.g., the printing press, penicillin, the contraceptive pill, the steam engine) than the Apollo 11 mission to the moon. Nevertheless, the financial challenge, logistical demands, geopolitical significance, explorative dimensions, and the sheer drama of the event made the lunar mission *the* technological act of the 1960s, if not of human history. For example, after the moon landing and amid all the congratulatory greetings from foreign governments and dignitaries, U. S. President Nixon enthused that it was “the greatest week since



the Creation” (Barker, 2011, para. 6). The political as well as cultural value of the moon landing was monumental. This feat, almost unimaginable just 10 years before, was celebrated globally; even in Soviet Union, Russians expressed “white envy”—envy with admiration (Scott & Leonov, 2004, p. 248).

In an article published in *Journal of Interamerican Studies and World Affairs* the year following the moon landing, Kohler and Harvey (1970) went to great lengths to gather global news reactions to the moon landing. In reading the excerpts from newspapers from all over the world, the authors noticed how the awe created by the accomplishment resulted in feelings of a united humankind. For example, President Nixon stated that, for a moment when the lunar lander reached the moon’s surface, “all the people of this earth” were “truly one” (Kohler & Harvey, 1970, p. 3). The *Wellington Dominion* in New Zealand reported that the astronauts who travelled to the moon were “envoys of all men stripped of their national colors.” The same sentiment was echoed in a report by *Die Nieuwe Gids* in Brussels, where the moon landing was seen as a “victory for all humanity,” as it showed that “man is the master of his own future” (Kohler & Harvey, 1970, p. 7). According to *Ngurumo*, a newspaper published Dar es Salaam, Tanzania, the success of America was a “success for every living man” (Kohler & Harvey, 1970, p. 3).

On the other side of the Cold War trenches, China, North Korea, and North Vietnam did not publicize the moon landing at all. However, in the Soviet Union, the event was reported as a “magnificent” or “major” “technical success.” Not surprisingly, the Soviet press emphasized that the moon landing was simply the final outcome of a long continuum of technological progress where the Soviets had taken most of the major steps before the Americans (Kohler & Harvey, 1970, p. 4–6).

The moon landing also had spiritual and existential meaning. According to the *New Delhi Patriot*, the moon voyage was “the extension of man’s mind and the human spirit to a higher plane.” The *Azad* in Pakistan envisioned that the exploration of the moon “will inspire mankind to restoring peace and love among nations.” To the *Johannesburg Star*, the lunar success made people see that the earth is not “a rat race or a battle-field, but “a welcoming and infinitely desirable home for dignified men.” The newspaper was hopeful the moon voyage represented “at last, the beginning of wisdom” (Kohler & Harvey, 1970, p. 4).

Not all editors of the world’s newspapers were as impressed by the moon landing. According to Kohler and Harvey (1970), the Swedes, for example, had an exceptionally critical tone. They reported that the *Stockholm Expressen* had noted, “The United States can handle tremendous technical problems while finding it considerably more difficult to cope with those of a complicated social, political, and human nature.” Moreover, the *Aftonbladet* noticed a certain “intoxication with space ... will swallow astronomical sums of money” that could be used to “battle against poverty under which entirely too many Americans live.” The *Dagens Nyheter* feared that the moon landing took the United States one step closer to “world domination” (Kohler & Harvey, 1970, p. 5).

As the ongoing march of technological innovation within the 20th century rolled over into the new millennium, James E. Katz and Mark Aakhus (2002), in their seminal work, *Perpetual Contact: Mobile Communication, Private Talk, Public Performance*, suggested a new term, *apparatgeist* (after Hegel’s *Zeitgeist*), to refer to a universal tendency of technology to enable new forms of social existence (see also Campbell, 2008, p. 159; Taipale, 2009). Katz and Aakhus (2002) coined *apparatgeist* particularly to refer to mobile devices, and it is applied to understand the social and cultural significance of single technological apparatuses. In a way, *apparatgeist* can be interpreted as the meaning of a technology given to it by users, *nonusers*,

and *antiusers* (i.e., those people who are explicitly against a particular technological innovation). According to the theory, the machine and its “spirit” change the nature and quality of social behavior and organizations. The term covers both expert and folk frameworks and involves both the tangible and intangible aspects, as well as the material and social elements of technology. According to Virginia Yonkers (2015), for example, *apparatgeist* is a device becoming more than the sum of the technology and its affordances—even to the extent that the technology becomes a symbol of a group.

The moon landing was not exactly a piece of technology but rather an event on the timeline of a technological process that drew on advanced social organization and multiple technological innovations, as well as significant financial resources and personal commitment. Yet, in a way, the event itself could be examined in the light of the *apparatgeist* in that the moon landing certainly influenced people’s worldviews and had immense social significance beyond the actual event itself. In this sense, the *apparatgeist* of the moon landing is visible in the newspaper excerpts and people’s positive (and negative) “affordances” of the moon landing. Even if some may have been critical of the financial cost of the event, it is evident that the sheer act of a person stepping on the moon made many experience an exceptional collective identity that was not limited by national borders. No matter where one lived in the world, it was “us” who landed on the moon; it was “our” technological accomplishment. All humankind witnessed the multiple successes, failures, and tragedies that set the stage for the ultimate historical event. And, ultimately, all humankind benefited from the technological advances needed to make space travel a reality.

Consequently, the moon landing was reflected in games, literature, and films—embodying a distinctly new post-lunar-landing reality. This unprecedented event also inspired new contributions in the everyday vernacular, such as a means of venting one’s frustration over the lack of satisfactory technological and social innovation: “We have sent a man to the moon, but still we cannot [X].” The X represents any kind of simple solution that the person feels should have been made already due to the general level of technological and scientific progress.¹ The *apparatgeist* of the moon landing is evident as well in the *antiusers* or even the radical denouncers of the event’s existence, the conspiracy theorists who claim people never went to the moon and the whole event was faked by NASA (see, e.g., Perlmutter & Smith Dahmen, 2008). The *apparatgeist* also manifests in anniversary events commemorating the moon landing when people reproduce the value and meaning of the technological event. One could say that this editorial reminiscing a moon landing that happened half a century ago is a way to uphold its *apparatgeist*.

It is not easy to think of an *apparatgeist* uniting the whole world like the moon landing did 50 years ago. However, if technological development can be directed to alleviate or even stop anthropogenic climate change, green technology might be a worthy contestant. The cost of developing and applying green technology to mitigate global warming successfully would be less than 1% of the world’s collective GDP for a decade, whereas the moon landing cost the United States 2.5 % of its GDP for a decade (e.g., Lafleur, 2010; Ritchie, 2017). It seems, therefore, that financing a green revolution to climate change would not be an unsurmountable problem. However, the “green race,” as compared to the space race, is not as simple to script or ignite humankind’s imagination: There is no straightforward plot centering around a few brave men (*sic*) whose accomplishments and the actual technological device (i.e., the Saturn rocket with the lunar module) can be shared in filmed footage and pictures. Moreover, although the stakes of the green race could be said to be radically more fundamental than those of the

space race, the consequences of the process will not manifest themselves dramatically on one particular day—unless the recent report from the Intergovernmental Panel on Climate Change report (IPCC, 2018) is reissued with evidence that worldwide initiatives have succeeded. Instead of a focused organization with well-known public representatives, the agents bringing about the apparatgeist of green technology will be the billions of citizens and their governments—in collaboration with multitudes of organizations and business entities from around the world—and the results will be gradual, often difficult to distinguish, and frequently exposed to skeptical scrutiny. Hence, it will be interesting to see whether humankind, at some point, can again “be as one” not also rhetorically and for a fleeting symbolic moment as on July 20, 1969, but for a long and sustained period of time engaging in pragmatic problem solving and political acts that transgress national boundaries and benefit the world community.

The article of the current issue of *Human Technology* are not about as dramatic events as the moon landing and global warming or deal explicitly with apparatgeist, although one can say each of their topics is a manifestation of the apparatgeist of digital media, one of the defining technological phenomena of this modern age. As articles of our journal in general do, they investigate technology as more than devices and their affordances. They examine the social and cultural meaning of technology. In the first article, **Kerstin Andersson** takes a scoping look at the vast literature on digital diaspora, that is, how a variety of forms of migrants integrate multiple types of online and social media for a diversity of purposes in their lives. The study provides a foundational look at research in a growing field. Next, in an article based on her vast ethnographic fieldwork data from rural India, **Sirpa Tenhunen** considers how the diffusion of mobile phones over a little more than 10 years has changed local political processes, women’s political involvement, and aspects of women’s agency. In the third article of the issue, **Annukka Jänkälä, Asko Lehmuskallio, and Tapio Takala** explore the use of photos in the online communication during dating. Specifically, they investigated how “forecasted photographs” in online dating app profiles serve to create a desired outcome (i.e., attracting a potential love interest) and then how photographs shared between the new couple, particularly those shared immediately after capture, feed the flows of social interactions over time and through multiple social media. GraphoGame, the serious digital game designed to improve literacy, is the object of study by **Morten Njå**. However, rather than focusing on its outcomes, Njå investigated the often overlooked dimension of game design and its significance for learners’ progression through the game. In the fifth article of the issue, **Tina Kavčič, Melita Puklek Levpušček, Maja Zupančič, Mojca Poredoš, and Chris Bjornsen** take a look at social media and mobile phone use—and abuse—in a cohort of Slovenian emerging adults. They explored how age, gender, and the Big Five personality traits predicted social media and mobile phone addiction, as well as the problematic practices of phubbing, creeping, and catfishing. In the final peer-reviewed article, **Lucia Monacis, Pierpaolo Limone, Flavio Ceglie, Giancarlo Tanucci, and Maria Sinatra** investigated how the number of years of teaching experience and their enjoyment and acceptance of technology predicted teachers’ educational practices of integrating ICTs into their classrooms. Among other things, they found that long experience of teaching tends to mean less enthusiasm in adopting technology in the classroom.

In addition to the six articles, the current issue includes a book review Raul Pertiarra who is also one of the authors of our very first issue published in 2005 and a member of our editorial board. In his review, Pertiarra analyzed the meanings of contemporary technology by reading

what he calls “an important antidote to the often-soporific claims of the information society,” that is, a book titled *Disorder and the Disinformation Society: The Social Dynamics of Information Networks and Software* by Jonathan Paul Marshall, James Goodman, Didar Zowghi, and Francesca da Rimini.

ENDNOTES

1. A quick search of the Web reveals that *X* can be a wide variety of things, such as a decent sports bra, a reliable printer, or the elimination of traffic jams.
2. Tenhunen has also assisted *Human Technology* in this issue by overseeing the review and revision processes of the articles by Jänkälä et al. and Andersson.

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DIGITAL DIASPORAS: AN OVERVIEW OF THE RESEARCH AREAS OF MIGRATION AND NEW MEDIA THROUGH A NARRATIVE LITERATURE REVIEW

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Abstract: Academic research on migration and the use of new media constitutes a growing field. The first studies dealing explicitly with the field appeared in the end of the 1990s. Now, it has become an established research area. The impact and importance of the new technologies for migrants is well established. Appropriation of ICTs and new media environments have become a ubiquitous feature of everyday life in migrant groups. The research area is still understudied, characterized by rapid changes and shifts, and is shaped by the changing structural conditions of migrants and the proliferation of forms of media. In this article, I provide an overview of the developing research area through a review of the existing literature on migration and the use of new media. I elaborate the various aspects of the research field, the research category, current themes and topics, theoretical and conceptual discussions, and methodological approaches.

Keywords: digital diaspora, migration, mobility, transnationalism, ICTs, new media, social media.

INTRODUCTION

In this article, I provide an overview of the developing research area of migration and new media through a narrative literature review. Academic research in the area of migration, diaspora, transnationalism, and mobility are closely related to factors within media and communication. In diaspora studies, initiated in the end of the late 1980s, for example Hall (1994), ascribed media a constitutive role in the construction of social and political life in the diasporic context and diasporic identity construction. In discussion of transnationalism, media and communication were ascribed a central role and a component that formed the basis for the emergence of transnationalism on a mass scale. Transnationalism, defined as the process by which migrants forge and sustain multistranded relations and create transnational social fields, was described as a constant traversing of national boundaries by processes of communication and exchange, such as capital expansion, the Internet, and other telecommunications (see, e.g., Portes, Landolt, & Guarnizo, 1999). In “the second wave of transnationalism” (Rogers, 2005, p. 405) that appeared around 2005, advanced high-speed communication systems and the impacts of simultaneity and copresence were considered to be constitutive factors of the transnational terrain (Smith, 2005, pp. 239–240).

The rapid development of information and communication technologies (ICTs) has led to an increased attention to factors such as media and communication in migration studies, as well as in studies of other population groups. In the field of migration and new media, the research area is characterized by rapid changes and fluctuations, influenced by the structural conditions and social reality of migrants and the continuous development of forms of new media (see also Borkert, Cingolani, & Premazzi, 2009). For example, the 2015 European refugee crisis led to a number of studies on the impact of new media on forced migration (see, e.g., Cabot, 2018; Gillespie, Osseiran, & Cheesman, 2018). The research area is interdisciplinary, drawing on approaches from a number of subject areas, such as anthropology, migration studies, diaspora studies, media and communication studies, globalization studies, studies in new science, Internet studies, sociology, and cultural studies. The structure of the research area is defined by its close relationship to the development of the new technologies. ICTs were introduced on a popular level in the 1990s, and the first studies of migration and ICTs appeared at the end of that decade. Initially, the research area contained a limited number of studies; however, the field has expanded rapidly, in parallel with the development of the new technologies, increased access to the technologies, and increased digital literacy. However, field needs further research and elaboration (see, e.g., de Kruijf, 2014; Leurs & Smets, 2018).

My goal in this article is to review the existing literature on migration and new media to provide an overview of the research field. I focus on the body of literature that has emerged at the intersection of the two related fields of migration studies and new media studies: the field of migration, transnationalism, mobility and diaspora on the one hand, and the field of ICTs, new media, social media and Web 2.0, on the other. The analytical lens is placed on studies that discuss media appropriation and communicative practices in the various categories of migration, in other words, studies that center on the implications of Internet, new media, social media, and Web 2.0 for migrant categories.

I elaborate on various aspects of the research field, such as the research categories that scholars deal with in their investigations of migration and new media. A great number of the studies include case studies on migrants, with respondents and informants from various backgrounds, countries of origin, and migration mechanisms, for example, internal, external, temporary, voluntary, or forced

migration. Secondly, I discuss the central themes and topics that have emerged in studies of migration and new media, such as investigations of the impact of new media on the migrant family, how migrant identity construction is influenced by the appropriation of the new technologies, just to mention a few. Further, I elaborate on the theoretical and conceptual areas that scholars researching the area of migration and new media have investigated and analyzed. New theoretical and conceptual discussions have appeared in the field, as well as a renewed focus on established theoretical and conceptual areas. Finally, I look closer at the very complex area of methodology that characterizes the research area and the various methodological approaches the scholars have used in research on migration and new media.

The balance of the article is structured within these four main aspects addressed in the various literature. I first look at the research categories that are encompassed within studies in digital diasporas. The following three sections address the findings of my analysis of the literature, grouped within the central themes and topics of the research, the significant theoretical and conceptual issues being discussed by scholars of digital diasporas, and finally the methodological approaches employed in research in this field.

METHODOLOGICAL AND CONCEPTUAL CLARIFICATIONS

This article represents a long-term project. My first ethnographic encounter with the area of migration and new media (Andersson, 2000) was in 2000, and I subsequently have engaged the topics and the field's development (Andersson, 2007, 2011). To solidify and update my knowledge in the field, I began a project of systematically surveying, reviewing, and mapping the literature in research area in 2014. Initially, I used methods such as literature searches on databases and reference list analyses (snowballing). The literature in the field is dominated by articles, journal special issues, and edited volumes, and I focused my searches on scholarly articles, edited volumes and, to certain extent, monographs. The material surfaced is predominantly written in English. And, in line with my goal, I concentrated on literature that demonstrates a clear focus on the topic of migration and new media.¹

In the literature searches, I combined keywords from the field of migration (e.g., migration, diaspora, transnationalism, mobility) and the field of new media (e.g., ICTs, new media, social media, Web 2.0), and conducted the searches using various constellations of the terms. Initially, I used resources such as Social Science Premium Collection; however, considering the interdisciplinary character of the research field, I found them too limiting. I then turned to databases such as Regina, Rex, Libris (Swedish research resources), and resources available at the Uppsala University Library. To develop a global perspective, I also searched the WorldCat. Further, because I had already acquired extensive background knowledge in the field, the reference list searches proved very fruitful. After completing the literature searches, I continued to monitor the research area closely for any new additions to the body of literature. At the end of 2016, I drew the line for incorporating new literature into the current study.

I present the results of the project in the form of a review article in the genre denoted alternately as a narrative literature review, overview, or descriptive review (see, e.g., Grant & Booth, 2009; Green et al., 2015; Yang & Tate, 2012). As Green et al. (2015) stated, a narrative review attempts to summarize or synthesize what has been written on a particular topic but does not seek generalization or cumulative knowledge from what is reviewed. Thus, my aim is to

provide an objective, inclusive, and comprehensive overview of the emerging research area through mapping the surveyed literature and providing a comprehensive synthesis of the field in narrative form. The material has been structured in sections based on the themes and topics that emerged as significant during the analysis process of the material. At the start of my analysis, I put forward some initial categories to structure the material, such as the date of research and the form of media discussed in the article. This established a foundation for the continued structuring and systematization of the material. My aspiration putting together this article is to provide the reader with an overview of the research area to serve as an information source of the field and a possible guide for future research.

I wish to state forthrightly two limitations in this study. First, I drew a line for continued literature searches at the end of 2016, a necessary choice that restricts the range of the study. However, this essential measure allowed me to conclude my investigation with the already-gathered material. The article was submitted for publication in autumn 2018. Second, in this article, sections of the material are presented in the form of tables, displaying for example overviews over authors and research in specific areas. I am well aware that this form of presentation renders the sources in a rather broad and general manner, leaving out significant elements.²

I use the concept *digital diaspora* in my discussions on new media and migration. The concept has been introduced in previous research on migration and new media, however, it has not been clearly defined, and several suggestions have been put forward. For example, digital diasporas have been described alternatively as new forms of coexistence, a technologically mediated diaspora, a diaspora organized on the Internet, an electronic migrant community, and an immigrant group that uses ICT connectivity to participate in virtual networks for a variety of communicational purposes (Axel, 2004; Brinkerhoff, 2009; Everett, 2009; Laguerre, 2010a; Mainsah, 2014; Tsagarousianou, 2004). In this article, I will not dwell on the definition of the concept. Rather, I use the concept of digital diapsora as an umbrella term to denote the new configurations that appear at the intersection of the two related fields of migration studies and new media studies: the field of migration, transnationalism, mobility and diaspora on the one hand, and the field of ICTs, new media, social media and Web 2.0, on the other.

THE RESEARCH CATEGORIES IN STUDIES ON DIGITAL DIASPORAS

The target groups and research categories that appear in research on digital diasporas are quite expansive, covering research interests from, for example, asylum seekers to transnational knowledge workers. Moreover, the body of research presents migrants and diasporic groups as frequent users of new media: They are digital natives, early adopters, and heavy users of digital technologies (Ponzanesi & Leurs, 2014) as well as more proficient than the host country's population at the same level of instruction in using ICTs (Borkert et al., 2009). Whether or not studies on digital diasporas provide an adequate understanding of the research area has been contested by various scholars. Nessi and Bailey (2014) stated that the literature on migration, diaspora, and Internet usage tends to focus on the underprivileged other. However, Borkert et al. (2009) criticized the predominant focus on studies of niche groups and elite groups, while leaving out the largest part of the migrant population. In this thematic section, I provide an overview over the various research categories that appear in research on digital diasporas—such as vulnerable groups, middling transnationalism and middle class mobility, and highly skilled migration—and

offer some examples on the character of these categories. For a full overview of scholars researching digital diasporas and the various categories they address, see Table 1.

Vulnerable Groups, Low Status, and Forced Migration

Scholars studying digital diasporas frequently include research on the categories' vulnerable groups, that is, groups with low social and economic status, displaced people, and forced migrants. For example, Tripp and Herr-Stephenson (2009) and Katz (2010) researched Latino children in the

Table 1. The Research Categories and Authors of Studies of Digital Diasporas (2000–2016).

Categories	Authors
VULNERABLE GROUPS	
Labor migration	Ackah & Newman (2003), Benítez (2006, 2012), Bonini (2011), Cabanes & Acedera (2012), Chib, Malik, Aricat, & Kadir (2014), Francisco (2015), Hoang & Yeoh (2011, 2012), Katz (2010), Madianou (2012, 2016a, 2016b), Madianou & Miller (2013), Mallapragada (2014a), McKay (2010, 2012), Miller & Madianou (2011), Nishitani (2014), Parreñas (2005), Platt et al., (2016), Rosel & Pascual (2016), Saxena (2014), E. C. Thompson (2009), Tolstokorova (2010), Tripp & Herr-Stephenson (2009), Uy-Tioco (2007)
Downward social mobility	Burrell & Anderson (2008), Lim & Pham (2016), Lorenzana (2016), Mainsah (2014)
Displaced peoples, refugees, asylum seekers	Cho (2011), Green & Lockley (2012), Halilovich (2013), Harney (2013), Leung (2011), Leung, Finney, Lamb, & Emrys (2017), Leurs (2014), Rinnawi (2012), Robertson, Wilding, & Gifford (2016) Wilding & Gifford (2013), Witteborn (2014, 2015)
MIDDLE CLASS MOBILITY	
Middle-class mobility	Adams & Ghose (2003), Alinejad (2011), Baldassar (2016a, 2016b), Christensen (2012), Costa-Pinto (2014), Georgiou (2012b), Mitra (2006, 2014), Schier (2016), Skop (2014), Skop & Adams (2009)
Students	Chin (2016), Collins (2009), K. Kim, Yun, & Yoon (2009), Li & Chen (2014), C. Lin (2006), J. H. Lin, Peng, Kim, Kim, & LaRose (2012), Narayan & Purkayastha (2011), Narayan, Purkayastha, & Banerjee (2011), Park, Song, & Lee (2014), Plaza (2010), Sandel (2014), (Shi 2005)
Precollege students	Durham (2004), Maira (2010), T. I. Yoon (2016)
Highly skilled migration	Bhimji (2008), Chen & Choi (2011), Hanafi (2005), Kang (2011), Y. Kim (2011, 2016), Nedelcu (2012), Nedelcu & Wyss (2016), Nessi & Bailey (2014), Ong & Cabañes (2011), Radhakrishnan (2008)
Expatriates, KTWs	Bork-Hüffer (2016), Colic-Peisker (2010), Mai (2016), Polson (2015)
COMPARATIVE APPROACHES	Baldassar (2016b), Denis & Paulos (2011), Fong, Cao, & Chan (2010), Kaur & Shruti (2016), Voigt-Graf (2005)

United States of America, Platt et al. (2016) investigated the precarious situation of Indonesian domestic migrant workers in Singapore, and Nishitani (2014) elaborated on Tongan mothers and daughters in Melbourne, Australia.

Filipino labor migration has been researched by a number of scholars (see, e.g., Cabanes & Acedera, 2012; Madianou, 2012; Madianou & Miller, 2013; McKay, 2010). The Philippines is one of the largest exporters of migrant labor in the world. Over 10% of the population is working abroad and a great number of them are women hired as care workers. The Philippine government actively encourages overseas migration. To legitimate female migration, the government, in collaboration with the main Philippine ICT companies, advance the position that ICTs and mobile phones alleviate the social costs of migration (Madianou, 2016b; Miller & Madianou, 2011).

Further, in their discussions on digital diasporas, scholars have recognized the phenomenon of downward social mobility in the host country. For example, Burrell and Anderson's (2008) research on Ghanaians living in London illustrated how migrants typically end up in low-paying, low-status jobs, even though they had a high educational level or a high-status family background. They were affected by their categorization as migrants from a developing country in Africa.

Another subcategory that is dealt with in studies on digital diasporas is the category of forced migration; displaced people; refugees, and asylum seekers. Leung (2011) described studies of refugees and their use of new media as a rather neglected area. The studies undertaken predominantly concentrated on refugees living in resettlement countries and focused on, for example, immigration administration and the provision of health and education services. Wilding and Gifford (2013) elaborated on the topic and pointed out the need to attend to the capacity of ICTs to be used for both harm and good. ICTs might be used as a tool for surveillance and control by governments and other bodies. However, ICTs also might be a tool of empowerment for refugees by, for instance, mediating social relationships, sustaining homeland identities, and supporting transnational activism. For example, Harney's (2013) study of asylum seekers, refugees, and irregular migrants in the Naples (Italy) region illustrated how mobile phone use might mediate and secure some reassurance amid the uncertainties of the migrant's lives.

Middling Transnationalism and Middle Class Mobility

The second wave of transnational studies that was introduced in migration studies in 2005, focused on "middling transnationalism" (Rogers, 2005, p. 204) and the everyday practices of middle class migrants (Smith, 2005). Scholars introduced a more general concept of mobility, that encompassed the categories of middle class migrants, working holidaymakers, tourists, festival goers, international students, and other mobile individuals (Rogers, 2005). According to scholars working on middling transnationalism, instantaneous communication and simultaneity and copresence impacted the constitution of the category (see, e.g., Smith, 2005).

In studies on digital diasporas, middling transnationalism and middle class mobility have been explored by, for example, Costa-Pinto (2014). She described how her respondents, Indian female migrants in Melbourne, who relocated in accord with Australia's immigration selection criteria, are typically middle class, English-language educated, Western-oriented, and well-positioned to take advantage of 21st-century technology. Alinejad (2011) described his

respondents, Iranian bloggers outside Iran, as predominantly middle class and leading middle-class lifestyles. They represented a variety of migration narratives. Some were first-generation migrants, while others were born in the United States or Canada. The Indian diaspora in the United States constitute another frequently discussed example of middle-class mobility. Adams and Ghose (2003), Skop and Adams (2009), and Mitra (2006) elaborated on the distinct character of the Indian diaspora in the United States. The category has a high socioeconomic status, high educational level, and are working high-income jobs. Both men and women generally have high levels of participation in the labor force. A large number of them work in the information–technology industry or managerial, professional, or related occupations. Often, they earn more than the U. S. American native population.

The category of students, a subcategory in middling transnationalism and middle-class mobility, has received considerable attention from scholars discussing digital diasporas. A number of studies have focused on the use of new media in this category and how new media and social media impact international students' adjustments to their new environments. Further, scholars have discussed younger students, such as South Asian Muslim high school students in the United States with a working-class background (Maira, 2010). Yoon (2016) analyzed education-driven transnational families and their use of new media and social media. In Asian middle-class families, precollege education of children has become a significant driving force in transnational migration. Sending the children to the West or other internationally renowned educational centers for precollege study is seen as a strategy to enhance the children's global cultural capital and place the children on the pathway toward upward social mobility. Yoon's (2016) study dealt with young Koreans attending precollege studies in Canada. Two thirds of them were living alone—that is, both parents remained in Korea—while one third lived with their mothers in Canada. The study illustrated how family interaction through use of new media, such as the smartphone, was incorporated into the rhythm of the everyday.

Talent Migration and Highly Skilled Migration

Studies on talent migration and highly skilled migration and the use of new media constitute a relatively recent research area in discussions of digital diasporas. According to Yeoh and Eng (2008), concepts such as talent migration, highly skilled migration, expatriates, and transnational elites are used variously to describe this category. The category is generally considered to be a recent phenomenon. For example, Colic-Peisker (2010) stated that studies of transnational professionals only recently have started to feature in systematic social research; Polson (2011) described the emergence of a new globally mobile middle class, composed mostly of college-educated individuals who migrate because they can find better opportunities abroad than in their countries of origin. According to some, the emergence of this category is closely related to contemporary globalization processes, economic logics, and transnational flows of capital. In globalization processes and a neoliberal framework, highly skilled migrants constitute a growing human capital in the global knowledge economy (see, e.g., Colic-Peisker, 2010). These studies emphasize the role played by new media and social media in the constitution of the category. According to Nessi and Bailey (2014), who focused on privileged Mexican migrants living in Europe, prior research has emphasized that more highly educated people and those with greater economic resource tend to be more active Internet users.

Some of the research categories that are discussed in this section are, for example, Indian women working in the IT sector in Silicon Valley and Bangalore (Radhakrishnan, 2008) and Filipino elite migrants in London (Ong & Cabañes, 2011). Hanafi (2005) studied Palestinian professionals in the diaspora and illustrated how new immigrant communities have appeared in the Palestinian diaspora. The research category consisted mainly of scientists and engineers that had stayed on in Lille (France) following their studies at the city's universities. Colic-Peisker (2010) introduced the category of transnational knowledge workers (TKWs). TKWs represent a diverse group of serially migrating career professionals who have spent extended periods of time in at least three countries. The majority of her informants came from less-developed, small, and/or non-English-speaking countries. The main purpose for migration was to improve professional and social status, and they were firmly embedded in Western ways. The majority had a doctorate or other higher degree of education.

Comparative Approaches

Some scholars have undertaken comparative studies on migrant groups engaged in the use of ICTs to explore how individuals within the various research categories appropriate new media and the implications and various outcomes of new media use in the groups. For example, Kaur and Shruti (2016) compared the use of mobile and Internet technologies among two sets of Indian migrants to Cambodia: highly educated professionals and rural and less educated single male migrants from eastern India. They concluded that education, income levels, and the cost of technologies at the destination country shape migrants' access to technologies. The category of professionals used more sophisticated technologies, while the rural migrants depended more on basic and commercially available public facilities.

CENTRAL THEMES AND TOPICS IN STUDIES OF DIGITAL DIASPORAS

In this section, I deal with the central themes and topics that emerged in studies of migration and new media, including the following subdivisions: the impact of new media on the migrant family, how migrant identity construction and cultural reproduction are influenced by the appropriation of the new technologies, the impact of the new media on the relationship to and perception of the homeland and home, and the new aspects and conditions that appear in the political arena and in social networks and organizations. I provide an overview of the main characteristics of the subsections and the central discussion areas and illustrate the discussion areas with examples. Further, I include a listing of scholars who have conducted research in the various subsections and their field of research in Table 2.

The Family and the New Technologies

In research on digital diasporas, the migrant family, and the various configurations that appear in the intersection between new media and family forms constitute an extensively debated area. Notions such as transnational "e-families" (Benítez, 2012) and "care-giving at a distance" (Levitt, 2009) illustrate the new formations.

Table 2. Outline of Authors and Central Themes and Topics Discussed in Studies of Digital Diasporas.

Discussion Areas	Authors
THE FAMILY AND THE NEW TECHNOLOGIES	
The transnational family	Baldassar (2008, 2016a, 2016b), Baldassar, Nedelcu, Merla, & Wilding (2016), Benítez (2012), Brown (2016), Kaur & Shruti (2016), Levitt (2009), Madianou (2016a, 2016b), Nedelcu & Wyss (2016), Robertson, Wilding, & Gifford (2016), Schier (2016), Wilding (2006), K. Yoon (2016)
Gender	Kang (2012), Narayan & Purkayastha (2011), Platt et al., (2016), Vancea & Olivera (2013), Witteborn (2014)
Feminized migration	Cabanes & Acedera (2012), Chib et al. (2014), Fortunati, Pertierra, & Vincent (2013), Francisco (2015), Hoang & Yeoh (2011, 2012), Katz (2010), Madianou (2012), McKay (2010, 2012), Miller & Madianou (2011), Parreñas (2005), Peng & Wong (2013), Rosel & Pascual (2016), Tolstokorova (2010), Uy-Tioco (2007), T. I. Yoon et al. (2011)
Emerging Research Areas	Baldassar, Wilding, Boccagni, & Merla (2017), Horn & Schweppe (2017), Share, Williams, & Kerrins (2018)
IDENTITY CONSTRUCTION AND CULTURAL REPRODUCTION	
Identity construction and cosmopolitanism	Bhimji (2008), Christensen (2012), Colic-Peisker (2010), Denis & Paulos (2011), Y. Kim (2011), Nedelcu (2012)
Identity construction and ethnic identity	Denis & Paulos (2011), Mainsah (2014), Marotta (2011), Shi (2005)
Identity construction and social media	Bozdag (2014), Karakusheva (2016), Lorenzana (2016), Nessi & Bailey (2014), Serafinelli (2016)
Cultural Reproduction and identity	Elias & Lemish (2009), K. Kim et al. (2009), Leurs (2015), Lewis (2006), Li & Chen (2014), C. Lin (2006), J.-H. Lin., Peng, Kim, Kim, & LaRose (2012), Maira (2010), Mandaville (2003), McAuliffe (2007), Park et al. (2014), Poole (2002), Sandel (2014)
NOTIONS OF HOME, HOMELAND, AND PLACE	
The Political Arena, Social Networks, Organizations	
The political arena	Bernal (2006), Chopra (2006), Conversi (2012), Ding (2008), Enteen (2006), Hickerson (2013), Kissau (2012), Marat (2016), Ong & Cabañes (2011), Therwath (2012)
Online networks, online organizations	Bachrach (2014), Bustamante (2010), Chan (2010), Cid & Ogando (2010), Demmers (2002), Graziano (2012), G. Green (2016), Hanafi (2005), Lal (2014), Mallapragada (2014a), Nagel & Staeheli (2010), Oiarzabal (2012), Ribeiro de Oliveira (2014), Siapera, Veikou, & Si (2013), Turner (2008)
Work conditions, social support structures	Biao (2007), Chen & Choi (2011), Engbersen & Dekker (2014), Hiller & Franz (2004) Janta & Ladkin (2013), Láštiová (2014), Montgomery (2008), Oh (2016)

The Transnational Family and the Impact of ICTs

In studies of the transnational family, a number of scholars have asserted that ICTs and new media have a salient impact on the family and its various configurations. Madianou (2016b) suggested that transnational family members “do family” (Morgan, 1999) through daily actions mediated by ICTs, incorporating distant ties and connections. According to Kaur and Shruti (2016), the appropriation of new media in transnational families generates affective bonds that support the family feeling that reproduces the transnational family. Several scholars elaborated on the notion of “connected presence” (Licoppe, 2004). Wilding (2006) described how connected presence establishes a sense of proximity among physically distant family members, blurring the distinction between absence and presence.

Baldassar, Nedelcu, Merla, and Wilding, (2016) introduced the concept of “ICT-based copresence” to encompass the various expressions of ICT-mediated communication in transnational families. The concept denotes the different expressions of being together that appear at the intersection of new technologies and the forms of communication in transnational families. The new forms of copresence materialize in “polymedia environments” (Madianou & Miller, 2013). In the polymedia environments, relationships are maintained and strengthened, possibilities for exchange of emotional support are rendered, and intimacy may be sustained across time and space. The concept has been extended to include various forms of copresence. For example, Madianou (2016a) put forward the notion of “ambient copresence” to describe the continuous peripheral awareness of distant others inherent in the “always on” culture of constant connectivity. Through ambient copresence, it is possible to be peripherally, yet constantly, aware of the actions and daily rhythms of distant others. Baldassar (2016a) elaborated on diverse modalities of ICT-based copresence; active, passive, immediate, and intermediate forms. In care circulation in the transnational family, the family members adapt various modalities of copresence and engage different types of new media in different contexts and at different points in time, thus establishing increasingly dynamic and multifaceted relationships across distance.

Feminized Migration and Gender Questions

Gender issues and “feminized migration” (Madianou, 2012) constitutes another research area that has attracted interest from scholars on digital diasporas. Access to and use of ICTs are inflected by broader social categories such as class, gender, and education. The appropriation of new media can reify gender hierarchies, create gendered spaces, and reinforce gendered divides (see, e.g., Platt et al., 2016). For example, Narayan and Purkayastha’s (2011) study of Hindu student websites illustrated the impact of new media on gendered identity construction. On the websites, representations of Hinduism and strong-woman imagery can reaffirm and reinforce gender hierarchies. Witteborn (2014) highlighted another aspect of new media and gender, the role of emotion in gendering digital practices. In the institutionalized accommodations for asylum seekers in Germany, the traditional values of shame and the notion of the promiscuous woman structured digital practices and reproduced gendered orders of technology.

A number of scholars have investigated feminized migration and appropriation of new media. In general, feminized migration denotes the recent trend of women migrating to take up mainly welfare and care professions. According to Fortunati, Pertierra, and Vincent (2013), feminized migration is based on labor market requisitions, such as domestic work in families of

industrialized countries and the establishment of newly emerging economies in South East Asia. Further, the increasing intraregional migration in the Asian region leads to a feminization of immigration (T, I. Yoon, Kim, & Eom, 2011). The notion encapsulates a number of problem areas reflecting the social costs of the migration, for example, distant and mediated mothering, parenting across borders, the position of children and fathers left behind, and the impact on gender and conjugal relations.

Scholars have discussed various aspects of the social costs of feminized migration. Tolstokorova's (2010) study of new media and Ukrainian migration illustrated the point. In Ukraine, migration and work abroad is one of the few ways for women to provide for the immediate financial care of their children. With the inclusion of new media, the women assume the roles of both providers and distant caregivers, and their family obligations are expanded. However, their new status position does not entail their empowerment; gendered roles are perpetuated. Madianou (2012) put forward that the use of cell phones allows for an empowered experience of distant mothering among Filipina migrants in London. However, Rosel and Pascual (2016) highlighted the ambiguous situation encountered by Filipina mothers in Singapore. Their research found that these mothers' experiences were marked by paradoxes, but the mothers still regard it as the best response possible to the situation imposed by their transnational separation. Hoang and Yeoh (2012), in a study of Vietnamese migrant parents and their left-behind children that focused on the children's principal carers in Vietnam, stated that access to ICTs helped members of transnational families maintain contact. However, ICTs do not have the power to bridge separations across time and space; they do not create a shared emotional and social field for family members.

Cabanes and Acedera (2012), Hoang and Yeoh (2011), and Tolstokorova (2010) investigated the role and position of the left-behind fathers in the migrant families. According to Tolstokorova (2010), in a study of a Ukrainian family, the changed gender roles of the left-behind fathers are only temporary: The reality does not entail a real transformation of the institution of fatherhood in Ukraine. Cabanes and Acedera's (2012) study on left-behind fathers and children in the Filipino family illustrated how use of new media and the mobile phone might mitigate some of the effects of migration, even as it has the potential to complicate conjugal power relations.

A couple of studies on feminized migration have emphasized the left-behind children's perspectives and feelings. For example, Parreñas' (2005) study on young adults in the Philippines illustrated the children's experiences of communication with absent mothers through SMS and phone calls. Miller and Madianou's (2011) study of UK-based Filipina migrants and their left-behind children included ethnographic research on both mothers and left-behind children. The research results illustrated how, although the mothers generally felt empowered by the use of mobile phones in their mothering roles, the attitude of the left-behind children was more ambivalent.

Upcoming Research Areas

The intersection of aging, migration, and new media constitutes a rather neglected area in studies on digital diasporas. However, scholars have showed an increasing interest for the subject (see, e.g., Baldassar et al., 2017; Horn & Schweppe, 2017). Growing interest is focused on topics such as the implications of the generational gap, elderly people's ability to apprehend and embrace use of new media, and the potential of new media to uphold intergenerational relationships and

solidarity. For example, Share, Williams, and Kerrins (2018) illustrated how Skype functions as an important tool for supporting care and intergenerational solidarity. Skype is a key tool in displaying family practices, where family members are engaged in meaning-making practices of doing family.

Identity Construction and Cultural Reproduction

A number of the studies on digital diasporas elaborated the role and implications of new media in identity construction and cultural reproduction among migrants. For example, Denis and Paulos (2011) suggested that ethnic identity is constituted by the content that the ethnic minorities produce, represent, and consume on the Web. A group of scholars have engaged with new media and cosmopolitanism in identity construction (see, e.g., Bhimji, 2008; Christensen, 2012; Colic-Peisker, 2010; Y. Kim, 2011; Nedelcu, 2012). Further, scholars have taken Hall's (1996) concept of ethnic identity as starting point in discussions on identity construction and new media. Shi (2005) described identities as social constructions and illuminated the central role of ethnic media in identity formation. The ethnic media had a socializing function and created a sense of cultural coherence and unity. Mainsah (2014), in discussing Norwegian youth of African descent, illustrated how cultural identities build community ties and ways of belonging that are created at the intersection of online and offline spaces and local and global contexts. It is the ambivalent tension between difference and sameness and between rootedness and dislocation that articulates the heterogeneity of the diasporic experience and identity formation (Hall, 1994).

The implications of Web 2.0 and social media in identity construction have drawn the attention of scholars. Bozdag (2014) and Karakusheva (2016) illustrated how ethnic identities are constructed in the social interactions of everyday life and in the communication practices on social media and Web 2.0. According to Serafinelli (2016, p. 350), through the mediation of social media and the use of smart mobile devices, individuals' practices of identity construction are altered in maintenance of long-distance social relationships. This author found Italian migrants in the UK appropriating devices such as Facebook and photo sharing practices such as selfies as means for identity construction.

Religion plays an important role in identity construction and cultural reproduction in general. In studies on digital diasporas, for example, Lewis (2006) discussed British Muslims from South Asian backgrounds and illustrated how online religious expressions and online religious movements affect the authority positions of Islam and the ulama (community of Muslim scholars) in the group. McAuliffe's (2007) research showed how appropriation of new media influenced internal religious differentiation and attitudes toward discourses of national belonging among children of Iranian migrants. He identified two distinct long-distance imaginings of national belonging that mediated the diasporic context.

The role of new media in cultural integration processes in the diasporic contexts is illustrated in, for example, Elias and Lemish's (2009) study of teenage immigrants from the former Soviet Union to Israel. For the teenagers, the Internet played an important role in their cultural integration processes. The authors concluded that the virtual life of the young immigrants might be instrumental in shaping their evolving identity during the period of social and material disadvantage. The new technologies can sustain the teenagers in the difficulties stemming from the relocation and resettlement into a new and sometimes hostile environment.

New Media and the Notions of Home, Homeland, and Place

Generally, in the discussion on the diaspora, the notion of home and one's relationship to the homeland holds a central position. Members of diasporic groups are considered to be linked together by a common interest in their location of origin and a foundational identity. These components of being also are integrated into the concept of the transnational community, albeit in a more fluid way that integrates both local and translocal dimensions (Hiller & Franz, 2004). Several studies on digital diasporas included discussions on the notion of home, the homeland, and place and elaborated the new aspects of these conditions that appear at the intersection of migration and the new technologies. Rinnawi (2012) suggested that Satellite TV and ICTs function as mediators between migrants in the diaspora and their homelands, and new media might strengthen one's sense of belonging to the homeland. Collins (2009) illustrated the ambivalent experience of the impact of the new media. The new technologies can diminish the distance between the experience of "here" and "home," even though the interaction may be characterized by inclusion and exclusion and processes of surveillance and disciplining. Burrell and Anderson (2008) and Narayan et al. (2011) pointed out that the focus on home country versus host country in studies of new media and migration need to be extended to include multiple host countries and a global view.

Some scholars rendered the ICT-mediated relationship to the home in more complex terms, including aspects such as bodily and emotional experiences and perceptions of place. For example, Alinejad (2011) argued that diasporas rely on emotive and embodied ties to the diasporic home. Kang (2011) elaborated on the role of the body and bodily-based perceptions of space in migrants' Internet-mediated reproduction of the homeland. Kang included three key embodied elements of the spatial experiences of the homeland: the vicarious travel of the body, everyday spatiotemporal practices, and transnational bodily contact constructed through the use of Internet. Polson (2015) demonstrated how the experience of place is formed by relationships and online and offline communicative interactions, where communication practices have the potential to create a sense of belonging and attachment to a place.

Impact of New Media on the Political Arena, Social Networks, and Organizations

In the political arena, ICTs give way to new dynamics. They enhance migrants' possibilities for taking an active part in their home country's politics, engage in political activities that span borders and cultures (Kissau, 2012), and engage in social and political activism. Some examples on the topics that scholars have discussed include online representations of identity politics discourses (Chopra, 2006), online politics and the role of online forums in the spread of long-distance nationalism (Conversi, 2012; Enteen, 2006; Therwath, 2012), the impact of new media in transnational civic and political participation (Hickerson, 2013; Marat, 2016; Ong & Cabañes, 2011), and the construction of nationhood (Bernal, 2006). For example, Ding (2008) elaborated on how the increasing use of ICTs by the Chinese diaspora plays a vital role in Chinese politics and China's efforts at building a positive national image.

ICTs and new media change and transform social and political organizational forms. ICTs have created new spaces and forms of collective expression, identification, and belonging. Online diaspora networks, as well as groups and associations on social network sites such as Facebook, have turned into a means for community formation, interaction, information dissemination, and

social support. Hanafi (2005) and Nagel and Staeheli (2010) elaborated on the role of online networks for the Palestinian diaspora. The al-Awda network is devoted to securing the right of Palestinians to return to the land and homes that they lost during the establishment of the Israeli state (Nagel & Staeheli, 2010), while the PALESTA network, involving predominantly Palestinian professionals in the diaspora, focuses on harnessing the scientific and technological knowledge of expatriate professionals for the benefit of development efforts in Palestine (Hanafi, 2005). Oiarzabal's (2012) study of Basque diaspora association groups on Facebook illustrated how the appropriation of Facebook strengthened the group's communication strategies and information dissemination.

The new technologies influence and impact work conditions and social support structures for migrants. The recruitment processes integrate new forms and assets; for example, social media platforms and virtual support networks are integrated into job recruitment processes (Janta & Ladkin, 2013). Montgomery (2008) illustrated how the support structures among transnational professionals have changed. The previous ethnic immigrant enclaves of transnational professionals have become separated from concrete places and new communication tools have given way to other spaces of support: virtual enclaves. Further, the introduction of the new technologies have provided resources for building social capital and computer-mediated social support (Chen & Choi, 2011; Hiller & Franz, 2004). Oh's (2016) study of the "MissyUSA" site, an online community for Korean-American women, illustrates the case. In this group, social capital and social support structures are created by the members through transmission of information and through positive emotional reactions.

THEORETICAL AND CONCEPTUAL DISCUSSIONS

The inclusion of new technologies as a focus in migration studies has opened new theoretical and conceptual discussion areas, as well as a renewed focus on established theoretical and conceptual discussions. For example, scholars have paid great attention to the appropriation of the new technologies in migrant groups and the notions of space and time, disembedding (Giddens, 1990), and deterritorializing (Deleuze & Guattari, 1972/1983). Discussion areas such as the relationship between the online and the offline, virtual and real, and technology and the human have emerged. Scholars have investigated concepts such as virtual community, the online social space, and the diasporic public sphere, and have elaborated on the implications of new technologies on theoretical constructions such as cosmopolitanism and mediation. In this section, I expound on the discussion areas that have appeared. An overview of the scholars engaged in these areas of research is provided in Table 3.

Implications of the New Media on Time and Space

Notions of time, space, place, and locality occupy a central position in analyses of digital diasporas. Factors such as new forms of media, the increased flow of information and ideas, and social and cultural forms of expression that transcend national, cultural, and social borders have had a deep impact. The reliability and constraints of notions such as place, space, and time are transformed, leading to an "intensification and time-space-distanciation" (Giddens, 1990, p. 14) of social relations. In discussions of digital diasporas, Giddens' (1990, 1991) concepts of disembedding and

Table 3. Theoretical and Conceptual Discussions and Authors of Studies of Digital Diasporas.

Discussion Areas	Authors
TIME AND SPACE	
Disembedding	Benítez (2012), Fong et al. (2010)
Deterritorialization	Alinejad (2011), Marotta (2011), Nedelcu (2012), Polson (2015), Van Den Bos & Nell (2006)
BODY, TECHNOLOGY AND THE HUMAN	
Interactions	Adams & Ghose (2003), Alinejad (2011), Costa-Pinto (2014), Kang (2011), Longhurst (2013), Marotta (2011)
Ontology	Adams & Ghose (2003), Baldassar (2016a), Skop & Adams (2009), K. Yoon (2016)
THE CONCEPT OF VIRTUAL COMMUNITY	Ackah & Newman (2003), Adams & Ghose (2003), Diamandaki (2003), Hiller & Franz (2004), Kang (2011), Marat (2016), Mitra (2008), Shi (2005), Skop & Adams (2009)
THE SOCIAL SPACE AND ITS DIGITAL EXPRESSIONS	Bozdag (2014), Gillespie, Herbert, & Anderson (2010), Hepp (2009), Horst (2006), K. Kim et al. (2009), Mahler (2001), Mainsah (2014), Marotta (2011), Nedelcu (2012), Skop (2014)
THE DIASPORIC PUBLIC SPHERE	Benítez (2012), Bernal (2006), Cunningham (2001), Georgiou (2012a), Hsu (2013), Kissau (2012), Laguerre, 2010b, Nagel & Staeheli (2010), Ong (2003), Parham (2004), Shi (2005), Therwath (2012)
COSMOPOLITANISM	Bhimji (2008), Christensen (2012), Colic-Peisker (2010), Y. Kim (2011), Nedelcu (2012), Nessi & Bailey (2014)
MEDIATION	Benítez (2006), Hepp, Bozdag, & Suna (2013), Mallapragada (2010), Mandujano, (2016)

re-embedding have been introduced as a means to grasp the new features that have proliferated. According to Giddens (1990, p. 53), new technologies are disembedding: Time, space and social life are reorganized and social relations are lifted out from local contexts of interaction and restructured across indefinite spans of time–space. The presence and action of the “absent other,” the one who is “locationally distant from any given situation of face-to-face interaction” is taken into consideration (Giddens, 1990, p. 18). Fong, Cao, and Chan (2010) elaborated on Giddens’ (1990, 1991) ideas and suggested that transnational contacts represent re-embedding activities that help migrants reconnect with local structures and institutions in the home country despite their physical absence. According to Benítez (2006), media are re-embedding social mechanisms that connect diverse time–space social contexts and make possible mediated communication practices among multiple family, sociocultural, and political networks. Benítez’s (2006) study showed that the informants’ appropriation of the Internet led to new forms of mediated family reunification and the reorganization of sociocultural interactions over time and space.

A similar interest has appeared for the concepts of deterritorialization and reterritorialization, introduced by Deleuze and Guattari (1972/1983) to denote the distancing (Giddens, 1990) of cultural subjects and objects from a certain location in space and time. In studies on digital diasporas, it has been suggested that migrants negotiate their identities through deterritorialization

and reterritorialization processes (Alinejad, 2011). Moreover, socialization processes in lifestyles shaped by mobility, instant communication, and remote social relations increasingly take place in a deterritorialized context (Nedelcu, 2012). The appropriation of ICTs among migrants generates new patterns of socialization and identification. It renders possibilities for migrants to act at a distance in real time to form multiple belongings and develop deterritorialized identities (Alinejad, 2011; Nedelcu, 2012). Marotta (2011), discussing the notion of home, stated that culture has been deterritorialized and decoupled from place, leading to multiple allegiances to places. The notion of home becomes a diverse category.

The Body, Technology, and the Human

The nature and qualities of online interaction constitute a well-debated area. In the 1990s, concepts such as the “cyborg” (Haraway, 2000), the “disembodied self” (Rheingold, 2000), and “virtual bodies” (Slater, 1998) were introduced to capture the character of the interaction that took place via the screen. Contemporary studies on digital diasporas integrate discussions on the essence of the interactions that take place in online contexts and elaborate on dichotomies such as online and offline (Marotta, 2011), the virtual and the real (Costa-Pinto, 2014), and the notion of body in online activities (Adams & Ghose, 2003; Alinejad, 2011; Kang, 2011; Longhurst, 2013). Longhurst (2013) elaborated on the performative relationships between technologies, spaces, and bodies. According to her, people develop and maintain relational and emotional links through technological interfaces. Thus, both cyberspace and real space are experienced through the body, and bodies and spaces are entangled.

Another strain of discussion concerns the ontological status of the relationship between society and technology, human and machine. Some of the proponents in this discussion are theoreticians Haraway (2000) and Latour (1993). The main argument put forward is that society and technology, human and machine, should not be divided conceptually. Bodies are “incorporated” within the machines they use. Discussing digital diasporas, Adams and Ghose (2003) and Skop and Adams (2009) elaborated on this notion, stating that technology alone does not constitute a virtual environment in which people engage in cultural syncretism. Rather, the virtual environment is the product of human activities that create and share meaning in and through technologies. Technologies that extend or act on the body not only are given meanings by people, but they also give meanings to people. The argument is reflected in discussions on domestication (see, e.g., Silverstone, 1993), suggesting that technology use can be understood as a dynamic and dialectic process between the technology, the users, and specific contexts (K. Yoon, 2016). Baldassar (2016a) extended the topic in her discussions on polymedia and relationships, and introduced the concept of “vibrant matter” (see also Bennett, 2010) to explain the relationship between the human and technology. In a polymedia environment, the person becomes joined with technology in both a physical and metaphysical sense (Baldassar, 2016a, p. 158).

The Concept of Virtual Community

Scholars working on digital diasporas have paid great attention to the concept of “virtual community,” introduced by Rheingold (2000) to describe how, with online tools, individuals form online sociality and webs of personal relationships in cyberspace. Several scholars have discussed and debated the concept. Some scholars suggested that virtual communities build on existing

community structures (Hiller & Franz, 2004). Therefore, the virtual community could be perceived as an ideal placeless replacement of the geographically based community—an online space for cultural practices that come into existence when offline resources and spaces for communication are lacking (see Kang, 2011, and Marat, 2016, for discussions on this topic). Others described the virtual community as a new kind of community, disembodied and independent of space and time (Hiller & Franz, 2004). A sense of community emerged through common interests, shared system of beliefs, values and norms, and a collective sense of belonging (Ardévol & Gómez-Cruz, 2014). Benedict Anderson's (2006) concept of "imagined community" has been brought in to explain the features of the online community (Mitra, 2008; Shi, 2005). For example, Shi (2005) stated that virtual communities generate collective diasporic imaginations that highlight the shared aspects of individual identities in terms of common culture, geography, and history, thus binding discrete subjects into an imagined community. Adams and Ghose (2003) and Skop and Adams (2009) put forward a differing interpretation of the virtual community. They introduced the concept "bridgespace" to denote the various media flows maintained by the Indian diaspora in the United States. The bridgespace functions as a means of cultural preservation, maintenance of ethnic identity, and cosmopolitan lifestyles.

The Social Space and its Digital Expressions

Two well-established theoretical concepts—the social space and the public sphere—have resurfaced in discussions on digital diasporas. The concepts "social field" and "transnational field" were initially introduced in discussions on transnationalism by scholars Levitt and Glick Schiller (2004) to describe the multiple interlocking networks of social relationships through which ideas, practices, and resources are exchanged, organized, and transformed in the transnational setting. Discussions on the relationship between new media and the transnational social field appeared in the early years of the 2000s (Mahler, 2001) and has been further elaborated in discussions on digital diasporas. For example, Horst (2006) discussed the use of the cell phone and its implication for everyday communications in the transnational social field. Scholars have suggested a variety of terms to describe the new configurations. They have, for example, suggested that the Internet constitutes an intermediary transnational social space: a liminal site (Nedelcu, 2012), diasporic "contact zones" (Gillespie, Herbert, & Andersson, 2010), and "diasporic resources" that establish "diasporic spaces" through new and social media (Mainsah, 2014). According to Bozdag (2014), the social space could be described as a "communication space" constructed through mediated or nonmediated communication practices. Further, he ascribed the media content a significant position in meaning construction and formation of identity, community and, culture in everyday life in the diaspora.

The Diasporic Public Sphere

The concept of public sphere (Habermas, 1991) has entered the discussion on digital diasporas, illustrated in concepts such as diasporic public sphere (Nagel & Staeheli, 2010) and transnational public sphere (Bernal, 2006). The creation of computer-mediated diasporic public spheres is facilitated by the decentralized nature, participatory, unregulated, and egalitarian qualities of online media (see, e.g., Benítez, 2012; Bernal, 2006; Kissau, 2012; Laguerre, 2010b; Nagel & Staeheli, 2010; Shi, 2005). Media production has become deprofessionalized and new ways of documenting,

publishing, presenting, and communicating ideas and information have emerged, turning media production into a public feature that is embedded in everyday life (Burrell & Anderson, 2008). In the diasporic public sphere, the boundaries between the public and the private are collapsed (McNair, 2008) and new opportunities for displaying and promoting dissenting voices and minority and subaltern views emerge (Therwath, 2012). Further, the diasporic public sphere might provide a political alternative to the control of centralized state media apparatuses (Georgiou, 2012a). As Hsu (2013) put it, digital media have enabled the creation of generative spaces for individuals to share personal and collective discontentment and opposition to the prevailing social conditions and dominant ideology. As Bernal (2006) indicated, the transnational public sphere is an emotion-laden and creative space where diasporas online may invent new forms of citizenship, community, and political practices.

The Concept of Cosmopolitanism in Studies of Digital Diasporas

In recent literature on digital diasporas, the concept of cosmopolitanism has resurged as an analytical tool. For example, Y. Kim (2011) suggested that cosmopolitanism represents a prime term of analysis in studies on migration and mobility. Globalization, greater frequency of travel, mobility, transnational media cultural flows, and the vision of a global, hybrid, and rootless culture has led to an intensification of cosmopolitan identifications (Christensen, 2012, Y. Kim, 2011). Generally, the concept denotes a variety of developments and phenomena (Christensen, 2012), such as a cultural phenomenon (Hannerz, 1992, 2005), a sociological discourse (Beck 2002, 2003), and a moral parameter (Appiah, 1997; Nussbaum, 1997). The cosmopolitan subject is frequently described as an elite category. For example, Hannerz (1992) put forward a distinction between cosmopolitans, locals, and transnationals. Nessi and Bailey (2014), following Calhoun (2002), described cosmopolitans as citizens of the world who have a lifestyle that allows them to be frequent travelers and easily entering and exiting polities and social relations around the world. According to Colic-Peisker (2010), the cosmopolitan subject is constituted by highly mobile elites. However, the elite view of the cosmopolitan subject has been challenged. Clifford (1997) put forward the notion of “discrepant cosmopolitanism,” critiquing notions of cosmopolitanism that are based in class or ethnocentric frameworks. Werbner (2006) discussed “vernacular cosmopolitanism,” a type of cosmopolitanism that also integrates local, rooted, and historically and spatially situated dimensions. As Y. Kim (2011) stated, following Robbins (1998), a wide variety of cosmopolitanisms may exist in various transnational contexts, such as European and nonEuropean forms, stronger and weaker forms, and thickly textured and thin forms.

Scholars have expounded on the appropriation of new media and social media and the construction of cosmopolitanism and a cosmopolitan identity. For example, Nedelcu (2012) stated that factors such as new media and communication imply a dialogical and reflexive condition. ICTs generate new ways of living together, new connected lifestyles, and new ways of acting transnationally that enhances a cosmopolitan mind-set. Christensen (2012) asserted a cosmopolitan identity formed in the intersection of online communicative practice and offline spatial formations. The importance of new media in the construction of a cosmopolitan identity is affirmed by the study by Nessi and Bailey (2014). They illustrated how elite migrants express a cosmopolitan outlook by gaining and managing their “cosmopolitan capital” in online contexts. Colic-Peisker (2010) suggested that subjects with high mobility combined with a strong professional identity are likely to adopt cosmopolitan attitudes. For TKWs, their globally recognized profession forms their principal

identification. Professional networks supported by Internet communication, open to anyone in the same professional class, regardless of ethnic and national boundaries and affiliations, functions as nodes for the construction of identity of belonging and a cosmopolitanism outlook.

The Value of the Concept of Mediation in Studies of Digital Diasporas

A theoretical area highlighted in discussions on digital diasporas is embodied in concepts such as mediation and mediatization. The concept of mediation generally denotes the relationship between media, society, culture, and peoples' daily life. Couldry and Hepp (2013) suggested that the concepts are used to capture the broad consequences of media for everyday life and its practical organization. Livingstone (2009, p. 4) referred to mediation as "the metaprocess by which everyday practices and social relations are increasingly shaped by mediating technologies and media organizations." Silverstone (1999, 2003) drew on the concept of mediation to describe the omnipresent and multidirectional nature of media's contribution to the "texture" of life, the dialectical interaction between media and one's broader life and culture. The concept has become increasingly theorized. For example, Couldry and Hepp (2013) suggested the key theoretical concept mediatization to denote the processes inherent in the proliferation of forms of media and media's embedding in everyday life.

In discussions of digital diasporas, scholars frequently use concepts such as mediation, re-mediation, and mediatization, even though the terms often remain vaguely defined and rarely investigated. Some scholars discussed explicitly the use of these concepts in their studies. For instance, Benítez (2006) and Mandujano (2016) turned to J. B. Thompson's (2005) interactional theory of mediation. Benítez (2006) illustrated how immigrants maintained contact with their home country through various forms of interaction: face-to-face interaction (i.e., copresence), mediated interaction, and quasimediated interaction (see also Thompson, 2005). Hepp, Bozdag, and Suna (2013) drew on the concept of mediatization and introduced the notion of mediatized migrants to denote how the articulation of a migrant's identity is deeply interwoven with and molded by various forms of media. Mallapragada (2010) introduced another notion of mediation in her analysis of Hindu temple websites and the textual and discursive practices used in the representations of the temple online. Following Bolter and Grusin (1999), she suggested that the concept re-mediation is useful in analyzing the processes through which older media forms—such as photographs of deities, Hindu calendar art, and the analogue sacred texts—are repurposed, refashioned, and re-mediated on the temple's sites, thereby creating a "desktop deity culture."

METHODOLOGICAL DISCUSSIONS

In research on digital diasporas, the theoretical and methodological discussions and debates have been framed in a broad interdisciplinary context. In this section, I look closer at the methodological approaches that researchers deployed in studies of digital diasporas. Ardévol and Gómez-Cruz (2014) distinguished three methodological approaches to studies of the Internet: virtual ethnography, connective approaches, and studies of the Internet in everyday practices. I find those methodological approaches useful in classifying the various approaches in the study of digital diasporas. I include as well a fourth category—digital humanities and big data research—that has emerged recently in this field.

The approaches suggested by Ardévol and Gómez-Cruz (2014) evolved in parallel with the various Internet development periods. Virtual ethnography, also known as ethnographies of cyberspace, appeared from the Internet beginnings to the late 1990s. With the expansion of the World Wide Web, connective studies of the relationship and interconnection between the online/offline spheres became common. The third approach, Internet in everyday practices, corresponds to the introduction of Web 2.0 and social media. The fourth category, methodologies developed in the digital humanities, is an emerging research area in studies of digital diasporas. It can briefly be described as big data research, where computational methods are used to investigate various aspects of the use of new media among migrant and diasporic groups. The categorization of these methodological approaches is tentative; the area is complex and often the approaches are used in an overlapping and complementary ways. I start this thematic section by positioning the discussions on the digital diaspora and method in the wider field of media and communication studies and media ethnography. Then, I turn to the suggested classification of methodological approaches in studies of digital diasporas. I give an overview of scholars working in the various methodological areas in Table 4.

Media and Communication Studies and Migration

Media and communication studies constitute a broad, diverse, and interdisciplinary complex, involving the humanities and the social sciences as well as portions of the natural sciences. Diminescu and Loveluck (2014) suggested that migration studies and media studies share common ground, and according to Ponzanesi and Leurs (2014), migration and the discourses on new media

Table 4. Overview over Authors and Methodological Approaches Applied in Studies of Digital Diasporas.

Methodological Approach	Author
ETHNIC MINORITY MEDIA STUDIES	Georgiou (2012b), Gillespie et al. (2010), Ogan & D'haenens (2012), Rinnawi (2012), Shi (2005), Yin (2015), T. I. Yoon et al. (2011)
SOCIAL SCIENCE METHODS	Fong et al. (2010), Kissau (2012), Oiarzabal (2012), Skop & Adams (2009)
MEDIA ETHNOGRAPHY	Baldassar (2008), Benítez (2006), Bernal (2006), Biao (2007), Bozdog (2014), Brown (2016), Colic-Peisker (2010), Harney (2013), Y, Kim (2011), Longhurst (2013), Madianou (2012), Maira (2010), Marat (2016), Miller & Madianou (2011), Mitchel (2008), Nagel & Staeheli (2010), Rinnawi (2012), Robertson et al. (2016), Schier (2016), Shi (2005), Tanikella (2009), Tripp & Herr-Stephenson (2009), Wilding (2006), Witteborn (2014)
VIRTUAL ETHNOGRAPHY	Adams & Ghose (2003), Andersson (2007), Chopra (2006), Joshi (2010), Mallapragada (2010, 2014b), Mitra (2008), Mitra & Gajjala (2008), Parker & Song (2007), Raman & Kasturi (2014), Scheifinger (2009, 2010), Siapera (2005)
CONNECTIVE APPROACHES	Burrell & Anderson (2008), Christensen (2012), Costa-Pinto (2014), Halilovich (2013), Marotta (2011), Mitra (2006), Polson (2011), Witteborn (2014, 2015), Yin (2015)
MEDIA PRACTICE	Alinejad (2011), Bork-Hüffer (2016), Kang (2011), Leurs (2014), Lorenzana (2016), Murthy (2010), Nessi & Bailey (2014), Nishitani (2014)
DIGITAL HUMANITIES	Diminescu & Loveluck (2014), Hsu (2013), Narayan & Purkayastha (2011), Narayan et al. (2011), NurMuhammad, Horst, Papoutsaki, & Dodson (2016), Plaza (2010), Purkayastha, (2009), Therwath (2012)

technologies, digital connectedness, and trans-medial practices are interconnected. According to Borkert et al. (2009), four major strands are discernible in studies of new media and digital diasporas: studies on the effect of media on cultural identities, audience studies, representation of diasporic minorities in the media, and diasporic ethnic minority media.

Researchers investigating digital diasporas have applied various approaches from the field of media and communication. For example, Rinnawi (2012), Shi (2005), and Yin (2015) discussed the effects of the use of ethnic media and online homeland media in migrant groups. Further, some scholars used social science methods, such as quantitative methods and statistical analysis, in their analyses of new media use in digital diasporas. Kissau's (2012) research illustrated the point: He relied on quantitative methods to determine the degree and characteristics of migrants' political online and offline activities.

Media Ethnography and Studies of Digital Diasporas

Ethnographic studies are a well-established research method in studies of communication, media, and the Internet. In studies on digital diasporas, scholars use the ethnographic approach in various ways, such as media ethnography, ethnographic interviews, and ethnographic case studies. In the media ethnographic approach, the focus is on understanding media as a cultural form, investigating active audiences by exploring genre readings, issues of race and gender, components of family living, and identity (Murphy, 1999). Benítez (2006), following Murphy and Kraidy (2003), stated that the aim of the media ethnographic approach is to comprehend how people are engaged in processes of media reception and cultural practices located in particular time-space contexts of interaction. Scholars should examine people's everyday relations with media texts from the intersections of different locales—home, school, workplace, and neighborhoods, among others. Witteborn (2014) relied on the method of ethnography of communication (Hymes, as cited in Witteborn, 2014) to investigate how “communicative practice created meaningful social life in situated locales” (p. 77). In her study, Witteborn (2014) made repeated participant and unstructured observations in various sites where people engaged with digital practices, as well as collected statements, and then analyzed where, when, and why people put forward a specific comment. In the analysis, she focused on the setting, the participants, and the goals and outcomes of the communicative acts and practice.

Some scholars apply the methods of ethnographic interviews and ethnographic case studies in their analyses. Shi (2005) deployed the method of ethnographic interviews in his research and stated that ethnographic interviews are one of the most common and powerful ways to grasp the meanings that people ascribe to their daily lives. The uniqueness of the method lies in its open-ended style that often allows the researcher to get unintended but valuable information or observation. Wilding (2006) suggested that an ethnographic case study is a valid methodological tool in the research of migration and new media. Specifically, Wilding (2006, p. 139) noted that it is in the ethnography of life as it is lived that researchers see the delicate balance of both utopian and dystopian tendencies in the impact of ICTs on people's everyday lives.

Virtual Ethnography: The Discourse of the Digital Diaspora

Virtual ethnography was introduced as a research method in the 1990s, influenced by for example Rheingold's (1993) discussion on cyberspace. According to Ardévol and Gómez-Cruz (2014), the

method implies that new social and cultural patterns flourished in cyberspace, giving birth to a brand new cyberculture to explore. In virtual ethnography, the focus is placed primarily on the online context and content-focused studies of the Web. The Web is seen as a collection of texts, thus the focus for the studies centers on web pages and their content, texts, and images and the studies are based in discursive or rhetorical analyses (Schneider & Foot, 2004). According to Kang (2011), the methodological approach has had a continuing influence, and it has been popular in recent empirical studies of diasporic Internet use.

A number of studies on digital diasporas have explored virtual worlds and their online shapes and forms. For example, Andersson (2007), Scheifinger (2009, 2010), and Mallapragada (2010, 2014b) explored websites and how they impact the migrant community, identity construction in migrant groups, and migrants' relationships to their homelands. Adams and Ghose (2003) and Joshi (2010) elaborated on Indian matrimonial websites, noting that the matrimonial sites target the diaspora population as well as groups in the home country.

Studies by Chopra (2006), Mitra (2008), and Siapera (2005) illustrated well the method of discursive analysis that is put forward in this approach. Siapera (2005) investigated virtual communities through analysis of the discourse presented on websites and in online forums. Chopra (2006) explored modes of representing collective identity in cyberspace through a study of websites and a close reading of selected virtual texts. Specifically, Chopra used a cultural studies framework: The websites selected for analysis were understood as discursive objects or texts located in economies of technology and culture. Mitra (2008), who analyzed blogs, noted that the Internet is composed of texts, images, and artifacts. Through the method of discursive analysis, Mitra demonstrated the possibility of understanding how the person who writes a blog produces a specific identity narrative.

Connective Approaches in Studies of Digital Diasporas

In the middle of the first decade of the 2000s, interest in virtual ethnography and exclusively online studies of the Internet decreased. Changes and developments in media forms and media usage, and the increasingly pervasive presence of Internet in everyday practices, led to a proliferation of studies focusing on the socialization process inherent in online participation. Scholars advocated that fieldwork should be undertaken both inside and outside the screen. In such research, the distinctions between the online and offline spheres would be bridged and the relationships between online and offline interactions could be investigated. As Ardévol and Gómez-Cruz (2014, p. 6) stated, a conceptual shift appeared in which the focus was put on identifying the productive social process of "siting" instead of identifying "sites" as pre-existing places for doing fieldwork. The new approach led to an unbinding of ethnographic research practices from location, whether physical or virtual.

Researchers of digital diasporas have used the connective approach to interpret the distinctions and interconnections between the online and offline spheres, the virtual and physical spaces. Concepts such as "cybernetic space" (Mitra, 2006) and "digital heterotopias" Witteborn (2014) illustrated the specific nature of the synthesis of real spaces and virtual spaces. Costa-Pinto (2014) emphasized the symbiosis within the real and the virtual in the migration experience. Migrants conduct their daily lives in real and virtual dimensions. From this perspective, migration can mean a change in physical place, though not necessarily in cyberspace.

The methodologies used in connective approaches are both complex and diverse in strains and approaches. Christensen (2012) and Burrell and Anderson (2008) combined online and offline methodological approaches to bridge the distinction between the real and the virtual. For example, Burrell and Anderson (2008) situated the field site in the context of everyday life, combining investigations in cyberspace—that is, in discussion forums and websites—with fieldwork and participant observation in the physical spaces frequented by the group. Further, they integrated informal in-home interviews in the study. Halilovich (2013) rejected a classical ethnography of fixed places and cultures and combined conventional and digital ethnography in his study. He interacted with the informants through mobile phones and in various social media as well as in physical locations. According to Halilovich (2013), the informants' social networks, life stories, and experiences were performed and sustained both in real space and in cyberspace. The distinction between the real and imagined was transcended.

The Methodology of Media Practice

Media practice constitutes a third methodological approach in studies of digital diasporas. The proliferation of Web 2.0 and social media led to shifts and new patterns in communicative forms. Social media promote communicative interactivity, user-generated content, and creativity (Blank & Reisdorf, 2012; Coleman, 2010; Oiarzabal, 2012). As Oiarzabal (2012) stated, implicit in social media is the assumption that people want to share information: It allows users to provide content on the Web and to share it in an unprecedented manner. The range of practices related to or oriented toward the media has expanded (Couldry, 2004) and the use of multiple media has become a regular feature of everyday life—embedded in practices of sociality, identity construction, and cultural production (Ardévol & Gómez-Cruz, 2014).

The approaches put forward in this category reflect the proliferation of new forms of media and the transformations in communicative forms. Deuze (2006, p. 66) used the term “bricolage” to describe the highly personalized, continuous, and more or less autonomous assembly, disassembly, and reassembly of mediated reality. Murthy's (2010) study illustrated the case. He explored how the creation of progressive virtual spaces is facilitated by music websites, discussion forums, social networking sites, and IP-based technologies. Factors such as viral spreads and flows between transnational spaces can build up progressive energies that affirm and make identities dynamic. In his methodological approach, Murthy (2010) aspired to be absorbed into the sphere of virtuality and reality. Ethnographic research (i.e., participant observation and interviewing) was conducted both online and offline, and he took part in Facebook and MySpace pages, discussion groups, and blogs. Further he conducted virtual interviews by e-mail, Twitter, and Facebook messages.

A group of scholars emphasized the importance of integrating factors such as embodiment, emotions, and sensory impressions in the methodological approaches employed in studies of digital diasporas. For example, Alinejad (2011) elaborated on the notion of “transnational embodiment” and underscored the importance of the embodied experience in transnational diaspora identifications, whereas Bork-Hüffer (2016) put forward the notion of “place perception” to illustrate how digital media affects attachments to and sensuous experiences of a place.

Nessi and Bailey's, (2014) study illustrated methods used in research on social networking sites (SNSs). These authors combined qualitative, textual, and ethnographic methods in their study of elite migrants and SNS use. They interacted in Facebook communities and groups, created online profiles, and observed and established relationships with members in the groups and on the

pages. They analyzed the informants' online profiles and the choices the informants made when they constructed their own profiles. Further, they examined the informants' membership in Facebook groups and the content that the informants uploaded in the various forums. They complemented the study with online questionnaires and online and offline in-depth interviews.

Nishitani (2014) elaborated on the notion of media flows (see also Couldry, 2008) in her analysis. In her research group, family relations were expressed as diasporic dramas, that is, communication flows that are seamless with the everyday lives, but also disrupted and asymmetrical. Communication technologies played a significant role in maintaining multidirectional ties among the informants. However, ICTs were only one of various means the informants used to connect with others. Messages and events that started with online interaction were extended through phone calls and discussed in face-to-face conversations. Methodologically, Nishitani followed the communication flows and media events across the various media through participant observation of the daughters' and mothers' everyday lives. The aim was to capture the overall dynamics of the communication flows and how they were harmoniously kept or disrupted.

Digital Humanities as Research Method in Studies on Digital Diasporas

Digital humanities have entered into the discussions on digital diasporas as an emerging research methodology (see, e.g., Ponzanesi & Leurs, 2014). The concept of digital humanities is broad and, so far, vaguely defined. In general, it denotes the combining of methodologies from traditional humanities disciplines with methods from computing and digital technology. Digital humanities as a methodological approach renders the possibility for researchers to access huge digital databases with the goal of archiving information, visualizing networks, designing cartographies, and plucking, systematizing, and creating typologies for user-generated content produced in social platforms such as Facebook, Twitter, YouTube, Wikipedia, and Flickr (Ponzanesi & Leurs, 2014).

The digital humanities method employs computational methods and a variety of data-mining techniques designed to extract useful information from Web data (Hsu, 2013). Hyperlink analysis and content analysis are the main methods used in research of digital diasporas. Hyperlink analysis takes into account the interactions between and among websites: the number of incoming and outgoing links, the "missing" links, and the various strategies of promotion and discretion used in the linking practices (Therwath, 2012). Hyperlink analysis is, at its core, a form of network analysis. It provides a means of identifying the constitutive elements and boundaries within a network as it exists online (Carpenter & Jose, 2012). Quantitative content analysis is used for analysis of textual big data produced by new media and social media. In content analysis, researchers quantify and analyze the presence, meanings, and relationships of the media content, as well as make inferences about the messages within the texts, the authors, the audience, and the culture and time of which these are a part.

A couple of studies on digital diasporas integrate methods developed in the digital humanities. For example, NurMuhammad, Horst, Papoutsaki, and Dodson (2016) applied content analysis in their study of Facebook usage among the Uyghur diaspora. Frequently, multiple approaches, such as hyperlink analysis and content analysis, are combined within the same research project. Hsu (2013) combined methods of conventional and computational ethnography with tools from the digital humanities to map the digital social terrain of the Kominas' virtual community. The digital social terrain comprised multiple online and offline sites. Moreover, Hsu (2013) introduced a

holistic approach to the study of the Internet. To illustrate how digital media are embedded in physically embodied social life, he performed field research and participant observation in both online and offline environments. Digital humanities methods—such as Web scraping, geospatial visualization, and mapping technologies—were used to map the transnational contours of the digital social terrain. The use of digital humanities methods uncovered new visual and geo-spatial patterns and visualized and contextualized the geographical coverage and the dynamics of social interactions across various geographical boundaries.

Diminescu and Loveluck's (2014) project, the e-Diasporas Atlas, was a study of 30 diasporas on the Web that compiled a corpus of approximately 8,000 migrant websites. The project elaborated on how collective identity formation of migrant groups is mediated by the Web. The presence of migrant collectives and diasporic communities on the Web is illustrated through the traces left by hyperlinks on the Web. The researchers introduced the notions of digital reason and graphic reason to define levels of analysis. The digital reason deals with the structural dimensions of diasporic networks, the position of websites within the network, and the meaning construction provided by the linking of these sites. According to Diminescu and Loveluck, linking constitutes a communicative strategy where actors try to enhance their visibility through associational effects, that is, through linking with certain websites and avoiding any association with other websites. The visualization of the general topology of the networks provided the authors new insights into the characteristics of migrant populations, such as the degree of cohesion and the bridging role played by certain actors. The notion of graphic reason included analysis of the content on display on the linked websites, including the associated discourses and representations. Websites store traces of information and user traffic and thus function as repositories, and at times mirrors, of various forms of media. Websites display the distinctive elements of the diasporic group through the texts, pictures, and sounds of their traditions that compose the singular but shared experiences towards which diasporas look back.

Therwath (2012) elaborated on the use of link analysis as a method to assess variations in discursive strategies of online nationalism and long-distance nationalism. She performed an analysis of the morphology of a corpus of websites to determine the influence of ethno-religious political movements and ideologies. The in-depth study of website administrators and of members of social networks rendered a sociology of the online activists. Further, she analyzed the resonance of the ideology by content-analysis techniques.

CONCLUSIONS

This narrative literature review provides an overview of the research corpus in the expanding field of studies on digital diasporas: the field of migration, transnationalism, mobility and diaspora on the one hand, and the field of ICTs, new media, social media and Web 2.0, on the other. My aim in the article was to outline the status of the research field to delimit the main characteristics of the field and to identify the ongoing research in the area. As I stated in the introductory sections of the article, I drew a line for literature searches in 2016 and the article was submitted for publication in autumn 2018. I am well aware that the research field has developed during the last two years. However, a gap in the recent literature is a natural consequence of any type of scoping study to allow time for analysis and publication.

The first studies of migration and ICTs appeared in the end of the 1990s, and the field has expanded rapidly. Initially, the research agenda in study of digital diasporas was characterized by the frequency of new media use by migrant and diasporic groups. Questions regarding the digital divide, access to the new technologies, and digital literacy were explored. A number of studies focused on, for example, the role of new media in the constitution of online diasporic communities and virtual communities. The research focus evolved from establishing the frequency and the nature of new media use by migrants to an interest in questions on how the use of the new media affects migration and how it impacts migrants and diasporic communities. Various aspects were explored, including factors regarding the impact on family constellations and relationships, how the use of the new technologies influenced and formed migrants construction of identity, ethnic belonging and community cohesion, whether or not the use of the new technologies enabled and strengthened the relationship to the home and the home country, and how the use of new media impacted on migrants political engagement, expressed in, for example, participation in home-country politics and long-distance nationalism. The later research has been characterized by explorations of appropriation and implications of the increasingly specialized and refined technologies of communication. The studies in this vein reflect and deepen previous discussion areas, such as the family, identity construction, the political arena, among other, thus refining and elaborating analyses in the digital diasporic field. Further, research approaches have expanded, integrating new research categories. For example, highly skilled mobility has become an established research focus, the appropriation of the new technologies in displaced groups has received attention from scholars, and the interest in new media in general mobility studies, such as by tourists and travelling people, is increasing.

Research on digital diasporas is closely related to the proliferation of new technologies and new media forms. The relationship between the research area and new technologies is accentuated in the field of methodology. The research methodologies implemented in studies on digital diasporas correlate with the introduction of new media types and communication practices. In virtual ethnography, introduced in the late 1990s, the focus was put on the online context and content-focused studies of the Web, for example, in discursive analyses of web pages. With the expansion of the Internet, the emphasis on virtual ethnography and exclusively online studies of the Internet declined. Researchers came to acknowledge that the distinction between the online and offline spheres should be bridged. Further, the development of Web 2.0 and the proliferation of social media introduced a methodological focus on media practices. The use of multiple media resources had become a regular feature of the everyday, embedded in the practices of daily life. In studies of digital diasporas, the media practice approach was used to examine the implications of the proliferating technological field and increasing number of media forms for migrant groups. The discussions focused on topics such as the appropriation and impact of polymedia, smartphones, Skype and real time video. It appeared a number of studies that explored, for example, how family relations are affected by communication in polymedia environments and how communication through technological assets such as Skype and real time video affect the nature of the relationships.

The research field of the digital diaspora has matured and increasingly takes the shape of an established research area within the mainstream academic discourse. The number of conferences and workshops that include panels on the topic have increased, as have the frequency of research groups focusing on the topic. One example is the Mig@Net project,

which included scholars from eight European universities and was funded by EU's Seventh Framework Program. The project researched migrants and transnational digital networks.

Yet, much still remains to be done in the field. The literature in the field is mainly dominated by a wide array of empirical studies and case studies on ICTs and migrant groups. Certainly, the research topics have benefited from the approaches of a diversity of academic fields. However, from my point of view the research field would benefit from a clearer positioning of research on digital diasporas in the wider academic context, delimiting the core areas in the field and defining the boundaries towards other subject areas. Further, a stronger integration and consolidation of the various academic subjects involved in the research area would be helpful in identifying the central fields and key issues that are of significance in advancing the understanding, knowledge, and research agenda in the field of digital diasporas.

IMPLICATIONS FOR THEORY AND APPLICATION

Through the narrative literature review method, I have provided in this article an overview of the growing literature in the rapidly expanding research area of migration and new media, specifically in regard to the primary themes and topics of research interest, the theoretical and conceptual issues under investigation, and the methodological approaches to research in this field. This article contributes to current and future research in several ways, most specifically in providing a comprehensive look at the field from the 2000 until 2016. Additionally, this article identifies trajectories of interest and knowledge that can offer future researchers ideas on where to delve more deeply or to open new streams of investigation regarding migrants (of all kinds) using diverse media in their everyday lives. From an application perspective, my analysis and compilation of the field's research provides a resource guide for persons and organizations working with migrants. In short, this article has the potential to function as an information source for academics, practitioners, and those who are new to the field and might provide a guide for future research.

ENDNOTES

1. The research field covers literature from the year 2000 up to 2016 and includes 210 posts (articles, book chapters, monographs).
2. My aim has been to include all relevant literature in the field. However, I am well aware of the limitations in this task. If, however, a source is missing, it results from a human oversight rather than an intentional omission.

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MOBILE MEDIA, GENDER, AND POWER IN RURAL INDIA

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Abstract: This article traces the diffuse connections between mobility and power by exploring how mobile phone use contributed to gendered power relations in rural India. It is based on ethnographic fieldwork on the use of mobile phones, conducted periodically between 2005 and 2013 in the village of Janta in West Bengal, India, and compared to earlier fieldwork in Janta, before the village had any phone system. Analysis of the increased mobility reveals how mobile phone use emerges within interconnected, changing fields of power. The political sphere earlier perceived as predominantly local was replaced by translocal political practices characterized by increasing mobility. Although new political practices eroded women's political participation in the village, mobile phone use made possible new forms of agency for women. The article contributes to the understanding of the unanticipated ways mobility and new media contribute to power and politics.

Keywords: *mobility, mobile telephony, power, gender, India, politics.*



INTRODUCTION

If mobility serves as a prime metaphor for the contemporary world, the ubiquity of mobile phones symbolizes this trope. Mobile communication is associated with a mobile lifestyle characterized by temporal and spatial autonomy (Katz & Aakhus, 2002). In this article, I analyze how mobile phone use has contributed to mobility and gendered power relations in rural India. I examine how mobile phone use has helped to create new political practices characterized by mobility and how the new mobilities have played a role for changes in gendered power relationships and women's agency. Theoretically, the article develops the understanding of how mobilities emerge from various fields of power, thus enabling interrelated power relationships and forms of agency.

A mobility turn in the social sciences emerged in the 1990s to understand the importance of movement on individuals and society (Sheller & Urry, 2006, p. 208). The paradigm underscored how social life, civil society, and political participation are performed through mobilities (Adey, Bissell, Hannam, Merriman, & Sheller, 2013). In addition to physical traveling, mobility can be regarded as the movement of objects, imaginative mobility (e.g., the movement of images and ideas through mass media), virtual mobility over the Internet, and person-to-person communication through letters and digital media (Urry, 2007). I use this definition of mobility. Although mobility often is celebrated as a progressive force, the ability to move is not spread equally because the same factors that produce movement and global linkages can also promote friction, immobility, exclusion, and disconnection (Alvarez, 1995; Cresswell, 2014; Tsing, 2005). Moreover, not all movements are equally meaningful and life-shaping for the people on the move (Salazar & Smart, 2011). In other words, mobility cannot be equated with power and agency even though it relates to power relationships.

Mobile phones have become such a key indicator of mobility that mobilities are analyzed based on mobile phone generated data both in the natural and social sciences (e.g., Csájiab et al., 2013; Palmer et al., 2013). Ethnographic studies on mobile phone use have both problematized and developed the understanding of the relationship between mobile telephony and mobility. Wallis (2013) and Archambault (2012, 2017) questioned the seemingly self-evident connection between mobile phones and mobility. Archambault (2012) argued that, although helping bridge distances in significant ways, mobile phone communication nonetheless also betrayed young men's mobility in Mozambique. She illustrated ways in which young men harnessed communication to express and address experiences of constrained physical and social mobility. However, their mobile phone communication simply expressed rather than resolved their exclusion. Indeed, rather than promoting physical mobility, mobile phones often open up a space for the enactment of imagined global identities (Archambault, 2012; McIntosh, 2010, p. 344). Wallis (2013) found that disciplinary regimes, as well as gendered job hierarchies in China, produced young migrant women as particularly gendered, classed, aged, and placed working subjects who remained relatively immobile in their work spheres despite their use of mobile phones. She argued, therefore, that the mobile phone enables "immobile mobility," which she defined as a sociotechno means of surpassing spatial, temporal, physical, and structural boundaries. Immobile mobility allowed migrant women inclusion in the expanded and enriched social networks, which in turn reinforced their identity as migrants and not Beijing people. Wallis' observations exemplify that analyzing mobility requires attention to the contexts of mobility and communication. Tacchi, Kitner, and Crawford (2012) explored mobility within everyday uses of mobiles and their social settings in

rural South India. They coined the term “meaningful mobility” to explain how the mobile phone emerged as a contributing agent to how women could bolster their social positions.

In this article,¹ I explore the meaning of mobile telephony-enabled mobilities for gendered power relationships. As noted by Goggin (2006) and Kinnunen, Suopajarvi, and Ylipulli (2011), power has remained a rarely explicated concept in research into mobile phone use, although most studies on new media have addressed power-related issues in some ways. Power issues are at the heart of the scholarly debate on digital divides (Castells, 2001; Green & Haddon, 2009; Loader, 1998; Mansell & Steinmueller, 2000; Tsatsou 2011), studies on intersectionality of mobile media use (Tenhunen, 2018; Wallis, 2013), and the study of the use of digital media for political action (Castells, Fernandez-Ardevol, Qiu, & Sey, 2007; Fortunati, 2002; Gergen, 2008; Ibarine, 2008; Liu, 2017; Rafael, 2003; Rheingold, 2002; Tenhunen, 2011). Additionally, the research on the gender aspect mobile phone use has been focused implicitly on power. Lim (2014) summed up much of the research on women’s use of mobile media in her review article, concluding that even as the technological landscape of mobile media changes, the social settings within which women appropriate mobile media tend to remain fundamentally unaltered. For instance, Dobashi’s (2005) research on Japanese housewives and Wajcman, Bittman, and Brown’s (2008) study of Australian women demonstrated that women used mobile media mainly to fulfill their familial obligations. Yet, as Fortunati (2009) pointed out, women tend to be more vulnerable than men to the pressure of “double work”—the challenges of balancing obligations in both the home and the workplace. Consequently, women have availed mobile media in many geographic locations to manage their double workload rather than using phones to induce radical changes in gender relationships. Moreover, much of the anthropological research on the uses of new technologies share an emphasis on the tendency of technology use to reinforce existing structures and, especially, adherence to kinship patterns (Archambault, 2010; Barendregt, 2008; Horst & Miller, 2006). However, a few studies on women’s mobile phone use in the Global South have indicated the potential for change. For instance, Chib and Hsueh-Hua Chen (2011) demonstrated how female mobile phone users in Indonesia maneuver through their social constraints to reap benefits from ICT use. Oreglia (2014) described how older women in rural China pursue their goals of maintaining relationships and accessing online entertainment after receiving training from their children and through collaboration and knowledge sharing with their peers.

Similarly to the studies discussed above, most studies on mobile telephony in South Asia have focused on the question of whether mobile telephony contributes to the strengthening of pre-existing social practices or whether it induces changes. Jeffrey and Doron (2012) argued that mobile telephony has great potential to disrupt the inequalities in India. They (Jeffrey & Doron, 2013) explored mobile telephony in India in its totality, drawing mainly on secondary sources, but also on ethnographic research in Varanasi (a city in Eastern India), which included policies, industries, and businesses. Doron (2012) noted the destabilizing nature of mobile phones for social relationships in Varanasi but maintained that phones were incorporated into households in ways that reaffirm dominant norms and practices so that young women’s phone use is restricted. In his study on rural Tamil Nadu in South India, Jouhki (2013) found men to be more active, dominant, and technologically literate users of mobile telephony than women. He argued that young men enjoyed more freedom and agency in the sphere of mobile telephony than women.

My approach differs from the above-discussed studies in that, like Rai (2019), who analyzed subaltern strategies of smartphone use in urban North India, I focus explicitly on power relationships. Moreover, I analyze how increased mobility can simultaneously influence power

relationships in contradictory ways, whereas the studies I discussed above have tended to emphasize either the positive or negative aspects of mobility for power relationships. Mobile telephony has helped women in Janta to negotiate kinship relationships and broaden their home sphere; however, at the same time, the reshaping of political activities resulting from the uptake of mobile phones has reduced women's role in politics. I use Bourdieu's (1998) notion of the field by which he refers to a relatively autonomous domain of activity that responds to rules of functioning and institutions that are specific to it and that define the relations among the agents. In other words, the concept of field denotes to how a society can be analyzed as subdivided into multiple settings that determine social positions and create possibilities for agency. My analysis of the contradictory effects of mobility for gendered power relationships reveals diverse fields and meanings of power, which are influenced differently by the increased mobility. My starting point is to understand power as diffused and extending beyond the formal political sphere; consequently, I relate the use of mobile phones for constructing new types of political practices to other phone-enabled mobilities. I regard agency as the active reproduction of social and cultural formations through social action and discursive means. Furthermore, I use Wrong's (1988, p. ix) idea that the key to understanding power disparities lies in assessing power through the presence of effects rather than the origins of action in choice. In other words, agency and power provide means with which to focus on different aspects of social action: The concept of agency reveals the origins of action and the notion of power exposes the actors' differing abilities to reach their goals. To sum up, I explore how mobile phone use contributes to mobility and, in turn, how new mobile practices relate to gendered power relationships. I focus on two areas of power relationships where villagers availed themselves of mobile telephony: political practices and gender and kinship. The choice of these spheres corresponds with my interest in exploring power as extending beyond the sphere of politics. By juxtaposing mobile phone use within two different fields, each of which entails different forms of power and agency, I sought to uncover and analyze the contradictory nature of mobility for gendered power relationships, particularly as they relate to local politics and changes in women's gender and kinship relationships.

ETHNOGRAPHIC FIELDWORK AND RESEARCH DATA

My primary fieldwork site, Janta, is a multicasite village in the eastern state of West Bengal. The village contains approximately 2,500 inhabitants, the majority of whom earned their livelihoods from paddy cultivation and vegetable farming. This article is based on ethnographic fieldwork—interviews, participant observation, and survey data—on the use of mobile phones in 2005, 2007–2008, 2010, and 2012–2013 (see Tenhunen, 2008, 2011, 2018). I also draw on my earlier fieldwork in Janta in 1999–2000 and 2003–2004, a period when no phone system was available in the village (see Tenhunen, 2003, 2009). I collected both quantitative and qualitative data; however, as ethnographic methods are particularly well suited for exploring the interlocutors' understandings and practices, I draw mainly from the qualitative data. My analytical approach is interpretive, and I have analyzed systematically all the research data, including the transcribed interviews and fieldwork notes, by identifying, categorizing, and analyzing the emerging themes and key issues by using qualitative textual analysis software (i.e., Alpha and ATLAS.ti).

I began my research on mobile telephony in 2005 by interviewing the first 10 mobile phone owners of the village. My initial interview questions delved into the phone owners' motivations

for buying the phone, patterns of phone use, and the perceived benefits and possible disadvantages of the phones. I kept my interview questions loosely structured in order to explore unanticipated aspects of emerging phone use. I retained the questions I formulated for my first interviews as part of the subsequent interviews, but I did add new questions on such themes as phone use for political action, gender relationships, and economic activities, as well as the use of smartphone applications in the course of observing new facets of phone use.

In 2007–2008, I again interviewed all phone owners of the village. The distribution of interviews reflected how the mobile phone ownership in the village was clustered in the Tili (upper caste) neighborhood at the time of the interviews: Of the 72 interviews, 60 took place in the Tili caste neighborhood. In addition, I interviewed two Tati, two Chasa, six Brahmin and, two Bagdi caste persons.² Most of the people I interviewed were men because men usually were considered the primary phone owners of the households. However, during each interview, I asked questions about other family members' phone use. When I returned to the village in 2012, phone ownership had become ubiquitous, which, for the first time, made it possible to interview several women and Scheduled Caste³ phone owners. During my fieldwork in 2012–2013, I interviewed 25 women and 39 men who owned personal phones; 45 of this interview group belonged to the higher caste and 19 to scheduled castes. In addition, I interviewed 32 political activists about political phone use. To sum up, over the years, I have interviewed 178 persons from the Janta village about their mobile phone use.

However, I gained some of the greatest insights into the role of mobile phone use by interacting and chatting with the villagers and by writing down these observations in my fieldwork diary. I did not merely observe phone conversations but also discussed these calls with the callers. Often I was able to listen to both parties of the phone calls because these people commonly used the speakers on their phones so that they could share their calls with those present. Phone use that turned into a tacit part of everyday life underlined the importance of observation as a research method, and this article draws more from my observations and interactions than from the interviews.

I speak the Bengali language fluently and lived in the village during 1999–2000; consequently, I was not considered an outsider there during my subsequent fieldwork trips. Initially, the mobility required by my fieldwork quickly revealed gendered power structures. Some men of the neighborhood where I lived in the village objected to my visits specifically to lower caste neighborhoods. I was able to get their approval by arranging a local assistant to accompany me during these visits. However, no one expressed any concerns about my mobility during my subsequent fieldwork visits: The villagers had developed a shared understanding of what my fieldwork entailed. Through my long history with my interlocutors, I gradually became able to develop relationships of trust that helped me to interact with people from different caste groups and classes.

Life in rural West Bengal was not stationary before the introduction of mobile telephony (Tenhunen, 2008). Because women usually married outside their natal village, kinship networks crisscrossed the region, and kinship relationships were maintained through visits. Several villagers commuted to nearby towns for work or study, and some people had emigrated to other regions in India. People also were used to commuting occasionally to rural towns to visit markets, governmental offices, and health practitioners. Nevertheless, mobility before access to mobile media was of a much more limited nature than after the appropriation of mobile phones. Women, for instance, were often not able to obtain the news of a serious illness or even the death of a

close natal relative in time to view the body before the cremation and to participate in the death rituals. When mobile phones first became available, women often mentioned their new ability to participate in the death rituals of their natal relatives as the phones' most significant benefit.

As Horst and Taylor (2014) pointed out, the mobile phone is just one among many recent tools that humans have adopted to overcome the restrictions of space and time. In Janta, mobile phones followed and strengthened the use of motor vehicles as objects of mobility. The first group of mobile phone buyers were car and tractor drivers, as well as small-scale entrepreneurs, who used phones for staying in touch with customers and calling for help if they experienced problems on the road.⁴ However, when the phone density⁵ was low, mobile phones were largely used as house phones, and phone use impacted mobility mainly in the sense that they reduced the need to travel. As the informants related, a short phone call could save time and money, that is, eliminating the need to travel by bus to deliver important news. Nevertheless, as the phone density rose, mobile phone use became more portable, enabling physical movement. People often could be seen talking on their phones while walking around the neighborhood, working in the fields, bathing by the river, and tending their vegetable gardens. Women could carry out chores, such as cooking and sweeping the floor, holding their phones in anticipation of calls from family members who lived elsewhere. Young men were using their phones to find work opportunities outside the village—and for facilitating a move out of the village.

ANALYZING MOBILE PHONE USE AND POWER RELATIONSHIPS

In the analysis of my ethnographic data below, I start by describing how mobile phone use influenced political practices. I illustrate that the development of new political practices enabled by mobile phones had unintended consequences for women's political roles. I then describe how the emerging mobile political practices eroded women's political participation while simultaneously creating other new possibilities for agency within the family and kin. So my ethnographic analysis is presented within three subsections, each addressing a separate context of the appropriation of mobile phones: village politics, women's participation in village politics, and women's agency. The interconnection among these three focuses helps demonstrate how mobile phone use relates to gendered power relationships in rural West Bengal in India.

Transformation of the Village Political Sphere

Political activists emerged as the heaviest mobile phone users in Janta, and I describe here how their mobile phone use helped change political practices. I carried out my fieldwork on political activists' phone use before smartphones became common. Consequently, my focus is on the phones' calling and texting functions, which differ from the affordances of Internet-based communication: Whereas calling and texting are based on prior relationships of the parties who communicate, Internet usage enables anonymity. Udupa (2017) demonstrated how online anonymity deepens the conditions of ambiguity necessary for online abuse and insult exchange among the middle class in urban India. Political groups in India, and especially the right-wing party BJP (the Hindu Nationalist Party⁶) that came to power in the national elections in 2014 and renewed its electoral victory in 2019, utilize the social media in multiple ways, including trolling, as discussed by Udupa (2017).

The top regional politicians in West Bengal have long used Facebook pages. Some of my Facebook friends from West Bengal have showed their support for the current ruling party, the All India Trinamool Congress party (a breakaway party from the Indian National Congress), by liking the posts and pages of the top politicians in the region, but so far I have not been able to detect Facebook posts criticizing the ruling party still holding power in West Bengal. Miller et al. (2016, p. 146) found in both South India and Brazil a genuine fear of direct negative consequences for oneself and one's family should members of rival parties feel antagonized. One of the crucial political affordances of the mobiles' calling function was that people in West Bengal could discreetly contact the opposition leaders, whereas Facebook could be experienced as too public for expressing rebellious views, especially in times of conflict.

India recently has experienced a proliferation of smartphones and Internet use, from 100 million Internet users in 2010 to 462 million in 2017, primarily due to the growing competition between the service providers (Agrawal, 2018). However, even after the onset of smartphones, only a minority of villagers used them to browse the Internet. The pre-paid system that has made the mobile telephony and its calling functions affordable for low-income people has not encouraged continual Internet connectivity in the Global South. As Donner (2015, p. 124–125) pointed out, when every click on the Internet costs money, users are likely to conserve airtime and assess their data bundles' balance carefully. Instead of surfing and browsing the Internet, the hundreds of millions of new Internet users are, in Donner's words, likely to dip and sip the Internet. Rangaswamy and Arora (2016) provided an example of such mobile Internet use in the Hyderabad and Chennai slum communities, where it required enormous dexterity from young users to build Facebook identities when every minute of access cost money. Additionally, in rural West Bengal, low levels of literacy prevented people from using the Internet, which is largely based on textual information. Consequently, the smartphones' calling and texting functions became important for most of the villagers, although by 2012–2013 most families in the village possessed inexpensive smartphones. At this point, they used the Internet but indirectly. They bought music, videos, and pictures, but these were downloaded onto their phone's memory chip in shops. When I carried out fieldwork among the low-income people in rural and urban West Bengal (in the South 24 Parganas district and Kolkata) in 2018, I witnessed that most of users still did not avail Internet access directly with their smartphones. As reported by the International Telecommunication Union (2018), prices remain a barrier to ICT adoption in the Global South.⁷

Even if the direct Internet access afforded by smartphones has not played a major role in rural West Bengal politics, mobile telephony and the phones' calling functions did contribute significantly to the rise of the opposition in West Bengal,⁸ where the Communist Party of India (Marxist), known as CPI(M), had been in power from 1977 until 2011—when the Trinamool party gained power. West Bengal is the only state in India where the CPI(M) was in power continuously between 1977–2011. The state government boosted the development of new industries by creating special economic zones for which it acquired land through the Land Acquisition Act. In 2007, West Bengal was forced to reverse its plans to set up a chemical hub in Nandigram (located about 150 kilometers from Janta) due to local farmers' resistance and ensuing violence (Chakraborti, 2007; "Red-hand Buddha," 2007). Rural people's resistance to government initiatives is by no means unusual in India or West Bengal. Since India's independence, *gheraos* (encirclements)—the surrounding of politicians or buildings until the protestors' demands are met—and strikes have been common choice for protest, especially in West Bengal. Moreover, this 2007 event was not the first violent conflict between the police and the rural people in West Bengal. The conflict in

Nandigram differed from earlier ones, however, and not only because forcing people to give up their land was considered more unjust than many prior police atrocities. First, the villagers could effectively remain informed of the police contingent's movements with the help of mobile phones. And secondly, 24-hour news stations broadcasted vivid reports of the conflict, whereas such events would only have merited a brief newspaper report before the liberation of television broadcasting. Following the violent conflict between police and farmers unwilling to give up their land, the ruling CPI(M) suffered its greatest electoral defeat in decades. A sizeable number of citizens voted silently against the Communist Party in the *panchayat* (local governing body) elections in 2008, even though communist party cadres used intimidation to prevent them from doing so in many regions. Mamata Banerjee's (party leader and the current chief minister of West Bengal) Trinamool Congress won the state elections in the spring of 2011 and renewed its electoral victory in 2016.

I found the villagers of rural Bankura (located about 150 kilometers from Nandigram) much less vocal about politics when I visited them after Nandigram events than before—the party cadres' violence against the opposition in Nandigram had made people cautious (Tenhunen, 2018). Whereas the villagers previously could criticize openly the ruling party, the CPI(M), I was advised to stop asking direct questions about the violence in Nandigram. I was told that fear had caused people to fall silent. The apparent silencing of the opposition (i.e., Trinamool) did not, however, stop its growth. An opposition supporter I met in Janta reflected the silent growth of the opposition. He carefully avoided commenting on politics during our discussion but mentioned that he carries the local opposition leaders' numbers in his phone. Other opposition activists explicitly stated that mobile phones helped them secretly mobilize against the ruling party. Before the state elections in 2011, the regional Trinamool office in the nearby town of Vishnupur buzzed with excitement—and phone calls.

In order to demonstrate the changes in political practices, I first briefly describe here the nature of village politics before mobile telephony. My understanding of politics resembles studies that have addressed political practices in their cultural form, such as Davis' (1983) and Hansen's (1999) studies, but differs from these in that I do not proceed from a general definition of politics. Instead, I analyze the local meanings of politics while also taking into account how local meanings are influenced by translocal⁹ relationships and political organization.

In 1999, villagers maintained that it was impossible to live in their community without the protection of one of the two main parties—the CPI(M) and BJP. The parties' power was largely derived from their role as arbitrators of disputes: Any person who felt that he or she has suffered an injustice could call a village meeting, led by village leaders, during which a solution would be negotiated between the disputing persons (Tenhunen, 2003, 2009). The discussions in the meeting aimed at finding a consensus thereby lessening the possibility of resistance against the solution. The CPI(M) party's power also was based on their elected representatives who served in the local decision-making bodies—*panchayats*—which authorize the distribution of local public finances. However, the villagers did not so much judge the parties by their ideological programs as by their morals. The understanding of politics as morality was in line with the literal meaning of the Bengali term *rajniti* (politics), which is a compound word consisting of the words *raj* (king, ruler, state, or government) and *niti* (morality, principle). Voters gave the party their support and, in return, expected assistance when they face hardships. The CPI(M), for instance, assisted small-scale farmers by distributing crop seeds. Party leaders acted as conciliators in family conflicts, tried to help gamblers and alcoholics overcome their addictions, mediated in divorce proceedings and concomitant property disputes, and helped with the registration of property. Because the local

public health centers did not have sufficient resources to treat patients with serious illnesses and the poor cannot afford private doctors, indigent villagers' only hope was that their party would arrange the required treatment for such patients. Party members formed a kind of kinship community, calling one another by kinship terms such as sister, brother, aunt or uncle. Kinship provided the metaphor for political parties and their activities so that kinship-based party membership was differentiated from other types of relatives, who were defined on the basis of indigenous ideas of blood relations, code of conduct, sentiment, and spatial aspects. Kinship ties meant having certain expectations of solidarity. Serious disagreements about these solidarities could lead to the splitting of the joint family or the termination of certain interactions among kin.

The ruling party's approval was frequently needed in various spheres of life: One had to turn to the CPI(M) in rural Bankura if one needed help to report a case to the police or to obtain a job in the government or the new industries (Tenhunen, 2003, 2009). The local leaders of the West Bengal CPI(M) belonged to the upper classes of the region, thus political work resembled the patron–client relationships that prevailed before the land reforms, when the landless had to turn to the big landlords for work and protection (Ruud, 2003; Tenhunen, 2003, 2009). Several studies have made similar observations regarding how the CPI(M) party mediated all spheres of activity in various regions of rural West Bengal (Majumdar, 2009; Roy, 2007, 2008, 2013; Ruud, 2003). These political practices had the backing of the ruling party, which had built its support through such patronage. Clearly, these practices cannot be characterized as informal and distinct from formal politics.

The following comment¹⁰ by one of the top leaders of the former opposition party, Trinamool, to my question illustrates how mobile phones contributed to new political practices that were characterized by increased mobility.

R: How do you benefit from your phone for your political work?

Before the mobile telephony, political leaders like me had to sit at home and receive visitors. Sometimes people from faraway places would come to meet me when I was not at home. Now I can travel and set up meetings with supporters. I can call the nearest political worker and communicate to all necessary places at once if there is an incident. This is the reason why every party activist needs a phone. Information about any type of action can be delivered in a fraction of a second. (A male Trinamool party leader)

Mobile phones have freed leaders to visit their constituency without having to neglect their other duties, which contributes to an increase in translocal political contacts. Whereas political disputes used to be settled in local village meetings, by 2010 even an informal meeting could be translocal. For instance, a young Bagdi man from Janta made phone calls to CPI(M) leaders after someone had stolen paddy from his field. To address the complaint, the CPI(M) leaders from Janta, along with leaders from adjacent villages, held several meetings arranged at a bus stand near the junction of the two major roads connecting the adjacent villages.

As the above examples illustrate, CPI(M) rule has not been based solely on violence, but coercive means repeatedly have been crucial for its electoral success (Gupta, 2010). Since overt support for the opposition ran the risk of provoking CPI(M) intimidation, phones offered the opposition a covert way of communication. As the CPI(M) sought to overpower the opposition through violent means, Trinamool organized protection through phones, sending party activists to protect its supporters even if an attack was merely anticipated. Workers of the Trinamool party office in Vishnupur frequently made calls to express support for their party members. A

Vishnupur Trinamool leader emphasized that, without the protection offered through phones, they would not have been able to increase their constituency:

R: How do you benefit from your phone for your political work?

Thanks to the phone, the work that used to take 24 hours takes only 20 minutes. I can access a larger area and more people than before. If I did not have the phone, I could not communicate with so many people. Today, rural people understand that the CPI(M) is destroying their opportunities. That is why we need development, to make progress. People have come forward, protested, and started a movement. When the CPI(M) has seen this movement, they have started a wave of terror. If some person gets in touch with a Trinamool leader, the CPI(M) becomes violent towards that person. They burn houses and poison ponds. They cut paddy from the field. Whenever people hear them plan this, they call us over mobile phones. They call us immediately if they get to hear about an attack. We can send our cadres; we go by ourselves or call the police. We inform the administration and immediately reach the place. So, they are not able to torture people. If we did not have phones, it would be very difficult. We now have the courage to support people. We could not have progressed this much without phones. (A male Trinamool party leader from Vishnupur)

Mobile phones provided the opposition with new means to defend their supporters from the intimidation of the ruling party. Opposition activists also used phones for spontaneous activities, such as organizing wildcat strikes and reporting the ruling party's misdeeds. Indeed the opposition used the mobile phone capabilities more often than the ruling party, whereas the CPI(M) continued to send information through letters. In contrast to the hierarchical flows of information and decision making of the CPI(M) party, the Trinamool Congress party used phones to construct new political contexts thereby introducing changes in how political hierarchies are imagined and practiced. After the Trinamool party gained power in West Bengal, general village meetings lost their power; since 2011, they were no longer arranged.

While the CPI(M) was a predominantly hierarchical structure with higher units encompassing lower ones and with information and decision-making flowing mainly from the top (Gupta, 2010, p. 26), the Trinamool party used phones to connect top leaders with grassroots activities and across regional units. For instance, Mamata Banerjee, the former opposition leader and current chief minister of West Bengal, maximized her reachability by having several assistants making and receiving calls for her on several phones registered in her name. She frequently connected with individuals at the various party levels and made unexpected appearances at crisis scenes (Roy, personal communication, May 2010). Banerjee's campaigning exemplified a new manner of leadership that Nielsen (2018) labeled the "activist style," which is characterized by public spectacles and maximizing publicity.

Mobile phones made it possible for the opposition activists to react to conflicts and arrange protection, while 24-hour news stations broadcasted vivid reports of any major conflicts (Tenhunen, 2018). As Lahiri (2014) pointed out, the critical views of the Left Front government (an alliance of left-wing political parties in West Bengal which held power in West Bengal during 1977–2011) that the newspapers in West Bengal regularly expressed did not have significant repercussions because most people did not read them due to their low levels of education and literacy, as well as their poverty. However, since 2000, broadcast news media have crucially expanded their scope in West Bengal thanks to the influx of private television networks with 24-hour news channels. Mobile technology fed the direct newscasts because reporters at the conflict scenes could transmit news, photos, and film to the television stations and newspapers by means

of mobile phones, although political parties have tried to restrict over-the-phone reporting in the troubled regions that is critical of their views.

The activist style of leadership contributed and strengthened the public sphere at the expense of village politics. The local political sphere merged increasingly into translocal politics and the public sphere at the expense of local political hierarchies, which had been co-constructed by the CPI(M) party and through village social relationships. Local people gained in that they no longer had to predominantly rely on local leaders and because phones offered an additional medium for the articulation of critical and alternative discourses. At the same time, the increase in the mobility of political activities decreased the influence and power of village-level leadership and especially the locally constructed political sphere that had helped create a legitimate political sphere of action for women.

In the next subsection, I illustrate how women's political participation was influenced by the above discussed changes in political practices. I start by briefly describing women's political participation before the phones.

Women's Political Participation

Village women were selected as *panchayat* representatives for the first time following the national women's quotas in the 1990s. During the same period, women of all castes started regularly attending the women's committee meetings organized under the auspices of the CPI(M). Nevertheless, women were still excluded from the general village meetings where men discussed village disputes. Family disputes, along with women's demands, however, were readily understood as political because politics was not perceived in opposition to the women's domain of household and kinship, as has often been the case in societies where Western ideas of politics have evolved. My experiences are in line with the anthropological stream of the past few decades (e.g., Collier & Yanagisako, 1987; Rogers, 1975; Rosaldo & Lamphere, 1974; Strathern, 1988; Yanagisako, 1979) that has illustrated the need to question the preconceived notions of power and politics as public phenomena. Evans-Pritchard (1940) and Fortes (1945), pioneers in political anthropology, explicitly dichotomized the domestic domain in contrast with the politico-juridical domain. The same dichotomy is implicit in a later definition of politics as public, goal-oriented activity (Swartz, 1969, p. 1; Swartz, Turner, & Tuden, 1966, p. 7). Contemporary anthropological studies of democracy have largely moved beyond the juxtaposition of politics with such domains as kinship (e.g., Michelutti, 2008).

In Janta, women's committees defended women in family conflicts and fostered awareness among women regarding women's rights and work, which they called *jagaron* (awakening; Tenhunen, 2009). They also ran a microcredit program based on women's self-help groups, in which women, in addition to saving money, advised and helped each other in solving the problems of daily life, such as family conflicts or health concerns. The savings were lent in turns to members for undertaking productive activities such as buying cattle. Similar to the general village meetings, the women's committee meetings could solve disputes by fining a guilty party. If a woman had been mistreated by her family, the committee representatives could discuss the situation with the family in order to help the woman. The mere threat of the committee's involvement could motivate family members to refrain from mistreating a woman. As it was the village *panchayat* representative who had founded the women's committee in Janta, the *panchayat* programs for women had been closely associated with the women's committee. The

women's committee focused on raising women's consciousness about their rights; it also motivated women to participate in programs and influenced the *panchayat* to pay attention to women's concerns. Tapati Kundu, the first female *panchayat* representative from Janta, arranged income-earning opportunities, a female literacy program, and a nursery school in Janta. Women in need of assistance found it easier to approach the female representatives.

The idea of women's protest and self-expression fit the local political realm, which entailed a moral discourse on a ruler's morality to a certain extent (Tenhunen, 2009). Similar to Janta's party politics, Kundu's politics entailed helping poor people and settling disputes. She demanded help from the Block Development Office (a rural area administratively earmarked for development) for people in need: clothes, wheat, paddy, and monetary assistance. She settled disputes by punishing the guilty party with a fine, just as informal village meetings did. She says she always thought about women and discussed things separately from men with other women *panchayat* representatives, perceiving women's political action and interests as separate from men's. Her political action and thinking followed the local understanding of politics as the realm of kinship-related morality and patron–client relationships where women act separately from men. Some of Kundu's aims were truly radical and difficult to pursue in the village. Although she said she advocated women's right to divorce and the eradication of the dowry system, she never worked for these aims in Janta. She acknowledged the difficulty of putting any radical ideas into practice in the village and recommended that, in practice, women should try to behave properly as far as they can and persuade their husbands to behave well.

The women's awakening propagated by women's organizations had reached village women who described the desired course of development for women as the freedom and right to study, take salaried jobs, move about freely, and participate in politics. The following comments from several young (aged 25–35 years) housewives from small landowning households in Janta, whom I interviewed in their homes in 1999, illustrate well the emerging awareness among women:

R. What kind of change is necessary for women according to you?

Women should grow up studying; they should participate in politics. Women should participate in politics just like men do. That is what I want. Men and women are the same.

R. What kind of change have you seen in women's lives?

I want my daughter to study before getting married.

R. What other changes have you seen?

Much has changed. Before women could not go out; they could not study. It would be regarded as dishonorable, but now women and men have the same rights. Previously wives could not move outside the house. Now if I tell my husband that I want to attend the women's committee and talk with a group of women and that we want to work together, he will say that I may go. But it was not like this before.

[And from another respondent] *It is, of course, different these days. Women are not scared. Previously women were afraid of their mothers-in-law and their husbands. Nowadays, women are not afraid of anyone. Everything happens as they want it to. Whatever they say happens.*

R. What kinds of freedom do women have these days?

Women can arrange things as they want them. Previously they did not study much. Now they study and see the world outside and learn to understand what to do. These days,

women have many fascinations: dress, education. Women have attained a new level in every respect. This is what we call modern. It was not like this earlier.

Women's involvement in politics under the CPI(M) rule also prepared the ground for Mamata Banerjee, the Trinamool party leader and the first female chief minister of the state, by helping to create an active female electorate motivated to give their votes to a woman candidate.

It was under the leadership of Banerjee that the CPI(M) was ousted from power in 2011. Mobile telephony, together with the private television news channels, helped create new political practices and leadership styles that were characterized by mobility. Villagers no longer relied on village political leaders because they were able to have constant contact with regional leaders who also were then able to travel and be reachable by their constituency. These mobile practices, in turn, served to erode the sphere of village politics, including women's political activities.

During the CPI(M) rule, women could organize politically within the village neighborhoods, that is, the locations associated with the female sphere and space. When political organization became more flexible, faster, and translocal, women's role in politics was reduced. A meeting with few women from a rural town of Vishnupur who were campaigning for the Trinamool party in various urban neighborhoods before the state election in 2011 exemplifies women's difficulties in adjusting to increasingly mobile political practices. The women political activists I observed were not moving in their comfort zone and had to deal with harassment even at their own party office. The public political sphere in India emerged as predominantly male during the colonial era (Chatterjee, 1993) and this gendered meaning of spheres has prevailed in new contexts. Women have been more successful in carving a political space in the village than as part of the general public and especially the digital sphere in India. As Udupa (2017) demonstrated, social media discussions in urban India often draw from the masculinist logic of shame.

Since the Trinamool party came into power in 2011, I no longer could witness women participating in politics in Janta. Despite the Trinamool party's initial plans to set up women's groups, women ceased to have political meetings in the village under the Trinamool rule, in line with the end of even general village meetings. While mobile telephony enabled and strengthened translocal political practices, it also decreased the village-based political practices, including women's political activities. My findings are similar to Wagner and Fernández-Ardèvol (2019), who found the choice of communication medium to be a political issue among a Guaraní community in Greater Buenos Aires. In this community, the upsurge in mobile-mediated communication contributed to the decline of face-to-face deliberations that had earlier been the mainstay of communal sharing arrangements and held a central position in the understandings of Guaraní culture.

Women's Agency as Mobile Phone Users

I now turn to describe how women availed the mobility offered by mobile phones in their daily lives. When I first moved in with a family in the Janta village in 1999, the situation of the young wife in this family puzzled me (Tenhunen, 2018). Like most married women in the region, she had moved from her natal village to live with her in-laws in Janta after her marriage. She had not visited her parents since her marriage about a year before. The villagers explained that young wives are not supposed to visit their natal families for a year after their marriage. No one supported my interpretation of her treatment as unnecessarily strict, and I never heard her demand

to be allowed to visit her natal home. But I could see that she missed her parents and was overwhelmed with happiness when her father visited her a few times during the year.

It used to be a well-accepted fact of village life that young wives do not visit and hardly communicate with their parents during their first year of marriage, and even the young wives seemed to approve of this custom. Fast-forward 13 years and I again witnessed a newlywed wife in the village. She had just arrived to live with her husband's family in Janta and was now completely preoccupied with her personal mobile phone with which she communicated daily with her parents. I was told that it is natural for young girls to want to stay in touch with their natal families. When I mentioned that things had changed, the older women—who had not been allowed to stay in touch with their natal families early in their marriages—looked surprised, as if they had not noticed the change.

The digital sphere constructed with the help of mobile telephony proved malleable—an environment that was initially considered as male-dominated in the sense that first phone owners were mainly young men has opened up for women. However, women's calling patterns emerged as distinct from men's (Tenhunen, 2018). Based on the phone diaries, 40% of the calls by men were to their friends, whereas only 1% of the women's calls entailed calling their female friends. Men's calls were more often about work or travel; women's calls mainly involved discussion of the general news or calling for no particular purpose other than to inquire how the other party is. Although these calls served no specific instrumental purpose, they deepened and strengthened relationships, which could help obtain both emotional and economic support when this is needed. Since women's calls were more limited to their close kin than men's calls, women were construed as more homebound than men even in digitally constructed spaces.

The few village women who attended college or had a service job outside the village always carried their personal phones (Tenhunen, 2018). They found that the ability to inform their family members at home about schedules and possible delays in commuting and to monitor the status of things at home helped them to move outside the home and into spheres not considered the ideal places for women. I did not hear women express that they felt calls from home as unwanted surveillance. Women value the possibility to call for help if they face problems, such as missing buses, accidents, break-downs of vehicles, traffic jams, and demonstrations on the roadway. A female college student who I interviewed in Janta in 2012 explained,

R.: How do you benefit from your mobile phone?

I travel to college by bus, so people can call me to tell me if the bus is not going to come. And if the last bus does not come, I can call home. The ability to call gives me mental courage. If I face any inconvenience outside the home, they [the family] will come and get me.

Women's sphere is associated with the home and the village, so women often use mobile phones to let them do the work of moving, that is staying in touch without leaving the home sphere. Mobile media support women staying in touch with their natal families even when they are quite distant. While kinship relationships have encouraged and motivated women's mobile phone use, phone use has, in turn, transformed relationships by helping to create new contexts for speech and action. Young women, for instance, can seek help from their parents, and mothers can advise their daughters over the phone even against the will of in-laws.

Similarly to television, translocal communication with the help of mobile phones has helped bring the outer world into the women's sphere. Because of access to mobile phones, women were better connected with their natal families, which, for most women, is a major source of support.

Just a decade ago, women could be facing food scarcity or were mistreated in their husband's house for years before the news reached their parents. The exchange of news over the phone by calling has become so intense that, for instance, news of loss to farming caused by a hailstorm reached a woman's parents within a few days, although she herself did not call her parents. The importance attached to relationships with in-laws has helped women gain access to phones. By calling their parents frequently, women have not adopted a completely new practice but have instead strengthened the relationships between kin groups, which were already valued as important. However, what is new is the greater communication density that phones enable, as well as the fact that women themselves could now initiate the contacts instead of their brothers and husbands.

Moreover, daughters-in-law often chose to call when their in-laws were not present, which signified that their calling was experienced as subversive (Tenhunen, 2018). Previously, opportunities for private conversations in the village were limited, but people did try to maneuver to avoid sharing all their discussions with the neighbors and the extended family. Mobile phones, however, offered the possibility to physically move away so that fewer people were within hearing distance, and phones were a novelty in rural West Bengal in the sense that the people could choose and reconstruct the context of their talk. Tacchi et al. (2012) similarly observed that women in rural Andhra Pradesh in Southern India valued their newly found ability to talk by phone without everyone in the household or vicinity hearing their conversations. A Janta woman who, over the phone, advised her daughter to disobey her mother-in-law is an example of how communication with natal relatives could include subversive elements. The daughter of the woman who gave the advice had married into a well-to-do household where the daughter was responsible for all the housework. The daughter was happily married in that she was well off, but her workload exhausted her. Usually, women shared tasks more equally than in this household, even though mothers-in-law tend to be in positions of power. The mother, over the phone, advised her daughter to simply refuse to do the excess work in her in-laws' house. She feared that if the daughter kept obeying, her workload would grow unbearable. Following her mother's advice, the daughter successfully refused extra chores.

Without a phone, the chances for this mother–daughter conversation would have been limited because the mother usually would have met her daughter only when surrounded by her in-laws. Therefore, mobile phones offered women a channel to express unconventional ideas and exert their will through networking by offering them a chance to speak to only one listener at a time if they so chose. Women had agency as phone users in that they were able to shape communicative contexts and pursue their goals of reforming the kinship-based code of conduct for women. Motivated by women's rights discourses and political activism, women used phones to realize their goals of widening the domestic sphere. At the same time, phones have helped introduce changes in women's relationships with each other: Phones facilitate young wives to challenge their mothers-in-law's authority and build closer relationships with their own mothers after marriage.

CONCLUSIONS

Mobile media represent objects of mobility: They have improved the possibility for people to travel while also providing the experience of mobility in lieu of physical movement. I have explored how mobile phone use has contributed to new political practices characterized by mobility and how the new practices influenced gendered power relationships and women's

agency. Mobile phones enabled new types of political practices that, in turn, influenced village social relations, including gender relations. At the same time, mobile phone use contributed to changes in gender and kinship relationships.

My study concurs with the scholarship that has pinpointed that mobility is not self-evidently positive (Alvarez, 1995; Cresswell, 2014; Tsing, 2005) and that the meaning of mobility depends on the contexts of mobility and communication (Tacchi et al., 2012). I have demonstrated that understanding the role of mobility for power relationships requires attention to the interconnected fields of power as contexts of mobility. Mobilities emerge within different fields of power that enable diverse forms of agency.

My analyses of mobile phone-based mobilities revealed two fields of power and agency: one that was based more on local social ties and the other on translocal ties. The village-based political order drew from the local symbolic domains the meanings of which women were able to negotiate in their everyday lives. Before the onset of mobile telephony, women's political activities took place as part of the culturally constructed women's sphere in the village. The strengthening of the translocal political sphere, however, decreased the importance of the village-based political sphere to which women had gained access. At the same time, mobile telephony contributed to the creation of translocal publics that emerged as an assemblage of a variety of factors including the mass media and translocal political organizations. It highlights the gendered difference in meaning between these two fields of power, in how women's participation in village meetings was not questioned, whereas their participation in political activities outside the village appeared risky and difficult. Although face-to-face interaction as part of the village sociality had supported women's political discourse, the translocal public sphere did not offer a safe space for rural women activists' discourses.

Replacing the political sphere that was earlier perceived as predominantly local by translocal political activities reduced the village women's role in politics. However, mobile phone use also made possible a great variety of forms of mobility and agency for women that gained importance at the expense of their participation in politics. Women found it easier to travel outside the home when they carried mobile phones. Mobile phones made it possible to extend the idea of safety associated with the home to movement in the outside world. Mobile phones also gave callers new possibilities to choose the context for their speech and to engage in critical and unconventional discourses, which could help women make concrete changes in their everyday lives. New forms of social interaction enabled by mobile phones challenge gendered power relationships in subtle ways; nevertheless, these small changes could be paving a way for epochal changes that, in turn, could have political repercussions.

While this article has focused on a specific context—the use of mobile phones in rural India during 2003–2013, its theoretical framework can help understand how other forms of new media in other locations contribute to power and politics in unanticipated ways. To summarize, I argue that exploring mobility and power relationships reveals changing fields of power. Analyzing their interconnections and the way they are symbolically and socially assembled helps researchers understand the unexpected ways mobility and rapidly evolving new forms of media contribute to power and politics. Despite the many affordances mobile telephony offers for political activism, mobile phone use for political purposes is embedded in local contexts in ways that elude generalizations about mobile phones simply as tools for democratization and empowerment.

IMPLICATIONS FOR THEORY AND POLICY

Through my research, I have sought to understand how mobile phone use helps create new mobilities that relate to power in diffuse ways. By studying the appropriation of mobile phones within different fields of power and as enabling different forms of agency, the article builds a research approach that can be applied to studying how other forms of new media in other locations contribute to power and politics in unanticipated ways. In terms of policy issues, the article demonstrates that the choice of communication medium can be a political issue; consequently, one cannot rely on new media like mobile phones to self-evidently empower people without encouraging and supporting local face-to-face interaction.

ENDNOTES

1. Although this article avails the same ethnographic data I have used for some of my earlier publications (Tenhunen, 2008, 2011 & 2018), the focus on mobility and power is new.
2. The dominant caste, both numerically and in terms of land ownership in Janta, is the Tilis (50%). Other major caste groups are the Bagdis (15%) and Casas (16%). Caste and class have, to a large degree, overlapped in Janta: Most Tilis and Casas own land, while most Bagdis, who are classified as a Scheduled Caste, earn their livelihood by means of daily labor, mainly agricultural work or work in the brick factories. About 10 other small caste groups, each which forms 1–2 % of the population, also reside in Janta. The most significant of these are the Brahmins, who own land, hold office jobs, and do not participate in farm work like other landowning villagers do. Some castes continue their hereditary occupations (Tatis weaving, Kumars pottery, Napits barbering, and Cutas carpentry) but, with the exception of the carpenter caste, their hereditary occupations only supplement their income from farming.
3. The *Scheduled Castes* refer to people at the bottom of caste hierarchy who are officially designated as disadvantaged people in India and for whom the Constitution lays down the general principles of positive discrimination. The government has allocated quotas in government jobs and educational institutions for Scheduled Castes and Tribes,
4. Initially, villagers purchased mobile phones from a nearby town. By 2012, a mobile phone repair shop opened in the village and the owner also sold mobile phones and their equipment. He did not keep a stock of phones but acquired them according to clients' orders.
5. In the fall of 2003, there were four privately owned mobile phones in Janta, and when I returned to the village in 2005, there were 10 phones in Janta and its two small adjacent villages. By 2007, the number of phones had risen to 100 and the phone density rose to four phones per 100 persons. By the spring of 2010, only four households of the 158 households surveyed in Janta did not have a phone. In India, tele-density increased from less than one per 100 persons to 82 from 1991–2015 (Telecom Regulatory Authority of India, 2012; Telecom Regulatory Authority of India, 2016).
6. The Bharatiya Janata Party is one of the two major political parties in India. It is the largest political party of India in terms of representation in the national parliament. Ideologically, it is a right-wing party that represents Hindu nationalist positions. BJP had not been able to become a major party in West Bengal until recently. It is now the largest opposition party in West Bengal, which is still one of the few states in India not ruled by the BJP. The All India Trinamool Congress party has held the majority in the State Legislative Assembly since 2011 when it ended the long Communist party rule in the state.
7. In developed countries, four of five people were online at the end of 2018. In developing countries, however, 45% of the population were using the Internet. At that time in the world's 47 least-developed countries, four of five individuals (80%) did not yet have Internet access (International Telecommunication Union, 2018).

8. In India, legislative, administrative, and executive powers are divided between the central government and the states. West Bengal is one of the 29 states of India.
9. *Translocal* refers to the interconnectedness between the local and the global.
10. I conducted all of the research in the Bengali language and I have translated the data quotations into English for this research report.

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PHOTO USE WHILE DATING: FROM FORECASTED PHOTOS IN TINDER TO CREATING COPRESENCE USING OTHER MEDIA

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Abstract: While studying Finnish users of the online dating app Tinder searching for long-term partnerships, we paid attention to the importance of photos in their social interactions. Based on our study, we argue that photos play an important role in online dating. Initially, photos are chosen and uploaded to influence future interactions, particularly regarding who will contact them via their profile. We term this particular future tense of photography forecasted photos. Second, photos enabled the creation of copresence between dates, especially via instant messaging services instantly after capture. Third, the classic notions of photos depicting the past became important when wanting to be reminded of previous meetings. Taken together, we argue that photos enhance intimacy building while dating on social media. This role should be accounted for by paying attention not only to photography's relation to the past or the present, but also to a future tense of photography.

Keywords: phatic communication, future tense photography, online dating, visual studies.

INTRODUCTION

During our research of individuals using social dating sites to find long-term partners in Finland, we noticed the importance of photos for triggering future connections. Our interest was sparked by hearing conversations of teenagers on a bus ride, focused on giving each other advice of how to choose photos on one's profile for getting "matches," signs of interest on Tinder, a widely used social dating site. These matches provided the teenagers, as well as others using the service, an opportunity to meet hitherto strangers in the future, strangers who possibly might become one of the closest persons that one has. These observations led to our interest in the role of photos in building intimate social relationships, with particular attention on how they are used in concurrent social media. It soon became apparent that the search for long-term partners, which may have started on Tinder, quickly moved to other communicational media, such as WhatsApp or Skype, or to a table at a café. This temporality in dating—from searching for matches to starting first conversations, and then possibly meeting someone face-to-face—is a good example of what we call the *flows of social interactions*, that is, the sequences of interaction that have particular rhythms, temporalities, places, and people involved. Importantly, flows of social interaction do not always stay the same but change depending on the social relations among those involved and the purposes of communication.

While dating using social media technologies might seem superficial because of the initial lack of face-to-face interaction, dating sites and applications have become major players in bringing people together. Sites today range from special dating sites for Muslims, Jews, and Christians to dating sites for people of specific or all sexual orientations. Finkel, Eastwick, Karney, Reis, and Sprecher (2012) identified 14 distinct categories of online dating sites, including general (e.g., Match, PlentyOfFish, OkCupid) and specialist sites (e.g., JDate, Grindr), matching sites that use self-reports (e.g., eHarmony, PerfectMatch) or don't use them (e.g., GenePartner, ScientificMatch), and "hookup" and adultery sites (e.g., GetItOn, AshleyMadison).

Whereas newspapers, magazines, and bulletin boards have been used for decades for mediated dating, arguably the facility of using digital devices has an impact on the popularity of today's dating technologies. Furthermore, the development of graphical user interfaces has allowed for a broader spectrum of representations on dating sites than earlier (MacLeod & McArthur, 2018). Early text-based announcements are nowadays amended with photos, and in many cases, it is the image that has taken upper hand in presentations of one's online self (Senft & Baym, 2015).

This photo-driven self-presentation reflects especially the case of Tinder, a service launched in 2012 for users to find potential partners by deciding, based on a profile photo, if they think that they would like the person depicted. If both parties "like" each other, that is, swipe each other's profile photo to the right on their mobile device screens, they can start to communicate with each other. The swipe determines future interactions in a binary manner and thus is decisive for using the platform (David & Cambre, 2016). Swiping profile photos continues to be a main feature of Tinder, and in 2018, the company claimed to have 1.6 billion swipes a day.

We decided to interview and observe users of the online dating app Tinder who were searching for long-term partnerships, paying specific attention to the importance of photos in their social interactions while dating. In following a practice turn in visual studies (Lehmuskallio & Gómez Cruz, 2016), we paid specific attention to the practices in which photo use is embedded, in this case, within the practices related to finding a long-term partner. One question specifically guided our research: How are photos used during the process of searching for long-term partners?

We narrowed the research question by focusing on users from the capital region of Finland who use, or have used, Tinder for searching for long-term partners.

Mobile photography is particularly important for capturing, sharing, and displaying photos when using dating apps for finding a future partner. Earlier studies of mobile photo use have shown that mobile photo communication tends to emphasize “real-timeness” and an ephemerality of images, which is in stark contrast to past uses of snapshot photography, which were often taken in the moment in order to remember the past (e.g., Gye, 2007; Van House, 2011; Villi, 2016). In contrast to this related work, our findings, presented later, show that photos, once uploaded to a dating service such as Tinder, are used initially to influence the future. The work of selecting proper visual representations of oneself and one’s surrounding is undertaken in order to frame future interactions in particular ways. We call these images *forecasted photos* because they are photos uploaded specifically to influence one’s future. This photo work adds a future tense to related work on snapshot photography, which has tended to focus either on that what has been, or in the present tense, on that what is (see, e.g., Rose, 2010; and contributions in Larsen & Sandbye, 2013, and Gómez Cruz & Lehmuskallio, 2016). The importance of using cameras or photos to evoke *desired futures* is apparent in other cultural fields as well, as we will discuss at the end of the paper.

Taking a perspective on the temporal unfolding of dating practices also allows us to underscore the role of *flows of social interaction* in using communication technologies: Specific communication technologies seldom are used alone but rather as part of a broader ecology of communicative interactions. This finding is at odds with the vast amount of related research focusing mainly on a single platform or service, pointing to the importance that methodological choices have for analytical conceptualizations.

RELATED LITERATURE

Snapshot Photography

In the following, we present related work on nonprofessional photo use, focusing on the practices within which image use is embedded. Early studies on snapshot photography are among the first to explore how images are actually used, thus providing an important backdrop for reflecting on current usages. Snapshot photography became popular in the early 20th century with the advent of relatively inexpensive, easy-to-use cameras combined with an industry supporting this ease of use. Film photos were used for about a century and are characterized by their materiality, durability, and use as objects of memory. As Van House (2011) pointed out, viewing traditional film photos after capture was delayed due to technical features of taking photos, mainly film processing and printing. This means that photos cannot be seen immediately after capture, and it can take at times quite long before seeing the printed photos. Thus, when the developed and printed photos are viewed, they are always about situations that happened already some time ago. No wonder that Richard Chalfen (1987) found in his 1980s study of snapshot practices in the USA that snapshot photos at the time were taken mainly to document the present and as reminders of the past.

Most film photos were taken with considerable deliberation, which was influenced by the costs related to buying and developing film (Chalfen, 1987). Photos tended to be of a selective set of topics, mainly of people close to oneself and of special events, such as weddings, graduations, travels, and get-togethers. These images of special events and close social relationships tied people together, particularly allowing for reinforcing contact between and among people living far from each other.

Due to their specific materiality, printed photos had a specific durability: Once printed, they can be retrieved even decades later without any special equipment (Rose, 2010). While the organization and annotation of paper photos is laborious, once organized in albums, often with annotations written on or beside the photos, a collection of paper photos can make sense even to someone who knows nothing about the people in the photos, for example, by someone who finds them at a flea market (Van House, 2011).

Mobile Camera Phone Photography

During most of the 20th century, once families bought a camera, they tended to have only one that was used for family photography. However, this social use of cameras changed with the advent of cheap consumer cameras. Every family member might have his/her own camera to bring on vacation or when meeting friends. With the uptake of mobile phones, and the embedding of cameras into these devices, mobile camera phones started to replace cheap consumer cameras, and later, in many cases, all family cameras.

Mobile camera phones have affected photo capture, sharing, and display, facilitating near-real-time sharing of place, as well as providing for distant closeness. Already in 2011, Van House suggested that digital photography was far more convenient than film-based photography, and camera phones in particular made it easy to take photos spontaneously. The automatic settings on camera phones make it easy to capture photos that are deemed good enough by many casual photographers. Moreover, digital photos can be viewed immediately after capture and then emailed or posted online. The archiving and annotation of photos is faster on the computer, and digital technologies allow easy modification of photos.

Various authors (e.g., Gye, 2007; Van House, 2011) have suggested that the digitalization of photography brought a change in its temporality: “The private photograph is now often ephemeral and shared,” as Van House (2011, p. 132) remarked. Personal photos are shared by being posted online, on sites that tend to be more public than the former social viewing of photo albums that Chalfen studied. On social media, it is nearly mandatory to have a profile picture, making photos of faces essential features on social media profiles. Whereas paper photos could be bought at flea markets by random people even decades after the photos had been taken, digital photos are ephemeral. This is because they lack the durability of paper photos and often are used for immediate communication: “Because digital images are more public, malleable and immediate, they are being used for communication and interaction more widely and in continually diversifying ways” (Van House, 2011, p. 133).

In snapshot photography, relationships are a recurring theme and people continue to take photos in order to remember special events. Snapshot photography tends to focus on social relationships, representation of self with and without others, and self-expression. People use photos to create and maintain relationships by, for example, including certain people in shared photos and deciding with whom to share specific photos. Second, people use them for representational

purposes, deliberately selecting certain photos that fit into the presentation of self that they want to give about themselves. And ever increasingly, especially camera phone photos are used in expressive ways, containing a specific aesthetics that tie them to imagined communities, such as the art loving or the inner city hipsters (Sarvas & Frohlich, 2011; Van House, 2011).

Sharing Place and Distant Closeness

The focus on cameras, photos, and their temporally changing use among the flows of social interaction is tied to our research question, that is, asking how are photos used during the process of searching for long-term partners. A clear difference between film and digital snapshot photography is the possibility to post photos online immediately after capture. According to Villi (2016), people “send the place” with a camera phone, mediating their current local presence to that of the receiver. With photos, it is possible to both communicate the place where the person is and mediate the presence of the person in the photo. Mediating one’s presence is possible because, with a photo, the receiver can see what the photo taker looks like and what he or she is doing at that moment. Villi also pointed out that the further away people are from each other geographically, the more reason there is to send photos. As he put it, “A photograph gives presence to absence” (Villi, 2016, p. 111), and it can achieve that in the present tense.

Prieto-Blanco (2016) explored these relations via photography and online video services among transnational families, providing important empirical research on the role and value of phatic visual communication for kinship ties. Even repetitive and possibly superfluous photos, such as current selfies, are often valuable for relationships, as they maintain a connection between people and communicate presence. Sending photos gives people a “sense of being together” because the photo “re-localises the act of communication” (Villi, 2016, p. 117). Whereas Chalfen (1987) pointed out that people had to get together to view printed photos of something that had already happened, camera phones now make it possible to share a moment with another person at the very moment. An absent friend can thus be brought closer by sending photos instantly after capture, creating a feeling of presence (Prieto-Blanco, 2016).

This feeling of presence is a precarious undertaking, and it relies on the functioning of the technical infrastructure in near real-time (Weltevrede, Helmond, & Gerlitz, 2014), so that an illusion of sharing time and space together in each other’s presence can be upheld. Tinder, as a location-based real-time dating app (Ranzini & Lutz, 2017), facilitates this illusion by providing users with possible dates based on location. It thus relies on affordances of mobile media, using geolocation information (such as GPS or Cell IDs) to sort who will be visible on one’s screen. This visibility is often a precarious undertaking, at times done reluctantly because no other options seem viable, particularly among groups of people who fear to be stigmatized because of their sexual behavior (Cassidy, 2016).

Tinder Use Among Flows of Social Interaction

When using the dating app Tinder, photos are a particularly prominent feature of the service, as choices on whom to like—that is, deciding whether one is interested or not in someone—is based on seeing an image. When joining the service, one first has to provide an account (a phone number or Facebook account), his or her name, date of birth, and gender (male/female). After that, s/he can answer voluntarily a question and then must upload a photo to proceed and consent

to allowing the phone to track one's location when using the app. To operate the app, one touches a photo, usually of the other person's face, and swipes it either to the right (like) or to the left ("nope") to proceed. At the time of our study, each user could upload a maximum of six photos that are visible in the profile. While the photos could depict almost anything, most users upload photos of their faces to attract another person. A photo of a face, tightly cropped or as part of a broader environmental context, becomes an important image for creating future intimacy.

Related research on Tinder use has focused on understanding the motives that different users have for using the service, ranging from finding long-term love or casual sex for self-worth validation to the thrill of excitement, trendiness, and travel information (e.g., Newett, Churchill, & Robards, 2017; Sumter, Vandenbosch, & Ligtenberg, 2016; Timmermans, & De Caluwé, 2017; Weiser et al., 2018). Other researchers have investigated problematic uses of the dating app, such as harassment and sexist abuse (Thompson, 2018), toxic masculinity (Hess & Flores, 2018), racism (Mason, 2016), body image concerns (Strubel & Petrie, 2017), or trolling (March, Grieve, Marrington, & Jonason, 2017). Our research adds to the literature by focusing on a specific user group, those seeking long-term partnerships, and exploring the roles that photos play in this process. As such, it builds on and advances related work on impression management in the use of Tinder (Ward, 2017), as well as related research focusing on technical affordances of the service, such as the swipe logic (David & Cambre, 2016) or gender categories as emerging from the structural needs of programming (MacLeod et al., 2018).

By paying attention to the roles of photos in this process, we additionally underscore the usefulness of a practice-based approach to understanding Tinder as one part in a broader ecology of flows of social interaction. Related work on online interaction, even when focusing on photo use, tends to concentrate on interactions within one technology or platform only, such as a social network service, an online gaming environment, or a chat service, mainly due to methodological restrictions (e.g., McLaughlin & Vitak, 2012). Many of these studies contribute to our understanding of presenting self (e.g., Uski & Lampinen, 2016) while neglecting the importance of evolving interactions in an ecology of communication technologies for creating and maintaining social relationships.

In contrast to these studies, our research points toward the flows of social interaction by studying how these evolve during online dating. In a similar vein, Yang, Brown, and Braun (2014) showed how layers of electronic intimacy are negotiated during the development of personal relationships. They illustrated this in relation to their study's respondents: "They usually started communicating with new acquaintances through Facebook and then progressed to instant messaging (IM), after which they might exchange cell phone numbers and, finally, scheduled a time to meet, if everything went well" (2014, pp. 9–10). In this example, each communication medium represented a different form of electronic intimacy to those studied. This perspective calls for studying social relationships across digital media and through a series of interactions in order to understand how flows of social interaction are constituted. Our aim, then, is to understand specifically the role of photographs in the build-up of long-term partnerships.

METHODOLOGY

People searching for a long-lasting romantic relationship are good participants to study because they specifically want to build close relationships, and they need to consider what communication

technologies to use in order to do so. Moreover, flows of interaction can be studied efficiently by studying how two people, often initially strangers to each other, get to know the other person, starting from the first match of swipes on Tinder. Photography is here of particular interest, as the decision to like someone is made based on visual cues in the photos uploaded. We are interested in understanding how photos are used when trying to find long-term partners and how their role changes during the flows of social interaction, starting from Tinder and then quickly moving to other communicational settings, including face-to-face meetings.

We interviewed 13 participants: nine females and four males. The participants' ages ranged from 23 to 42 years, with an average of 29.5. Based on whether the participants were searching for men, women, or both on Tinder, one participant was bisexual and the rest were heterosexual. At the start of our study, nine of the participants were single and four were in a relationship, with two being in a long-distance relationship and one dating someone not met on Tinder. None of the participants mentioned having any children. Most of the participants had a university degree or were pursuing one. Although we did not ask for more specifics of their sociodemographic backgrounds, as far as we can tell, the research participants belong to the broad, educated middle class and live in the capital region in Finland.

We recruited the study participants using Facebook. The sample was chosen carefully in order to meet three main requirements: They (a) are or had been seeking a romantic life partner, (b) are or had been using Tinder, and (c) had met some of their Tinder matches face-to-face. For ethical and practical reasons, the subjects had to be at least 18 years old and live in the Helsinki metropolitan area. All interviewees were informed of the voluntary nature of providing information and were asked to read the project description prior to consenting to participate in the study. All interviewees confirmed participation in the study, as well as allowed for the analysis of the data collected. Personal identifiers were anonymized; however, one participant agreed to a selection of her photos to be published as part of this research article.

As research methods, we used semistructured interviews and observation, which were deemed suitable for studying a novel topic. Semistructured interviews allowed ample space for research participants to reflect on their dating experiences, while also providing the interviewer a means to guide the conversation and ask clarifying questions. The interviews were held in autumn 2016 in the Finnish language at university premises (i.e., Aalto University and the University of Helsinki). In the interviews, the participants were asked to tell about the Tinder matches they had and about the way the relationship with these people progressed. The participants told freely about their relationships while drawing a timeline of main events and a curve showing feelings toward their date at specific times depicted on the timeline. The use of the visualization task was added early to the interviews because we noticed that when the interviewees simply told how an event unfolded, they needed assistance for reflecting on what had actually happened. In addition to interviews, the study participants were asked for permission to see and analyze their Tinder profiles, as well as the conversation histories that they had. This part enabled us to access the kind of photos that the participants used in their Tinder profiles and exchanged on instant messaging services with their dates.

All interviews were conducted in Finnish, transcribed by one of the authors and a transcription service and then analyzed using grounded theory. First, topics and themes were identified, and these were discussed among the authors in regular meetings. While the individual stories of the participants differed, after conducting and analyzing 13 interviews, we

deemed to have reached thematic saturation. The quotes for this paper have been translated into English by the authors.

FINDINGS

Photos Used to Influence One's Future

In online dating, profile photos primarily influence people's futures, instead of functioning as reminders of the past. The profile photos may have been taken initially to remind oneself of the moment of capture but, once uploaded to Tinder, they await an uncertain future. This is the case because users are aware that many expectations of them are formed based on profile photos. Due to the user interface, a user must choose between a nope and a like for each profile presented in order to proceed to the next possible match. Thus, profile photos play an important role for finding a long-term partner via the service: A profile photo forms expectations for future social interactions.

These expectations are verified, changed, or proved inaccurate later in conversations on Tinder or other communication services, or at the latest when meeting for the first time in person. Due to the role of expectation formation, users want to manage the impressions they give to others by choosing their profile photos with their futures in mind, as they want to draw the interest of certain others who could be potential romantic life partners. The ways in which this is done is culturally specific, and interesting comparisons could be made in future work between research participants from very different backgrounds. In the following, we show how our participants negotiated these expectations in visual form.

Visual Appearance, Versatile Personality, and Distinguished Codes of Communication

When searching for potential long-term romantic partners, the participants had expectations toward others' based on their Tinder profiles. These expectations were geared specifically toward the photos in the profiles. Based on these expectations, our participants noted explicitly three aspects to include in profile photos in order to draw their interest. First, *visual appearance* was very important for the interviewees. They wanted to see what the other person looks like and particularly wanted the other person to be attractive in their eyes. Most participants felt that seeing the other's face was mandatory, underscoring the importance of the facial profile pictures. Second, the participants were not only interested in visual attractiveness of those depicted, but they wanted to get to know something more personal about the potential date. For example, they were interested in something about the person's personality or hobbies that could be deduced from the visual clues (see Figure 1 and Figure 2). *Versatility in pictures* enabled others to get a good idea of what the other person looks like and what s/he is interested in, not through just one image but in several images. Finally, the participants wanted profiles to be *distinctive*, not repeating the same visual tropes as others, so that the profile would stand out positively from other profiles. They thus expected the person uploading profile photos to be knowledgeable of the Tinder visual code of communication and the ways in which they could distinguish themselves from it.

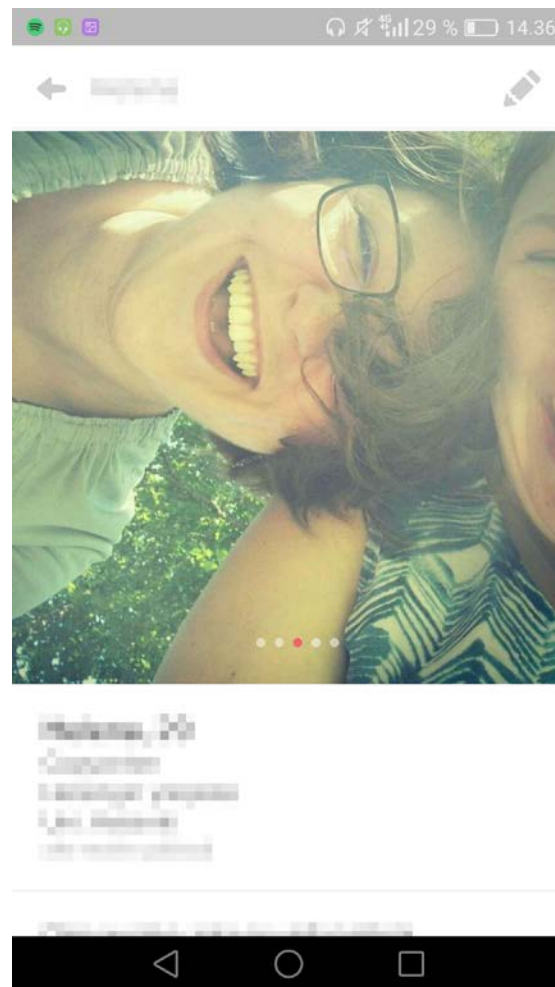


Figure 1. A participant wanted to show her social and happy personality in a Tinder profile photo. The photo also shows her face, which most participants wanted to see in a Tinder profile.



Figure 2. In this Tinder profile photo, the participant is writing poems. She also wrote a poem on her Tinder profile to illustrate further this interest. With the photo, she wanted to show the deep and thoughtful side of her personality in order to find a similar person.

Visual Appearance in Profile Photos

Our participants paid considerable attention when choosing their own Tinder profile photos, with the goal of visually appearing attractive to potential future dates. Additionally, when they chose with whom to match, personal attraction toward the other person's visual appearance was paramount. This did not mean that the person had to be “*some Mr. Finland or Ms. Finland*,” as illustrated by Sarah's comment. Rather, some of the participants compared attention to appearance on Tinder to that of going to a bar, as told here by Jason:

If you compare Tinder with going to a bar, it's the same thing: You see directly from someone's face or her profile photo [on Tinder] what she looks like. And you can tell if she looks like someone you'd like to talk to.

However, even though one's visual appearance can be seen from profile photos and may be deemed attractive at the time of the swipe, there is no guarantee that there is attraction toward the person when meeting face-to-face. In fact, it was very important for participants to meet personally, at some point, with their Tinder matches in order to know whether there is chemistry between the couple. Many of the participants thought that this spark cannot be perceived online. Nevertheless, some participants did talk about instant feelings of chemistry online, but even they suggested that meeting face-to-face was essential in order to verify attraction offline as well. Sarah talked about the necessity to meet the other person offline to know whether there is chemistry:

For me, it's the meeting in real life that counts because, no matter how good the communication is there [on Tinder], if I'm not interested in him physically, then I'm just not interested. It's a lot about unconscious things like how you like his scent, for example. You can't know that there [on Tinder].

In these cases, the profile photos were chosen to facilitate pleasurable face-to-face meetings in the future. The participants underscored that offline meetings with that certain bit of chemistry might lead to long-term relationships.

Distinguished Codes of Communication in Profile Photos

Individual profiles on social dating sites are part of larger photo collections, of operational photo archives (McQuire, 2013), consisting in many cases of hundreds of thousands of others who are also looking for future romantic partners. So while a single account may have very interesting photographs, these photos often tend to consist of repetitive visual attributes that easily lose their distinctiveness. Jason remarked on this repetition in visual presentations pointedly:

People have a lot of dullness in their photos. For example, very often, there is an extreme sports photo where one's skydiving or they're on a holiday somewhere. All those holiday photos, people have them very often. If it's not the first photo, then it's one of the other photos. And there are these social media trends that you pose in a certain way, this can especially be seen among the profiles of younger women, very like, somehow, I dunno. Like all the photos look exactly the same. You can't tell the difference between these people. I think I've seen this person before, even though I haven't. You categorize these people very easily as people who, somehow, probably don't have much to them.

Many participants felt that most profiles are actually rather similar on Tinder, as illustrated by Jason in the previous quote. The participants named several clichés in pictures, such as cars, gym selfies, and vacation and sailing photos. They disliked seeing these common themes in profiles, and these clichés were often a reason to dismiss a profile. However, Tinder users must know of and about the visual code of communication in order to distinguish themselves favorably from the crowd.

Interestingly, participants saw different things as clichés depending on their own interests. Therefore, although some might consider a particular visual attribute a cliché, it may not bother someone who likes the same thing. Instead, the photo suggests common ground, which many consider a good start for dating.

Balancing Being Honest with Showing One's Best Qualities

In a Tinder profile, a person can present only six pictures and 500 letters of text. Particularly because it is not possible to include significant information in the profile, pictures are chosen with great care. After an initial selection, many participants talked about modifying their Tinder profiles from time to time. Some of them wanted to test different kinds of profiles to see what kind of information improves the matches—in terms of both number and quality. Additionally, through experience with using the service, the participants gained knowledge of successful codes of communication, which they then used to modify information in their profiles. The outcomes of online discussions following a match and disappointments from first dates helped them gain the knowledge needed to tinker with their Tinder profile toward better future interactions. As Holly realized when others kept asking for a photo showing her figure, it was beneficial to add a picture showing her body figure on her profile:

But now I have noticed that I don't have a body photo there, so people ask for it in a conversation, and I've been thinking that maybe I should add a body photo here.... But now I've started to think that maybe it limits my chances if I don't have a body photo, that maybe people think I'm a beached whale if I don't have one, I don't know. But I'm seriously considering that I should take a proper body photo of myself.

The research participants wanted to show their best qualities in their Tinder profiles, which might lead to very specific kinds of pictures, providing their matches with wrong kinds of expectations. This is why our research participants thought it beneficial to be open and honest about themselves in their profiles, thereby including other types of images that might not interest seekers generally but might interest better matches. This need for authenticity has been found in related Tinder research too (e.g., Ward, 2017). This approach was especially true for our participants because they were hoping to find a romantic life partner—and avoid meeting a variety of one-night stands. In order to draw the interest of potential life partners, interviewees believed it was better to concentrate on honesty rather than overemphasizing their appearance or abilities. Betty described the thinking behind her choice of her first Tinder profile picture that she thought was not very attractive but showed her personality well:

I made quite some changes to my profile because I felt that I wanted to be met as me, as a person, and not because of my looks. I am searching for a soul mate who would like me as the kind of person and human being that I am. In the first photo, I have no makeup on and I think that I look odd and not that pretty. However, it's the most genuine me, and I was

happy when the photo was taken. I thought that photo shows my personality better than an intentionally cute photo where I am something that I would like to be.

As the participants disliked seeing clichés in other people’s profiles, they tried to avoid clichés in their own profiles. To achieve this, they considered how they might present themselves in photos to make themselves stand out from the crowd. Sometimes this was difficult when clichés and interests were overlapping, as Jason noted:

But it was funny when I began using Tinder, and I’ve honestly always liked cats, since I was young. And I’ve liked music since I was 13 years old, and so I had these things in my profile.

But then it was amusing when the Iltaalehti, a local daily [newspaper], wrote: “Men, put these in your profile to get matches,” and these same things were there [already in the profile]. My friends were like, “You’re pretty bad for using those kinds of clichés.” But it was easy for me because I genuinely like these things. But, then, the other sex thinks that, “Oh no, this is one of those guys again.” And I’ve heard from many female Tinder users that there are a lot of cat guys in there. And a woman often has in her profile, “No cat guys,” or something. It’s like, I’ve been cornered! That’s why I don’t have anything about cats in my profile, I think, and no cat pictures because there’s this stigma on Tinder, a kind of meta thing. So, there’s nothing about these things in there.

Because Jason thought his love of cats was a cliché on Tinder, he did not want to show his interest so that he would stand out from the crowd. However, when looking for a romantic life partner, he was also considering that it could still be better to tell about one’s interests. When choosing to tell openly about things that may cause some people to dismiss the Tinder profile, one can influence the future by avoiding likely future conflicts and disappointments, as told here by Annie:

At times, I even put up a photo of me and my cat even though it’s a huge risk. Some people are so allergic to animal photos. Like “Okay, this one has a cat; she’s crazy—next!” [laughs]. Usually I didn’t put up any cat photos but, maybe a couple of times, I did when I thought that if someone hates cats then he’s not for me.

Therefore, while visual presentations were often chosen in order to get many matches, our research participants were also clear about the need to discourage those from contacting who would not be in accord with important parts of their lives. A match from someone on Tinder is not necessarily a match for life.

Drawing Impressions of Others from Minor Cues in Photos

To generate a clear idea about a person on Tinder, the participants formed impressions of others based on minor cues drawn especially from photos. These impressions were linked to the things that the participants valued in others. For example, as most of the participants were university graduates or students, some of them also valued education in others, and interestingly believed that they could figure out a person’s education level from photos, as depicted here by Carol:

Well I can give a provocative example that educated men never have a huge number of tattoos, and they don’t have a cig between their teeth and are wearing a Guess shirt by the campfire [laughs]. But, even if they are once a year at a summer cottage like that, they wouldn’t have a photo of them taken like that, or they wouldn’t put it on Tinder.

For Carol, tattoos, smoking, and clothes of certain brands in a profile photo symbolized lesser education. However, the formed impressions on any given profile are based on the likes and dislikes of the viewer. As can be expected, then, impressions formed by different people from the same profiles can be diverse. Similarly, the participants also talked about different things that they perceive in profiles. Participants noticed various cues in the photos and interpreted these in their own ways. In the following quote, Emily talked about her dislike for sailing photos and other cues in photos depicting wealth.

If a person is interested in sailing, sure he can have a photo of himself in a sailing boat—nothing wrong with that. It's just that, from many of them, you can clearly see the purpose behind them, that the golf and sailing photos are there only to show a certain amount of wealth, and not for any other reason. It doesn't matter if it's a photo showing a man in a suit with a glass of sparkling wine in a sailing boat or wherever, if the point is to show, "Hey, I have dough." And I'm not interested in dating people who feel the need to tell you that.

While our research participants valued education, many considered that wealth was something that should not be made explicit in order to fit their ideals of a socially suitable match. This is very much in line with broader societal values in Finland, where showing off is considered inappropriate behavior, and heads of state, as the current president, is depicted in mass media as someone who is happy to sit at an event on the stairs if seats are no longer available.

Searching for as Much Information About Others as Possible

As the information in a Tinder profile is scarce, the participants usually searched for other social media profiles, bulletin boards, or information on company Web pages to verify their initial impressions and to gather additional information about the persons of interest. The interviewees usually wanted to get as much information as possible before going on a date with someone. Some of the participants realized that, at times, it is possible to get crucial information from other social media profiles. For example, some participants mentioned that they decided not to continue communication with the person of interest after seeing on that person's Facebook profile that s/he was racist or in a relationship with someone else, as told here by Jason:

This particular female had her Instagram username in her Tinder profile, and her Instagram had her name. And when I put her whole name to Facebook, I found out that she was in a relationship. Then I backed off—went away. It was really shocking! I was like, I can't believe how I dodged a bullet here.

Some of the participants realized that social media profiles also are lacking in information and that the impressions formed from the profiles may sometimes turn out to be untrue. The additional information gained from other social media profiles influenced, and at times changed, how a person on Tinder was perceived. The initial photos seen and initially evaluated and selected by the interviewees to direct their futures often were accompanied by additional searches on that person, if a spark of interest had been ignited. Although someone might seem visually pleasant, most participants wanted to avoid dates with people who they considered in advance not being suitable life partners, which is why they tried to search for as much information as possible online about their Tinder matches. Moreover, a few female participants were concerned about their safety when meeting an unknown person for the first time and thus wanted to gather information to be more at ease. These mediated means of communication were of particular importance in directing

dating behavior. Still, the research participants stressed the significance of the first face-to-face date. When meeting in person, the participants tried to verify or prove inaccurate the expectations they had made from online information, thus they valued face-to-face meetings as particularly revelatory, in contrast to mediated interactions.

Restricting Available Information About Oneself

Participants believed that they usually can form accurate impressions of others by searching for additional information on the Web on possible dates and were eager to look at information on social media profiles beyond Tinder. However, the participants did not want to provide too much information about themselves in their social media profiles. This *desire for information asymmetry* represents a paradox: They sought online information to confirm the suitability of their selection of whom to date, yet they wanted to restrict available information about themselves because they did not want to risk others forming incorrect impressions about them. For example, while it is possible to link one's Instagram profile to one's Tinder profile, most of the participants preferred not to share this content with unknown people. This paradox in wanting to search for a lot of information but restricting one's own available information remained for some interviewees difficult to explain verbally. Jason exemplified the paradox well:

I believe I have a pretty good sense of people, especially in terms of the kinds of profiles people have, for example regarding Facebook or Tinder. But I can also think about it the other way around—that I don't want people to make assumptions about me based on my Facebook feed because I have only posts concerning cats. And I do like cats a lot, but someone might think that I'm just interested in one thing. I'd like to be able to create the image of me myself—in interaction.

Jason related confidence in his ability to derive accurate impressions of others based on their social media profiles while assuming others are not capable of making similar correct impressions of him. By restricting their own profiles, the participants wanted to make sure that others do not reject them as potential dates because of too few cues or posts that could be misinterpreted. However, they were not similarly worried about forming false impressions about others based on profiles. They trusted their own instincts in making correct expectations. The risk of not finding out disqualifying information about the other person, such as racism or an ongoing relationship, seemed to be a more significant concern for the participants than the risk of making incorrect impressions.

Photos Used to Share Presence

While the major task of sorting out who to date in the future is done in advance, and photos play here an important role, photos after the contact with their match are also used importantly to share presence with distant others. Once our participants had been on a date face-to-face, they kept sending, especially, photos to their love interest between dates in order to create feelings of copresence, using other media than Tinder to do so. By sending photos, our interviewees wanted to show their dates what they had been doing. As they were able to do so using mobile phones in near-real time, they could connect with each other instantly after something had happened—or often even during an event—providing a feeling of distant closeness.

Photos Help in Recalling and Gathering New Information

The profile photos on social dating sites lose much of their significance after couples have met, but they still help in recalling the person. Without photos, people would have to rely on their memories of the person between dates. Profile photos not only help in remembering, but new aspects of the other person can be inferred from the various profile photos. Additionally, the photos can be viewed differently depending on what one now knows about the other person. Betty told about the importance of photos after the first date:

It does have a huge meaning, especially as you can't see the other person. So you have a way to remember that person. And because there are different photos, you'll see other aspects of the person as well. But especially, you somehow remember better what kind of a person he is.

Photos also allow a person to see with whom a person of interest spends time. A person's friends and relatives can tell a lot about the person, and thus it can be revealing to learn more about these people. The participants did not usually meet the other person's friends early in their relationships, but they could get a sense about those friends from online photos, as Nancy told:

I actually had a pretty good idea about his friends before I met them. It was funny that I had been able to match a face and a name from Facebook, so when I met them, I already knew who was who.

However, the interviewees felt that mutual friends could be a disadvantage in Tinder dating. For example, when Rachel learned that she shared several common friends with the individual she selected, she was hesitant to go on a date with the person. From Rachel's perspective, such overlap in social networks suggested to her that the relationship is not going to last:

Well, I'd say that if there's a lot of common friends, I might start thinking that, when you know that, it's probably not someone, something, that necessarily lasts for long. So do I want to, you know, take the chance if people start gossiping about me dating some guy a lot?

Sent Photos as Conversation Facilitators

The participants typically switched from Tinder to other social media services rather quickly after a match, usually even before the first date, to make it easier to work through the logistics if they actually were planning to meet offline. One of the reasons to stop using Tinder was that it is not possible to send photos through this app. All participants enjoyed sending photos while instant messaging, and some participants felt that dates would carry even more value if photos could not be sent. Just as with social media overall, shared photos helped the couples stay in touch between dates. Moreover, the shared photos sometimes benefited the sender's communicating about certain things. For example, Mary felt it was easier to communicate feelings with pictures:

I'm not good at sending messages saying that I'm missing him or, somehow, expressing feelings in a message. So I say those things more face-to-face, and then I can send a cat meme or something like that. I can't give a very good example of it but something that shows a bit how I'm feeling with a picture.

It not only seemed easier to communicate emotions with pictures than with text, but some things (e.g., emotions, events) the participants considered important were expressible only with pictures and they would be pointless to talk about without the visuals. Emily stated that, without pictures, she would only send a text message when she has something important to say, bringing forth the idea that people might communicate less often between dates if they could not send pictures:

Many photos that I send, they don't necessarily communicate the thing itself. They are rather something that is told with images. Maybe I'd rather send messages when I actually have something concrete to say, if I couldn't send photos or something similar.

Pictures also can serve as conversation starters. Particularly when neither party has something specific to say but one would like to communicate, a sent photo provides a reason for the couple to have a conversation. Kevin described this dynamic in practice:

So, you don't have to go and ask, "How are you? How's it going?" You can send a cat photo. And then, kind of automatically, there's a contact.

The importance of using photos for phatic communication is particularly evident in dating. Indeed, Miller (2008) predicted that online communication, over time, would move significantly toward the phatic.

Sharing One's Presence by Sending Photos

When a couple cannot be together, one can update his/her love interest about what s/he has been doing by sending photos. The participants indicated that they often sent situational photos rather than selfies that did not provide a context. The goal of this practice, the participants noted, was the desire to share the things they were doing and the places they visited. The photos presented meaningful moments to the person, and the interviewees enjoyed seeing what the other person has been doing, as explained by Rachel:

Yea, you want to share that moment with that exact person—usually it's like that. It's less often anything like, yeah, usually it's not that you want to somehow, somehow show that, "Look where I am," or something. If he's someone who I'm interested in, then you send him photos and, well, you want to share the moment or you want to show that, "Hey I like to do these sort of things." For example, like I've been gathering mushrooms and then I take a photo [laughs], "I do these sort of things," because they may not come up in conversations like, "Hey by the way do you gather mushrooms?" And, then again, some may find it odd, but for me it's very therapeutic [laughs].

As Rachel's quote illustrated, the participants wanted to share their lives with their dates by sending photos. These situational photos also enabled the participants to bring forth new aspects about themselves while, at the same time, getting new information about the other person. In a long-distance relationship, the participants felt it was especially important that they could send photos to their love interests. As Annie related, the distance between them meant the couple saw each other less often:

And especially now, as I have a long-distance relationship, as my man lives in another town, we do send a lot of photos. It brings the other person closer.

Photos as Mediators of Togetherness

Already in a Tinder profile it is possible to use visual cues in photos to show what one enjoys doing. For example, Betty had a photo of sheet music on her Tinder profile to symbolize how music as a hobby is important for her (Figure 3). These kinds of cues aim for the future, as the person wants to find someone with similar interests.

By sending pictures of specific themes, a couple can create solidarity. In the following quote by Emily, she explained that photos are sent not only to show what one has been doing but also to share common interests and thus create solidarity between the couple:

And we sent lots of photos of drinks. Okay, this is silly. It probably started when we had been drinking on our first date, and then the next day we sent photos like, “I’m recovering here,” photos of pints. And it kind of remained that we didn’t have to specifically tell each other that, “I’m going to a bar with my friends again,” but you could just send a photo of a pint. Then the other person is like, “Ah, you’re there again.” It brought a kind of cohesion to the relationship—that it was very important for both of us that we had our own friends who we spend a lot of time with and we both like beer. So it wasn’t anything like— It was a common interest. And another one was pizza. We usually ate pizza together on Sundays while having a hangover, but we also sent each other photos of pizzas. Like, “Are you envious?”

For pictures to bring a couple closer, they do not have to be photos taken by the sender. In fact, pictures or videos can build intimacy also when an unknown other person’s social media posts are shared. Some participants shared funny and cute pictures or videos by, for example, tagging the other person in the comments of the picture. This kind of tagging is often mutual and it can thus create solidarity. It shows that the tagger is thinking about the other person.



Figure 3. A participant put a photo of a musical notation on her Tinder profile to symbolize how important music is for her.

DISCUSSION

As our findings show, photos are a particularly important communicational means for those seeking long-term partnerships. They are used to attract attention, as when uploading photos to one's Tinder profile, and for phatic communication, as when upholding a feeling of togetherness and distant presence after a match. The importance of photos is not self-evident because other means of communication are available, such as text, voice messages, or phone calls.

Related research on Tinder has focused mainly on the platform itself and pointed toward a variety of uses that it has, such as for casual sex, for finding long-term partners, or for purposes of excitement (Sumter et al., 2016; Weiser et al., 2018). As well, the negative uses have been studied, such as issues related to body image concerns when using the app (Strubel & Petrie, 2017), the possible addiction to a swipe logic (David & Cambre, 2016), or harassment and sexist abuse (Thompson, 2018). These studies tend to point toward other venues for meeting and communicating, but still they focused on the use of one platform. In contrast, our focus on photo use revealed different temporalities in the build-up of intimacy, depending on the stage in the process of getting to know a possible future partner. Although related research acknowledges the importance of Tinder's use for meeting later face-to-face (e.g., Duguay, 2017), and thus points towards the future tense in which many Tinder actions are performed, it does not address the particular feature of visual impression management on the dating application.

The care and thoughtfulness that our research participants showed and reflected upon when selecting their profile photos validates the importance of impression management on Tinder (Ward, 2017), as well as when using other social media (e.g., Uski & Lampinen, 2016). The future orientation of this impression management, recognizing that users do not know when someone will see their profile pictures, is evident in the use of dating applications. These photos are not intended, at least usually, to show "that what has been" (Barthes, 1980/1982), nor do they communicate in real time. Rather, the photos our research participants carefully assembled were intended to communicate toward the future and with people they usually do not know in advance. As such, the creation and selection of these images, uploaded to one's profile, entail modern forms of divination, prediction, and foretelling in that our research participants could not know in advance who would swipe their profile to like. In practice, they had to guess what kinds of images would possibly lead to a match and held a host of rules of thumb for doing so. While predictive pictures (Lehmuskallio, 2016), such as those taken by stationary traffic cameras to record speed violations, also are photos taken with a specific future in mind, their visual aesthetics are predictable because they need to be processed efficiently to sanction the speeders. Although many profile photos on Tinder seem, at first glance, to fit into the notion of predictive pictures, our findings show that what characterizes the visual assemblage of forecasted photos are the specific differences of one's profile photos in contrast to the mass of images in Tinder's image archives. What is forecast in these photos—done before they are thrown (i.e., cast) in a specific direction (fore-, *prefix*, and cast, *verb*; Oxford English Dictionary, n.d.)—is a complex reading of potential likeability, including dimensions such as education, class, body type, hobbies, and profession.

In other and earlier dating applications than Tinder, which are more text-based, the profile has been framed as a promise that needs to balance veracity and misrepresentation in order not to disappoint a potential partner when meeting face-to-face (Ellison, Hancock, & Toma, 2011). In the case of Tinder, as our research participants were searching for long-term partnerships, the forecasted profile photos were selected in order to fit one's ideals of what a desired potential

partner would like. In that sense, forecasted photos were chosen to predict what an unknown respondent would find enticing. This reflexive stance in creating and selecting one's profile photo shows the inherent uncertainty that lies within these forecasted photos, one that involves both the communicative situation and the use of photos for communication. The person assembling these photos does so for someone whom s/he does not know but who s/he hopes, in turn, will become interested in the person casting the photos. As our findings show, photos of people tend to be interpreted in a wide variety of ways and seemingly more tied to the interpreters' visual imagination than a clear set of commonly shared attributes. Although a useful first taxonomy of visual cues in selfie photos and their relation to perceptions of authenticity has been provided using the Q methodology (Lobinger & Brantner, 2015), our participants focused on a wider variety of cues in assessing the desirability of a potential partner and did not focus solely on the specific expressions of a depicted face. Thus photos and their related attracting connections facilitate a wide array of interested or disinterested interpretations that remain difficult to control, even though the visual cues are crafted carefully to achieve that explicit purpose.

From the point of view of our research participants, the person who becomes interested in their profile should not be someone who is unlikeable, harassing, intimidating, or insulting. S/he also should not be someone who does not fit within one's desires and expectations of the profile creator for his/her future. Thus, forecasted photos entail complex assemblages, making them a special case of photographic impression management, especially because one does not know who actually is looking at the photos. They differ from classic notions of impression management in which a person presents an image of the self in a particular face-to-face situation where one knows to whom one is talking (Goffman, 1990). This is not applicable in the case of Tinder.

Considering forecasted photos more broadly, it becomes apparent that an important aspect of contemporary image use, including that of profile photos, includes modern forms of divination and foretelling. For example, job applications often include profile photos, which as such do not entail comparative information for reviewers, as written lists of achievements do. Rather, the profile photo on the application reflects an understanding that an applicant has of the visual characteristics a reviewer would find compelling. While these visual characteristics in job applications differ from those found in dating, what is similar is a communicative situation in which a photographic medium needs to act as an agent convincing a previously unknown person to contact the person who cast the image. In addition to online dating and job applications, advertisements belong to this group, which is why advertisers typically strive to get a better understanding of to whom they are directing their advertising. This information, collected in the industry through various means, is used in presenting an image that leads to desired results (e.g., a customer buying a specific product or voting for a particular candidate).

The importance of the future tense for considering photos as digital images also has to do with their specific materiality that may have an effect on the use of forecasted photos. A digital image is virtual because the image cannot be seen immediately in its physical form by looking at the storage medium. In contrast to looking at, for example, developed film negatives, special equipment and software is needed to make the photo visible to a human eye.

Once the digital image is made visible, that is, by rendering it on a computer screen, it is visible only temporarily. When another image is rendered visible, the previous digital image disappears or is visible usually in different form, such as part of an image collage (e.g., in thumbnails). This adds

to the ephemerality of digital photos, especially of those on social media, which often are used as part of situational communication and not in order to be seen over again.

Also, the possibility of replacing a stored image with another, editing the picture in various ways, or reusing it in different contexts underscores the ephemerality of digital images, in contrast to film and paper-based photographs. In some cases, such as the photo sharing service SnapChat, this ephemerality of the digitally networked image is a key component of the design principle because a shared picture can be viewed only once and for a short time before it is deleted.

Treating networked images as forecasts with ephemeral images that are used for phatic communication is not without frictions. As recent literature is increasingly pointing out, although end-users, such as our research participants, may use photos in order to start a chain of actions that preferably leads to their intended goal, large amounts of digital images can be stored with negligible costs either in private hard drives or in the ever-increasing cloud services. This potentially limitless capacity allows people to save all photos, without the need to select which of them are important. This typically results in a person's photo archive with too many pictures, making it difficult to find a specific photo or even remember its existence. Some researchers (e.g., Halpern, 2015) have speculated that digital media change the way the human memory works, not only but also due to a person's inability to find a lot of the digital content once captured. On the other hand, a growing body of work addresses this accumulation of digital traces critically by pointing out that businesses enabling these services collect this information into vast databases, first, in order to make these photos available when needed, and second, in order to collect user data that can be used for economic purposes. The use of these photos, along with other kinds of data, is in this strand of related research equated with surveillance capitalism (Zuboff, 2015) or, even more sinisterly, with data colonialism (Couldry & Mejias, 2018).

CONCLUSIONS

Images, and especially photographs, carry specific agency in computer-mediated flows of social interactions because they allow for phatic communication—a sense of mediated intimacy—which was at times for our research participants easier to do for dating purposes than sending elaborate, witty, emotional, or analytic text messages. Common interests were felt to enhance this intimacy. As people spend time together, they form symbols of social relationships. Inside jokes are shared in person as well as on social media, and it is especially easy to share these esoteric symbols by sending pictures using social media. These symbols make the couple feel that they have something in common that others cannot understand, thus creating solidarity. Photographs have an essential role in all these, especially today when mediated social interaction is moving to networked social media, where it is easy to share photos of immediate situations and those published by others.

Before arriving at this stage of visually mediated distant closeness, our research participants took meticulous care to create and adjust their profiles on Tinder, a location-based real-time dating app, designed specifically with images in mind. We call these profile pictures forecasted photos because they are assembled carefully before they are cast into the wide and far-reaching realms of the Internet. This work was done by our case study participants in order to find someone who eventually will become very close and intimate with them, particularly so because they were searching for a long-term relationship. The initial addressees of the

forecasted photos remain unknown to the person creating one's profile because one does not know in advance who will see these photos nor, due to the technical affordances of the dating service, who has seen them, especially if these others have not "swiped to the right." Forecasted photos are thus created based on one's ideas and desires of what an unknown person will like and pay attention to, an unknown person with whom one will want to become intimate. As we discussed above, the notion of forecasted photos is useful for other forms of visual communication as well, helping to pay attention to the future tense of photography.

Based on our study, we argue that photos play an important role in online dating in that they are first chosen and uploaded to influence future interactions, particularly regarding who will contact the dating profile owner. Second, although those interviewed wanted to meet a match soon in person, photos enabled the creation of copresence between offline dates, especially by sending photos on instant messaging services instantly after capture. Third, the classic notions of photos depicting the past became important when wanting to be reminded of who the person actually was, whom one had just met. Taken together, we argue that photos enhance intimacy building while dating on social media. This role should be accounted for by paying attention not only to photography's relation to the past, or the present, but also to a future tense of photography.

The empirical grounding of the main findings, as well as the implications for theory, discussed below, are limited by a relatively small sample size, focusing on 13 adults in Finland's capital region, all searching (or having searched) for long-term partnerships on Tinder. Tinder itself has important mobile affordances that explicitly support the role of photography in searching for matches, as well as lead people quickly to take up other communicational means for further interactions. This means that Tinder itself, as an application, leads those searching for dates to focus early on the visual communication via photos that may affect the latter importance that these photos have for creating copresence when using other communicational media.

While location awareness is an important mobile affordance of Tinder, its role for interpersonal communication has been followed only anecdotally while collecting the empirical data. After a match, if the relationship starts to develop, various messaging services (SMS, Instagram, etc.) are used to keep in touch and to build a shared copresence. This appears to be particularly important if there is geographical distance between the couple, as Tinder does not support communication between people being too far away from each other. While photos were sent using other communicational media to share one's whereabouts ("sharing the place"), Tinder itself does not allow doing so. The flows of social interaction are thus negotiated concerning not only time and the selection of situational communicational media to use but also regarding one's situational location. The role of place in interpersonal visual communication is an important aspect that could be taken up in future studies, asking especially how place, time, and communicational media affect interpersonal boundary regulations, and thus notions of placemaking.

Keeping track of these flows of social interaction is a challenge for future research. Researchers can partly discover them by interviewing or by accessing communication data from single services (e.g., Tinder, WhatsApp, SMS), but the exact flows may be impossible to track or to memorize. Here software that collects information about the use of a digital device and its various applications, mapping time, location, and communication partners may provide an avenue to shed light to this novel research topic.

IMPLICATIONS FOR THEORY

While previous research on online dating, especially on Tinder, tends to limit itself to studying the use of one communicational medium at a time, our work shows the importance of focusing on the flows of social interaction among multiple platforms in order to understand the role that different communicational media take in searching online for long-term partners. As our findings show, the process unfolds starting from assembling a profile to a search for candidates, to matching, starting a chat, moving to other communicational media, to a face-to-face meeting, followed both by computer-mediated and further face-to-face-meetings, all depending on both parties wanting to advance.

A focus specifically on the uses of photography within online dating allows us to point to the changing roles that visual communication takes in flows of social interaction. In contrast to related research, which tends to stress either the past (“the has been”) or the networked real-timeness and ephemerality of mobile photography, our research uncovers forecasted photos, a specific focus on the future when assembling profile photos. Only later, using other communicational means than Tinder, do photos take the roles discussed in related research for creating copresence and distant closeness, used for enhancing intimacy.

Both concepts identified in this research—flows of social interaction and forecasted photos—offer new avenues for research, helping to pay attention to visual communication within a broader ecology of practice.

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PLAYERS' PROGRESSION THROUGH GRAPHOGAME, AN EARLY LITERACY GAME: INFLUENCE OF GAME DESIGN AND CONTEXT OF PLAY

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Abstract: Researchers of serious games frequently investigate outcomes of play but overlook the underlying game-design components that drive those outcomes. In this paper, I aim to show how game design and context of play influence progression through GraphoGame, an early-literacy game. This is done by means of two intersecting studies. The first study shows how the game can be represented by a model that explicitly hypothesizes how the interaction between the player and the game drives progression. The second study explores user data generated by first graders ($N = 137$) who played the game over a period of 25 weeks as part of early literacy instruction. The juxtaposition of these two studies reveals factors that influence progression. I also highlight an underdeveloped area within the research field and point to the benefits that bridging game design and outcomes of play may hold for researchers, game developers, and educators.

Keywords: *serious games, adaptive learning, game design, literacy games, GraphoGame*



INTRODUCTION

Digital games are now an integral part of popular culture, and, in recent years, the presence of such games in educational settings has grown as well. The educational setting includes not only entertainment games repurposed for educational use but also games specifically designed to promote specific learning outcomes, which are commonly referred to as serious games (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). In these games, the entertainment factors typically associated with digital games are secondary to the instructional ones yet employed to motivate players to achieve better learning outcomes (Wouters et al., 2013). Although serious games do not necessarily increase players' motivation and engagement levels, these games may lead to positive learning outcomes, especially if used as part of other instructional activities (Boyle et al., 2016; Connolly, Boyle, MacArthur, Hainey, & Boyle, 2010).

To date, most researchers of serious games have investigated the outcomes of play (Boyle et al., 2016; Connolly et al., 2010), whereas less attention has been paid to how these games work (Gaydos, 2015; Lämsä, Hämäläinen, Aro, Koskina, & Äyrämö, 2018). Although it is quite possible to conduct such research without a comprehensive understanding of how these games work, this lack of attention to the workings of games means that the specific components driving outcomes of play may be undistinguishable from one another. Hence any insights pertaining to the game itself will be restricted to the game as a whole. Clark, Tanner-Smith, and Killingsworth (2014) argued that the design of digital tools, not the digital medium itself, is the strongest predictor of learning outcomes, and they call for research exploring how design choices in digital games influence learning outcomes. This view is shared by Lämsä et al. (2018), who called for research into how game design influences learning in children with learning difficulties.

This paper contributes to this underdeveloped area within research into serious games by investigating possible connections between game design and user progression in the Norwegian version of GraphoGame. This game is described as “a technology-enhanced learning environment for learning to read” for children who are “in the early stages of their formal education” (U. Richardson & Lyytinen, 2014, pp. 39-40). For my research of game design and user progression, I conducted two studies. Based on an investigation of the literature, the first study presented a theoretical model for how progression may occur as a result of playing the game, whereas empirical research in the second study generated user data from the gameplay. Juxtaposing the findings from those two studies makes it possible to identify some underpinning factors related to game design and the context of play that drive the outcome measured—in this case, progression through the game.

Researching Serious Games

Part of the reason for the predominance of studies investigating outcomes of play may be that serious games are designed to promote specific learning outcomes, and so researchers may be inclined to examine whether the games do what they are supposed to do. Further, stakeholders and decision makers in the educational sector often call for research that investigates “what works” and best practices in relation to digital learning technologies (Biesta, Edwards, & Allan, 2014; Eisenhart, 2006), which may further influence researchers' choice of focus. Because of this emphasis on measuring output, experimental research designs are commonly used in

research into serious games. In the case of research into language learning, for example, the question asked may be whether a particular teaching strategy or activity enhances students' learning performance (Phakiti, 2014).

A systematic review of earlier research into the specific serious game studied here, GraphoGame, showed that most studies used experimental designs geared toward measuring reading outcomes from play (McTigue, Zimmer, Solheim, & Uppstad, 2019). As mentioned above, such research may be carried out without any scientific knowledge of the components that constitute the game because the object of study is the game itself, not its specific individual design elements. Hence the underpinning components that drive the output measured may remain unexplored.

A good metaphor for this is that of the black box, as explained by Latour (1987). This provides a useful framework when discussing how researchers deal with complex systems such as serious games. A black box metaphor is used here in the sense of an artifact for which knowledge exists about how to use it and about the outcome of using it, but for which there is a lack of understanding about how it works. Mark Richardson (2016, p. 661), in reference to Latour's (1987) use of the metaphor, explained that black boxes are found "where the outer skin [of an artifact] masks the inner workings and obstructs comprehension." The use of experimental research approaches may "thicken" this outer skin in that the game as a whole may be considered the object of study. What is more, in one common view, digital learning technologies are seen as tools designed to generate outcomes (Furberg & Lund, 2016). Hence, the tool itself will be of interest only in terms of the results generated by its use. Latour (1999, p. 304) touched on this phenomenon in his claim that the success of technology actually deters comprehension: "When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become."

Price, Jewitt, and Brown (2013) pointed out that the research approaches taken to digital technology are trailing because of the rapid changes seen in digital technology. The lack of effective investigative approaches capable of piercing the outer skin to unpack the components of a serious game is another reason why the scope of research may have to be restricted to observing the output (e.g., learning outcomes) from playing serious games. Researchers thus may be forced to use theoretical approaches not specifically designed with the affordances of digital technology in mind. For example, a vast amount of user data is generated by players' interaction with GraphoGame, but these data are rarely explored in-depth (McTigue et al., 2019). In this case, the sheer amount and complexity of the data, in and of itself, may obscure insight into the black box. Indeed, Saarela and Kärkkäinen (2017) pointed out that, even where high-quality data sets such as those from the Programme for International Student Assessment (PISA) are readily available, research making proper use of those data sets is surprisingly rare. However, in two related fields—learning analytics and educational data mining—approaches are being developed to facilitate the use of big data in educational settings, but the tools used have not become standard yet in researchers' toolboxes.

An Activity-Theory Perspective on Serious Games

Playing serious games involves a complex interplay of factors, such as patterns for players' interaction with the game and its components, cognitive processing during play, and factors

relating to the social context of play. Each of these may influence the outcome of use to varying degrees. Activity theory (see, e.g., Engeström, 1999; Leontiev, 1977; Vygotsky, 1978) may provide a lens through which to explore such factors. Nardi and Kaptelinin (2006, p. 10) laid out the premise of this theory: “People act as subjects in the world, constructing and instantiating their intentions and desires as objects. Activity theory casts the relationship between people and tools as one of mediation; tools mediate between people and the world.” This premise proposes that technology reaches beyond an isolated interaction between a person and an artifact (such as GraphoGame); rather, the use of technology, and by extension playing of serious games, embodies complex social dynamics. When it comes to the use of digital technology (e.g., serious games), this theory offers an approach enabling the coordination of various aspects of technology, such as physical interaction, conceptual interaction, and social-context interaction (Nardi & Kaptelinin, 2006).

The application of activity theory to research into serious games requires a change of perspective compared with typical experimental research. As Bannon and Bødker (1991, p. 241) pointed out regarding studying artifacts (e.g., GraphoGame), “We cannot study them as things, [sic] we need to look at how they mediate use.” In other words, the focus of research must shift from the game itself to the actions taken when users interact with the game. The application of this theory creates a need to pinpoint exactly what players are doing in their interactions with a serious game. As a result, aspects influencing gameplay that otherwise tend to be hidden inside the black box may be revealed.

At the core of this theory is the concept of activity. Leontiev (1977) broke down activities into three interconnected hierarchical levels. At the top of this hierarchy is the *activity* that a person engages in (such as playing a serious game). *Actions* are segments consciously chosen by a person (the subject) to attain goals (the object) that typically relate to the motivation underpinning the undertaken activity (such as solving a task in the game), whereas *operations* are aspects of engagement whose performance does not require any conscious thought (such as clicking a mouse button or drawing on tacit knowledge).

Su, Feng, Hsu, and Yang (2013, p. 2577) stated that activity theory provides “a useful framework for conceptualizing technology as a dynamic mechanism that conditions and enables development and change in learners and in the mechanism itself.” Thus, the perception of the object of study as “a whole” limits the research approaches taken. The activity theory-based model for analyzing serious games and conceptual design proposed by Carvalho et al. (2015) made a distinction among gaming, learning, and instructional activities, further highlighting how the process of playing the game involves actors other than the player, such as game designers and teachers. The player engages in gaming and learning activities, which have separate tools and objectives. Game designers influence the game intrinsically, whereas the teachers responsible for deploying the game influence it extrinsically. Hence, this model provides a way to break down the components of the serious game and identify how players, designers, and teachers engage with it. The premise of this approach—that human activities take place in social contexts—enables not only exploration of the various actors involved with the game (i.e., researchers, designers, and others) and their interaction with the player through the game’s components but also exploration of the agents actually present during the playing of the game (i.e., teachers and students).

Learning and Entertainment in Serious Games

Balancing learning and entertainment in a game can be a complex prospect. Arnab et al. (2015) called attention to the challenge of incorporating established pedagogical approaches into serious games, that is, accounting for differences in perspectives among game designers and educators of what a learning game should be. With game designers leading the development process, games may be entertaining but lack essential processes for knowledge acquisition. However, when educators are in charge, the game may be efficient as a learning tool but not fun or motivating to play (Marne, Wisdom, Huynh-Kim-Bang, & Labat, 2012). Nothing prevents these two approaches from coexisting, but it would require stakeholders (i.e., game experts and pedagogical experts) to share a common language (Marne et al., 2012). Even so, as serious games are intended to promote knowledge, pedagogical approaches should underpin the design.

GraphoGame emphasizes the serious element of serious games but also makes use of game elements intended to engage and motivate players. A synthesis of research on Graphogame (McTigue et al., 2019) showed that GraphoGame may support users in developing sublexical skills and improving letter–sound knowledge and phonological processing. However, these authors found that the game supported better word reading only with strong adult interaction during play. McTigue et al. (2019) also provided an overview of Graphogame’s theoretical grounding, which included the simple view (Gough & Tunmer, 1986) word reading (Ehri, 2005), psycholinguistic grain size theory (Ziegler & Goswami, 2005), and orthographic depth hypothesis (Katz & Frost, 1992).

The Present Studies

The present paper is based on two studies. The aim of the first study was to investigate how game design influenced players’ progression through the game. The related research question was how the interaction between player and game was operationalized. The second study drew upon the exposition of game elements discovered in the first study and sought to investigate the direct consequences of this game design. The aim was to document any progress that became evident in 137 Norwegian first graders playing GraphoGame four times a week for 25 weeks and to relate this progress to the design elements of the game. The related research question regarded what differences in progress could be seen between a group of students initially identified as being at risk of reading and writing difficulties and a group initially identified as not being at risk of such difficulties.

User data were collected at 5-week intervals. They showed how far the students progressed through the game during the timeline of play. The division of students into groups was based on the results of a screening test administered at the onset of schooling. The at-risk group consisted of students identified as being in danger of developing reading difficulties ($n = 17$) whereas the regular (not at-risk) group consisted of the remaining students ($n = 130$). This division was made to explore the possibility of different progression trajectories based on students’ starting point.

STUDY 1: OPERATIONALIZING GRAPHOGAME

The aim of this first study was to explore the influence of GraphoGame's design on user progression. Hence, the primary research question sought to articulate how the interaction between player and game could be operationalized. In response to that question, a conceptual model detailing how progression occurs through GraphoGame was developed. This model pinpoints central design elements of the game, identifies how players interact with the game, and demonstrates how this interaction drives progression. The main function of this model is to make explicit certain components that would otherwise be hidden in the black box.

Theoretical Grounding for the Model

Generally speaking, the ways in which information flows between the player and the game influences how the interaction ultimately drives progression through play. Earlier models exploring the interaction between computers and humans provided inspiration for the operationalization of GraphoGame. Schomaker et al. (1995) presented a model providing a bird's-eye view of the interaction information flow as it alternates between human and computer through the interface (Figure 1). In brief, the computer captures human output (e.g., touch, voice) from its input modalities (e.g., mouse, keyboard, touch screen, microphone), processes this information according to its programming (marked as "cognition" in the model), and produces output media. The user perceives those media through human input channels (e.g., visual, audible, and tactile) and then mentally processes that information, which leads to the next cycle of information flow. The computer, the interface, and the human can be considered separate spaces in this interaction. Although this is a simplistic model, it provided a starting point for laying out the various spaces and stages in the model presented in this study.

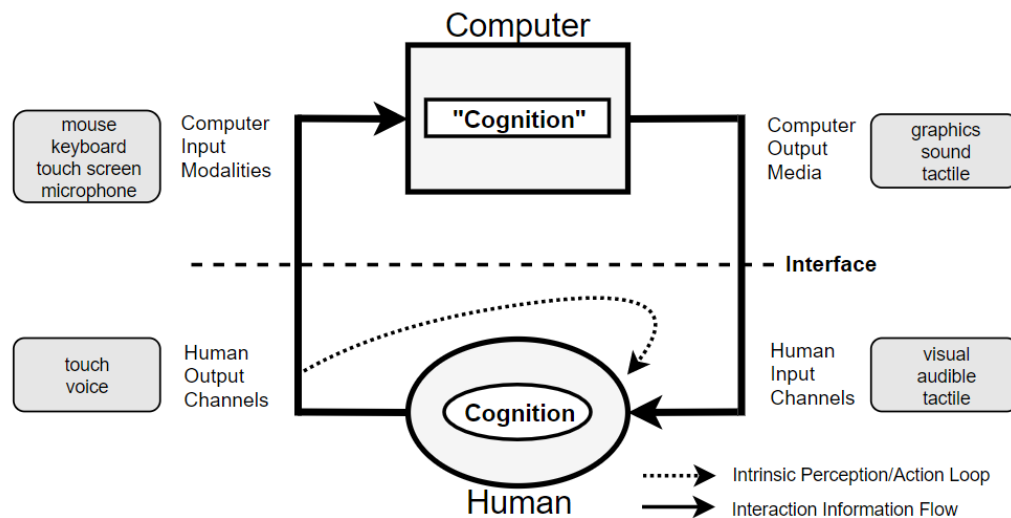


Figure 1. Basic model of human–computer interaction (adapted from Schomaker et al., 1995). This figure illustrates how information flows between computers and humans through various input and output channels, modalities, and media. Humans use their cognitive abilities to interpret the computer output and then take action by using their output channels. The computer processes this output through its programming ("cognition") and provides output media through the interface.

Bienkowski, Feng, and Means (2012) described the structure of an adaptive-learning system reflecting the continuous interaction between a student and that system (Figure 2). This interaction generates user data that are stored in a database. Those data are analyzed by a predictive model that aggregates the data, presents the aggregate to teachers through a dashboard, and feeds data about the student to its adaptation engine. This engine generates output content that suits the individual requirements of the student. (Some adaptive-learning systems, but not that of the present version of GraphoGame, also include an intervention engine that allows teachers or administrators to directly influence the content delivered to the student.)

Interactive Model of Progression Through GraphoGame

GraphoGame provides a learning environment where players may practice sound–letter correspondences. The content is presented as multiple-choice tasks, which represent the learning activity. A game starts with the player selecting one of the nine possible game modes.¹ A game mode represents a series of tasks that share the same theme. Figure 3 shows an example of a task from the Balloon Game.

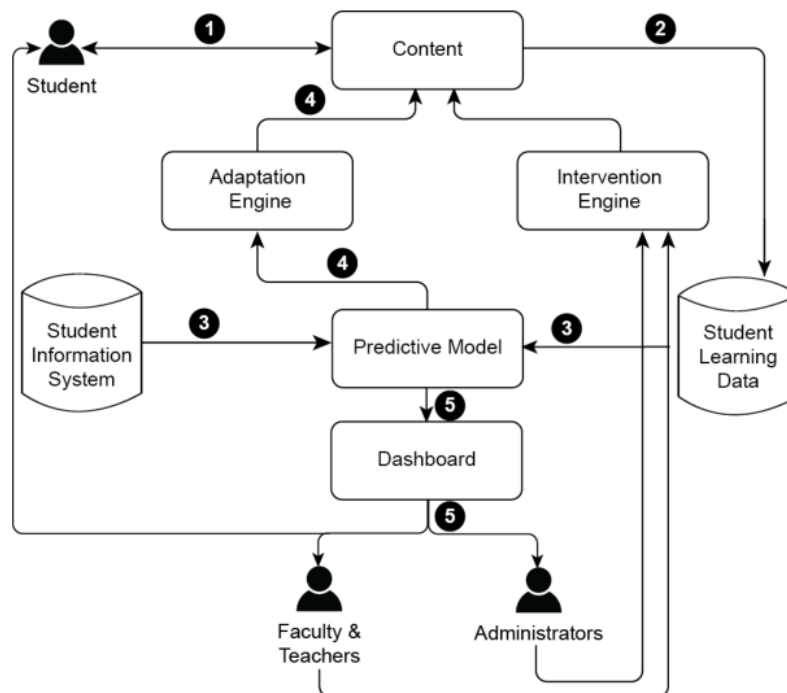


Figure 2. Diagram depicting data flow (the arrows) in a typical adaptive-learning system (ALS; Bienkowski et al., 2012). The model shows how students, administrators, and teachers interact with the various components of an ALS. The student interacts with the content (Line 1, bidirectional to emphasize the interaction aspect) and the outcome of this interaction is stored as student learning data (Line 2). These learning data, along with other student information, are funneled to the ALS's predictive model (Line 3). This combined information is used to create new content through the adaption engine (Line 4), which completes the cycle between student and ALS. In addition, this information can also be accessed by students, teachers, and administrators through a dashboard (Line 5), providing insight into students' performances. In addition, teachers and administrators may influence the content directly through the ALS's intervention engine.

As the player is presented with the graphical elements, as seen in Figure 3, the sound representing the word *gå* [walk] is played out loud. The player's task is to select the word that corresponds with this sound from three possible choices (i.e., one target and two distractors). Following this task, the player is presented with another task until all tasks in the game level have been completed. The yellow bar at the bottom of the screen indicates how far through this game the player has progressed. At completion, the player gets to choose a new game mode. The player may complete several game modes during a single play session.

In the following, I propose a model that details how the interaction between players and the game drives progression. The model produced during the first study (Figure 4) consists of five stages of a cycle that are positioned across three spaces: the *game space* represents the programming and data-access layers of the game, the *interface space* details the way players and the game interact, and the *mind space* deals with how the player processes the information presented through the user interface.

The five stages of interaction are distributed across three independent but interlinked spaces. The game state represents the values stored in the game to represent players' current progress through



Figure 3. An example of a multiple-choice task in Graphogame.

Figure 4. Five stages show the interaction between player and GraphoGame that drives progression through the game. The stages move from the program (game design), through the interface, and into the mind of the user, resulting in user reaction within the interface and a change in the game state. The cycle then repeats.

the game at any given time. Those values are used to generate trials (the learning task; *trial generation*), which are presented visually and aurally to the player through the user interface (*trial presentation*). The player then internally processes those visual and auditory cues (*mental processing*), which causes the player to take an action (i.e., a response to the perceived task) through interacting with the user interface (*user action*). Finally, the result of this action feeds and alters the game state, which in turn establishes the basis for the next trial, and so on. Progression through the game then takes place through continuous repetition of these stages of the model.

As an example of how these activity stages unfold, I present a case where the player first selects the Pirate Game on the selection screen shown between games. The first trial (Figure 5) is generated based on data relating to the player's current progression (i.e., based on prior play or from an initial level), taken from the game state. At the start of this trial, a recording of the sound /e/ is played and the letters *e*, *a*, *u*, *b* and *r* are shown on the screen. The player's task is to identify the letter (i.e., click *e*) that corresponds to the sound played. In this example, the player clicks on the correct item, and the game state is altered to reflect this. A new trial is then generated (Figure 6). The words *riv* [tear], *mur* [wall], *rot* [root] and *rim* [rhyme] are shown on the screen. The sound /riv/ is played and the player again makes the right choice by clicking on the balloon containing this word. After successfully completing the task, the player earns a reward (indicated by the coin appearing above the word *riv* after selecting it). The student then performs six more trials to complete the selected game mode. At this point, the player is presented with a new game-selection screen and may select a new game mode. In the following subsections, this example will be discussed in greater detail against the background of the individual stages of the model.

Game State

The game state represents the current state of various variables detailing a player's progression and performance in the game at any specific time during play. As the player interacts with the game, these values change to reflect the outcome of the player's actions. Two clusters of variables are discussed as part of the adaptive interaction cycle: *player knowledge* and *player performance*. The first of these clusters, player knowledge, includes variables that reflect how well the player knows the content of the game (a value assigned by the game that may or may not reflect a user's actual knowledge). These variables persist between game sessions. Each item in the game is

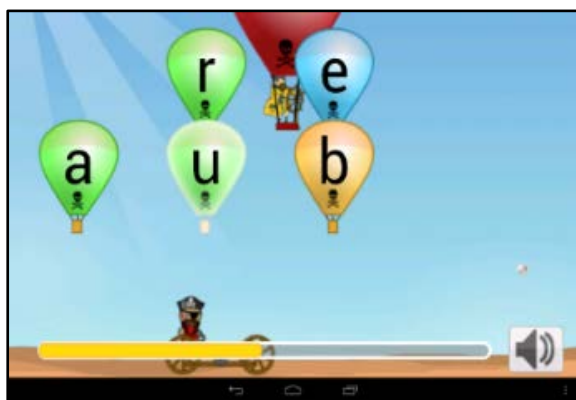


Figure 5. GraphoGame trial, player's initial trial.



Figure 6. GraphoGame trial, player's subsequent trial.

assigned a knowledge value, which is increased or decreased based on how the player responds in trials where that item is the target (i.e., the correct item). The amount of the incremental change is governed by the number of distractors (i.e., wrong items presented as options) in the trial. For example, the knowledge value of the target item *los* [pilot] will increase more after a successful trial if there were three distractors rather than two. Other variables are derived from the knowledge value of the items. For example, the game keeps track of how many items are known for each content type and for each group of items (dimension). Within the second cluster of variables, the game tracks player performance for each content type in the game (i.e., letter content, syllable content, and word content). Those values are based on performance in the last (up to) 10 trials, and they reset between play sessions. In other words, each time a player starts a new play session, his or her player performance needs to be re-established. The player's performance variable for each content type increases or decreases throughout a gaming session as the player makes correct or incorrect selections for that specific content.

The Norwegian-language version of GraphoGame includes a total of 730 items as targets and/or distractors that a student may encounter during play (see Appendix A). These items are divided into three content types: letter content (24 items), syllable content (272 items), and word content (434 items). The items are further organized into dimensions (i.e., item groups) in roughly an ascending order of difficulty. Letter Dimension 1 consists of the letters that are considered the easiest to learn, whereas Letter Dimensions 2 and 3 include more challenging letters. (Three letters of the Norwegian alphabet have been omitted: *c*, *q* and *z*; these letters appear infrequently in the Norwegian language and are typically not focused on at the onset of letter instruction.) Syllable content consists of two- or three-letter one-syllable words divided into 22 dimensions, each containing a median of 15 target items. The items included in a dimension were grouped together on the basis of specific criteria. For example, the items in Syllable Dimension 1 consist entirely of letters from Letter Dimension 1 (e.g., *er* [am/is/are], *is* [ice], *om* [about]); the items in Syllable Dimension 2 consist of letters from Letter Dimensions 1 and 2 (e.g., *at* [to], *av* [of], *en* [one]); and the items in Syllable Dimension 3 all start with a consonant (e.g., *ta* [take], *be* [pray], *fe* [livestock]). Word content consists of three- to six-letter words divided into 90 dimensions. A median of 12 targets are included in each dimension (excluding dimensions consisting of minimal pairs, i.e., words that differ with respect to a single sound, such as *ul* [howl] and *ull* [wool]). The first seven dimensions consist of three-letter words whereas Dimensions 8–19 include words with double consonants (representing a common spelling difficulty in Norwegian). Dimensions 20–84 consist of minimal pairs. Finally, Dimensions 85–90 include more difficult words including digraphs, that is, cases where several letters are used to represent a single sound.

Trial Generation

To generate trials, GraphoGame uses an adaptation engine. (This term encompasses all components of a game involved in the generation of trials.) Concretely, trials are generated by algorithms that use the current values of variables (i.e., the game state) as their starting point. The adaptation engine's task is to advance the player through the game while recalibrating the difficulty level if the player performs poorly. In other words, the adaptation engine predicts what will lead to the best outcome for the player and generates a trial based on this. Typically, it will tend to step up the difficulty level. However, if a player's performance drops below a certain threshold, the engine will generate easier trials to keep the player engaged. This accuracy

threshold varies across content types; it is 85% for letter content, 75% for syllable content, and 65% for word content.

Trial generation is a two-step process. In the first step, the adaptation engine selects a content type for the trial (i.e., letters, syllables, or words) based on player knowledge and player performance (see the game state stage). If the player is deemed to know fewer than 40% of the letters, the content type is restricted to letter content.² Beyond this threshold, there is a likelihood for initiating other content types, and this likelihood increases drastically once a player knows all 24 letters. The basic likelihood of syllable content is inversely proportional to the likelihood of letter content. For example (assuming no likelihood of word content, as is the case at earlier stages of game use), if the likelihood of letter content is 35%, then that of syllable content is 65%. If a player is performing well on syllable content,³ the likelihoods are recalculated⁴ in favor of word content. The likelihood of word content is calculated based on the combined likelihood of letter content and syllable content.⁵ For example, if the likelihood is 10% for letter content and 30% for syllable content, the likelihood of word content will be 60%.

The second step of trial generation is based on the outcome of the first step: The adaptation engine assembles a list of items (one target and one or more distractors), all from a single dimension of the content type selected at the previous stage. If the player is performing poorly, easier trials are generated, whereas if the player is performing well, more difficult trials are created. For example, Figure 7 shows a trial consisting of one target and four distractors from Syllable Dimension 9. The adaptation engine first created a list of suitable dimensions based on the percentage of known items in each dimension. For easy trials, known items are preferred; these are selected from dimensions with a percentage of known items greater than the target percentage for the content type in question. The opposite is true for difficult items. For instance, if a player knows 85% of the syllables in Syllable Dimension 3 and 45% of those in Syllable Dimension 4, a difficult trial may have an unknown word from Syllable Dimension 4 as target whereas the target of an easy trial may be a known item from Syllable Dimension 3. For syllable and word content, the number of distractors is increased by one after a correct answer and decreased by one after an incorrect answer to a maximum of four. For letter content, the maximum number of distractors is six.

Trial Presentation

After a trial has been generated, it is presented to the player through the user interface in visual and auditory forms. The interface can be seen as a mediating tool with which the player interacts as part of playing GraphoGame. The game area is assembled from graphical elements of various shapes and functions. Some of these can be interacted with (e.g., the objects representing items in Figures 6 and 7), but most are purely visual (e.g., the background image).

GraphoGame presents nine different game modes, each with a different visual profile and minor variations in gameplay. Figure 7 shows the game area for the Balloon Game, and Figure 8 shows that for the Pirate Game. In the Balloon Game, the player avatar is displayed on-screen; in the Pirate Game, a pirate with a cannon and a pirate flying a red balloon are displayed. The tile shapes that represent the items are also different: circle-shaped or shaped like hot-air balloons.

As the examples show, the presentation of the tasks varies. There are slight differences between the nine game modes available, but the core gameplay remains the same across all



Figure 7. Balloon Game, three syllable items.



Figure 8. Pirate Game, five letter items.

game modes. For example, in the Balloon Game, a player receives auditory feedback if he or she selects the wrong item, but that item remains visible on the screen until the player correctly identifies the target. Consecutive unsuccessful trials in the Balloon Game will have one fewer distractors until there is only one item left, which ends the game. By contrast, if a player selects a distractor in the Worm Game, all distractors vanish, leaving only the target item on the screen. The player is then required to click on this item before proceeding to the next trial. Additional gameplay factors are programmed into the game, such as time limits, but they are not activated until a player has progressed quite far in the game.

GraphoGame also provides incentives to keep the players motivated. Players earn coins for each successful trial played, which they may use in the in-game shop to buy accessories with which to dress their avatar. Those accessories have no effect on gameplay but are included in the game as an incentive to keep on playing.

The game has a high degree of transparency, meaning a player who wants to engage the game finds few barriers to that goal. However, user agency is limited when playing the game. In fact, the only thing the player can do is to click on an object containing one of the items that are part of the trial.

Mental Processing

As the player perceives the visual and auditory presentation of the trials, the player's brain will process the incoming stimuli and prompt the player to interact with the game. To answer correctly without guessing, the player needs knowledge about the correspondence between the spoken letter or word and its visual representation. The player's perceptive faculties, both visual and auditory, are required to perform the task correctly or to expand knowledge after an incorrect answer. For each consecutive trial containing the same target, the player's knowledge should increase, making it more likely that the correspondence concerned is correctly identified.

These repetitions are intended to aid the player in mapping the spoken language to the written language, an important step toward learning to read (U. Richardson & Lyytinen, 2014, p. 43). GraphoGame applies a synthetic phonics approach, where speech sounds (letter content) are introduced first, which may then be used to decode words that include these sounds (U. Richardson & Lyytinen, 2014, p. 45). As players continuously process trials, their ability to read words is expected to improve steadily.

However, this view of knowledge expanding as a direct consequence of the interaction between player and game is not sufficient, as the knowledge that the players show when playing the game may also originate from outside of the game. Rather than restricting the perspective to include only the interaction between player and game and the context in which the game is employed as part of classroom play, it is preferable to take a broader language-learning perspective where the player of the game also will build skills of the type that are transferrable to other contexts. In addition to knowledge gained from playing GraphoGame, players also would strengthen their knowledge of phoneme–grapheme correspondence by participating in other teacher-guided activities aimed at developing letter knowledge and word recognition. Further, other language-learning strategies may be introduced outside of the phonics approach deployed by the game that may lead players to apply these strategies when playing the game. For example, some students may have developed orthographic reading skills, which is an applicable strategy when identifying word content.

Player Action

It may be assumed that a player's action is the outcome of the mental processes triggered by the visual and auditory input from the user interface. When players engage with the game through the user interface, they make choices by way of clicking on one of the items presented. This click results from a conscious or unconscious process occurring in the brain, something that can be observed only indirectly through actions taken. After mentally processing the trial, the player interacts physically with the user interface by selecting one of the items. This action, from the perspective of activity theory, represents the player's (i.e., the subject of the action) goal of selecting the correct item in a trial (i.e., the object of the action) by using the various tools available in GraphoGame.

The question of what lies behind the action of clicking on a specific item is complicated. In a somewhat simplistic reasoning, a player making the appropriate choice based on knowledge rather than luck must correctly identify the sound(s), must know the letter corresponding to each sound, and must properly match the sounds to the corresponding letters. These represent the necessary components to adequately decode the letters and words encountered in the game. This game-related outcome requires the player to possess an adequate level of knowledge, either learned from playing the game or from other sources outside of the game. The actions the student performs when faced with each new trial in the game will govern his or her progress through the game, as those actions adjust the current game state and hence change the premises for the next trial generation.

Model Summary

In the proposed model, five stages detail how the interaction between student and game takes place and how this interaction drives user progression. This operationalization of gameplay provides a way in which to interpret game data and to identify connections that might otherwise have remained hidden. Progress in a game is governed by the design of the content used and by the adaptation engine that facilitates the distribution of this content based on player interaction. Because this distribution of content is based on specific instructional methods (phonics), progression also may demonstrate the scaffolding of learning based on this method. The activity

of playing the game creates a learning environment that exploits the affordances of digital technology: storage and retrieval of data occurs instantly, and the data are used to assemble new, customized tasks on demand and in real time.

STUDY 2: PROGRESSION THROUGH GRAPHOGAME

In this second study, I investigated the effects of game design on student progression. The research question focused on what differences in progress could be seen between at-risk and other students. The availability of two groups based on their school-starting evaluation made it possible to explore whether their progression through GraphoGame varied depending on their baseline skill levels. The purpose of this study was to identify implications of GraphoGame's design as observed through the user data recorded from the students' actions. This ties in with the overarching aim of exploring how design and context of play influence measured output, which in this study is represented as progression through the game.

Method

Deployment and Participants

The Norwegian version of GraphoGame was developed to be part of the On Track intervention study. This was a randomized controlled trial aiming to investigate the effect of an early-intervention strategy to prevent the development of reading difficulties (Lundetræ, Solheim, Schwippert, & Uppstad, 2017). The participants in the present study belong to an On Track subsample from two schools where GraphoGame was played by all students in the classes ($N = 137$), not only by those identified at risk of developing reading and writing difficulties. All students received ordinary reading and writing instruction supplemented with the element of playing GraphoGame for specified amounts of time. The students were all first-graders and 5 to 6 years old; the majority of them were native Norwegian speakers.

The students underwent a set of diagnostic tests at the onset of schooling designed to identify those who might be at risk of developing reading difficulties. The tests were specifically developed for the On Track intervention study. Those screening tests provide an opportunity to differentiate GraphoGame players (as opposed to other interventions employed as part of the On Track program) and to explore the extent to which students' prereading skills influenced their progression through the game. This could provide insights into how learning may occur through the game based on existing knowledge at the start of the interventions; it also could yield information about how the adaptation engine adjusts content based on the players' previous knowledge. The screening tests included letter knowledge and rapid automatized naming as well as isolation and blending of phonemes (i.e., language sounds). Students scoring below the 30th percentile on any of these three tests were given one risk point for each test. They were also given one additional risk point if at least two close relatives reported having reading difficulties. Students obtaining three or more risk points in all were categorized as at risk. This yielded an at-risk group ($n = 17$) and a regular (not-at-risk) group ($n = 120$).

Data Collection

Progression data were segmented into five measuring periods of 5 weeks each (excluding holidays). Table 1 shows the time span for each period. The fourth and fifth periods were extended by one week owing to the winter holidays.

Two data sets were generated. The first was exported directly from the database containing students' user data for each of the five measuring periods and also for all periods combined. The exported data related to the number of days played, the number of trials played, and the time spent playing trials in the game. The second data set was manually collected from the GraphoGame website, where various types of aggregated data from the database are presented. This included game logs showing current progression in terms of items known at the onset of each trial played. The status of known items was given for the most recent play session for each student within each time period. In addition, known items were manually correlated to content type, as the list of known items did not show this information. If an item was found in more than one content type or dimension, the lowest one was used to indicate progress (see Appendix A for item lists).

Data Analysis

Progression was measured separately for the regular group and the at-risk group. Then the groups were compared to identify any significant differences. In testing the null hypothesis (H_0), I confirmed that no difference existed between the two groups in their progression as measured with the user data relating to known items that had been extracted. The significance threshold was set to .05.

Two approaches were taken to exploring the data, each yielding one block. The first block contained data for days played, trials played, and time spent playing. These data were presented for each measurement period as well as for the total timeline of play. Because of the difference in size and variance between the two groups, Welch's *t*-test (i.e., a test that does not require the assumption of equal variance) was used to test the validity of the null hypothesis.

The second block of data detailed players' overall progression and their progression for each content type. These data were presented as boxplots, which provide a clear picture of the distribution of player progression. Because boxplots use median values, the Mann–Whitney *U* test was used to test the null hypothesis for this block. Data that summarize a complete period

Table 1. Span of Time for Each of the Five Measuring Periods Used to Assess Progress.

Period	From	Until	Time span
P1	2014/10/13	2014/11/14	32 days
P2	2014/11/17	2014/12/19	32 days
P3	2015/01/05	2015/02/06	32 days
P4	2015/02/09	2015/03/20	39 days*
P5	2015/03/23	2015/05/05#	43 days*

Note. *The time span for the last two measuring periods were extended due to school holidays. #Students at School A ended gameplay 04/30 while students at School B ended gameplay 05/05.

are referred to as P1 ... P5, whereas measurement points (snapshots) of progression are referred to as M1 ... M5.

Results: Play Sessions, Trials Played, and Time Spent Playing

Table 2 shows that the regular group played more sessions ($M = 83.7$, $SD = 7.1$) than the at-risk group ($M = 79.1$, $SD = 8.0$). However, this difference was not significant ($p = .039$).

Table 3 shows the total number of minutes spent playing in the different measuring periods and in total across the timeline of play. The regular group ($M = 516$, $SD = 82$) played the game for slightly longer each session than the at-risk group ($M = 479$, $SD = 76$), but this difference was not significant ($p = .078$).

Table 4 shows the number of trials completed by the students during each measuring period and in total. The regular group played more trials ($M = 7260$, $SD = 1864$) than the at-risk group ($M = 5948$, $SD = 847$), and this difference was strongly significant at $p < .001$. During the intervention timeline, the at-risk group actually kept pace with the regular group during the first two periods (P1: $p = .557$ and P2: $p = .946$), but the difference between the groups was strongly significant throughout the rest of the intervention (P3: $p = .002$, P4: $p < .001$, P5: $p < .001$).

Table 5 shows the average number of minutes spent playing during each play session. The regular group ($M = 6.15$, $SD = 0.72$) and the at-risk group ($M = 6.04$, $SD = 0.57$) played for a similar duration per session; there is strong statistical support for this conclusion ($p = .481$).

Table 2. Number of Play Sessions in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	17.4	15.2	18.3	18.1	14.5	83.7
	<i>SD</i>	1.6	1.7	2.0	2.5	3.0	7.1
At Risk	<i>M</i>	16.8	15.8	17.3	16.7	12.6	79.1
	<i>SD</i>	2.5	1.3	2.1	3.0	4.1	8.0

Note. *M* = mean; *SD* = standard deviation

Table 3. Time Played, in Minutes, in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	114	92	115	109	86	516
	<i>SD</i>	18	17	21	27	29	82
At Risk	<i>M</i>	109	94	106	99	71	479
	<i>SD</i>	20	12	19	30	32	76

Note. *M* = mean; *SD* = standard deviation.

Table 4. Number of Trials Played in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	1648	1256	1567	1560	1229	7260
	<i>SD</i>	355	360	489	673	525	1864
At Risk	<i>M</i>	1598	1251	1298	1035	766	5948
	<i>SD</i>	323	268	272	330	310	847

Note. *M* = mean; *SD* = standard deviation.

Table 5. Time Played per Session, in Minutes, in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	6.51	6.02	6.25	5.98	5.86	6.15
	<i>SD</i>	0.80	0.88	0.93	1.04	1.28	0.72
At Risk	<i>M</i>	6.51	5.98	6.10	5.83	5.56	6.04
	<i>SD</i>	0.55	0.74	0.80	0.98	1.13	0.57

Note. *M* = mean; *SD* = standard deviation.

Results: Longitudinal Progression

Overall Progression

Overall progression (see Appendix B, Table B1) was measured in terms of the number of known items out of the total number of items in the game ($N = 730$) at each measuring point along the timeline. The boxplots shown in Figure 9 give an overview of total progression across the intervention period.

The boxplots indicate the percentages of known items (y-axis) for the regular group and the at-risk group at the five measuring points (x-axis). There were no outliers in either group. The regular group had progressed further than the at-risk group at all measuring points, and this difference was strongly significant at $p > .001$ in all cases. The interquartile range was fairly consistent along the timeline for both groups, with the at-risk group more closely clustered together. For the regular group as a whole, the range of progression covered almost the full inventory of items (especially towards the end of the intervention period), and a steady rise in median progression was seen throughout the period; the at-risk group progressed more slowly and had a more limited overall range of progression. Comparison of the two groups shows that regular group accelerated away from the at-risk group throughout the intervention: At M1, the average difference between the groups was 61 known items, but at M5 this had increased to 141 known items.

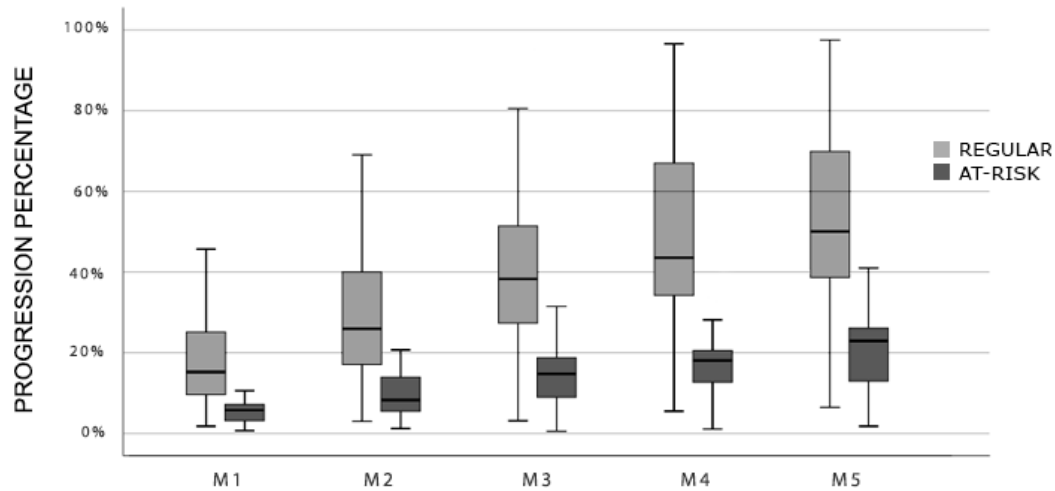


Figure 9. The figure shows boxplots of percentage overall progression for regular and at-risk students through GraphoGame at each of the five measuring points (M1 ... M5).

Letter Content Progression

Letter content (see Appendix A, Letter Items, and Appendix B, Table B2) is the first type of content encountered in the game, and progression to other types of content is held back until a player knows at least 40% of the letters. Given that M1 occurred after approximately 18 play sessions, the specific point where the students progressed from only letter content to letter and syllable content was not captured. The boxplots in Figure 10 show the median and percentile progression for known letters throughout the intervention period.

Most students in the regular group knew all letters at M1 and onwards ($Mdn = 24$). The at-risk group progressed more slowly, with a median of 20 known letters (83.3%) at the first measuring point (M1) and 23 (95.8%) at M2. Further along the timeline, most at-risk students knew all the letters ($Mdn = 24$). It should be noted that the outliers who can be seen in the regular group represent a small group of students (less than 5%) who progressed significantly more slowly than the rest of that group. There was a significant difference between the groups at all measuring points along the timeline ($p < .001$).

Syllable Content Progression

Syllable content (see Appendix A, Syllable Items, and Appendix B, Table B3) is the second content type encountered in the game. The boxplots in Figure 11 show the different patterns for the two groups' progression with regard to syllable content.

At M1, the regular group knew a median of 90 syllables (33.1%). This increased to 169 known syllables (62.1%) at M2 and to 251 known syllables (92.3%) at M3, at which point the regular group had thus largely mastered all of the syllable content. After this there was a plateau during the rest of the intervention period. For the at-risk group, the progression curve is rather linear throughout the intervention period. At M1, the median was 23 known syllables (8.5%). At M2, this had increased slightly to 37 known syllables (13.6%), and further along the timeline there

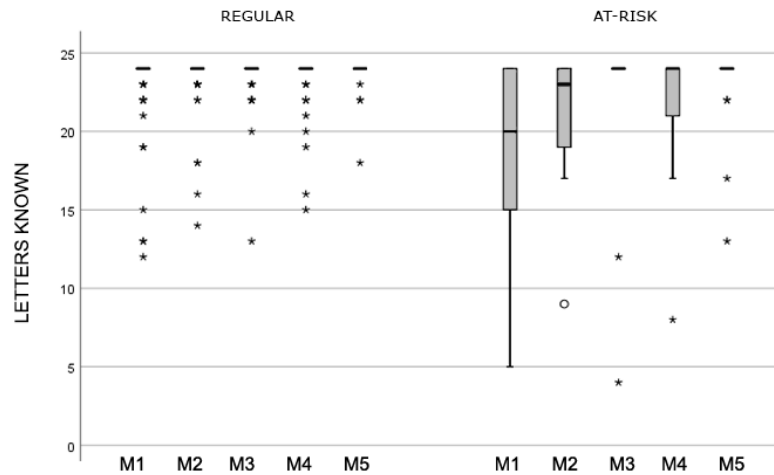


Figure 10. The figure shows boxplots of letter-content progression for regular and at-risk students through Graphogame at five measuring points (M1 ... M5). The y-axis shows how many letters were known out of a maximum of 24 letters.

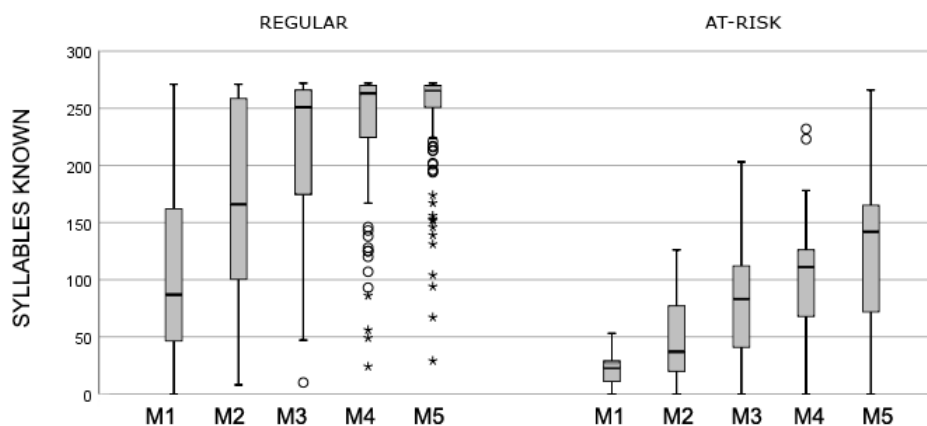


Figure 11. The figure shows boxplots of syllable-content progression for regular and at-risk students at five measuring points (M1 ... M5). The y-axis shows how many syllables were known out of a maximum of 272 syllables.

there was a steady increase: 83 known syllables (30.5%) at M3, 111 known syllables (40.8%) at M4, and 142 known syllables (52.2%) at M5. The interquartile range narrowed in the regular group, largely as a result of the plateau, but remained similar across the intervention period in the linearly developing at-risk group. Notably, syllable content was the content type where the members of the at-risk group spent most of their game-playing time, whereas most members of the regular group progressed past the syllable stage during the third measuring period. There was a significant difference between the groups in all five periods ($p < .001$). In contrast to letter content, which most players learned during the first period, progression with respect to syllable content was spread out across the periods to a greater extent.

Word Content Progression

Word content (see Appendix A, Word Items, and Appendix B, Table B4) is the last type of content encountered. This content type also accounts for most of the content in GraphoGame, which has 60% more word items than syllable items. The boxplots in Figure 12 show that only the regular group made any significant progress with word content.

At the first two measurement points, only a few students in the regular group (the outliers) had made any significant progress in terms of words known. At M3, the median for the regular group was 6 known words (1.4%), whereas at M4 the median had increased to 35 known words (8.1%). However, at that point, the upper quartile was already at 197 known words (45.8%). At M5, the median was 76 known words (17.6%) and there had been a slight increase in the upper quartile to 214 words (49.8%). The at-risk group made only negligible progress with respect to word content throughout the intervention period.

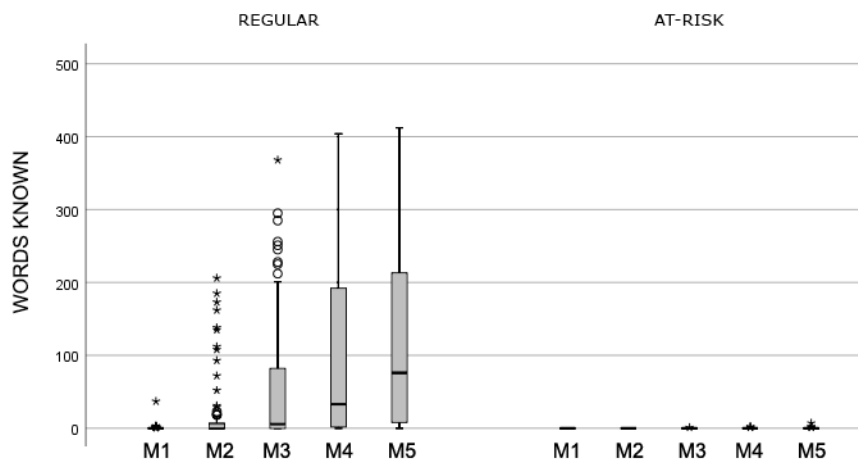


Figure 12. The figure shows boxplots of word-content progression for regular and at-risk at five measuring points (M1 ... M5). The y-axis shows how many words were known out of a maximum of 434 words.

GENERAL DISCUSSION

Players' progression through GraphoGame is inherently tied both to features of game design and to the context of play: The game design establishes the premises for progression, whereas playing the game realizes those premises. In the following subsections, I discuss the three overlapping factors that influence progression, namely content design, play time, and adaptation design. These factors were identified as a result of applying the knowledge obtained from Study 1 in order to contextualize the findings made in Study 2.

In reading the analysis below, I must emphasize that I do not make any strong claims about learning outcomes as a result of this research. It is impossible to know exactly, from the data collected, what the participants have internalized as a result of playing even though progression is operationalized using the measurements of the number of known items (out of all 730 items

available). Further, the factors that emerged from the juxtaposition of the two studies are not intended as a definite exploration of possible factors.

Progression Through GraphoGame

Content Design

Most students did not encounter the full range of content available during the play period, yet even so, progression unfolded differently in the regular group as compared to the at-risk group. At the last measuring point, after 25 weeks of play, the overall progression of the regular group fell just short of the halfway point in terms of items known (49.7%), with a mean of 7,292 trials played across 85 play sessions. For the at-risk group, progression at that point was less than a quarter (22.7%), with a mean of 5,986 trials played across 79.8 play sessions.

A closer look at progression for the individual content types provides a more nuanced picture. The transitions between content types show how quickly players moved from letter content via syllable content (two- or three-letter words) to word content (four- to six-letter words and minimal pairs). Most students in the regular group knew all of the letter content at the first measuring point (i.e., after an average of approximately 17 play sessions across 5 weeks), whereas many students in the at-risk group were still engaged with letter content at the second measuring point. In other words, it took the average at-risk student more than 30 play sessions across 10 weeks to progress past the letters. For syllable content, the regular group saw steady progression from the start, leading to a plateau, reflecting the fact that the majority knew most or all syllable content at the third measuring point (about 50 play sessions across 15 weeks). By contrast, the at-risk group manifested a linear progression throughout the play period, with a median progression just past the halfway point for syllables at the end of the 25-week period. When it comes to word content, only the regular group achieved any noticeable progression, and it was not until the third measuring point that the majority had made any significant progress. At the end of the play period, the median proportion of known word items was 17.6% for the regular group and zero for the at-risk group.

One possible interpretation of these results is that there is too much content in the game for the average pupil to encounter during an extended play period. However, other factors also need to be considered. The time spent playing and the workings of the adaptation engine cannot be separated from content design when discussing progression. In reality, both at-risk and regular students should be able to complete the game, given enough time, and progression might have been faster if the adaptive algorithms had been adjusted. That said, faster progression does not equal a better game. Even though no measurement specifically pertains to learning, the content of GraphoGame is designed and distributed in line with established theories of language learning that suggest that a slower pace of progression may be better in regard to long-term learning outcomes. In other words, content design is not just about the amount of content included, but also about instructional aspects leading to mastery of fundamental elements essential to reading.

The time factor can be seen as consisting of two aspects: how much time is spent playing and how the adaptation engine adjusts the measure of player performance between game sessions. In this case, playing GraphoGame was an activity carried out as part of regular classes, with 10 minutes allocated to play and 5 minutes for the teacher to start up the activity. The data collected show that of their 10 play minutes, players devoted approximately 6 minutes to engaging in trials. The data do not show how much time students devoted to other activities in

the game, such as browsing the in-game store or customizing their avatar, but this should account for a significant part of the remaining four minutes. Adding a single minute of effective gameplay to each play session would increase the total number of trials played during the entire play period by 800–1200, if all other factors remained the same.

The short bursts of play a few times a week are engulfed in large chunks of time when the students are not playing. During that time, knowledge may regress, meaning that what was known at the end of the last play session may not have been retained over time. As mentioned above, although the game stores knowledge about each item between play sessions, player performance resets at the start of each new session. Although player performance is not the only factor influencing content generation, this does mean that a player will have to perform a few trials before attaining his or her previous performance level. The likelihood of being presented with easier content from lower dimensions and content types is thus higher at the beginning of a new session. Considering that a typical play session involves only around 70–90 trials, this design choice may play a significant role for the pace of progression.

Adaptation Design

The adaptive algorithm in GraphoGame is calibrated to let players encounter items and correctly identify them enough times for it to be reasonably certain that the item in question has been mastered. In order to progress through the game, a player needs to know most items from lower dimensions and to perform better than the target percentage for each content type. This means that if a player makes a few wrong choices, the adaptation engine will provide already-known content from lower dimensions. This slows down the pace of progression but may result in better long-term learning outcomes as the adaptive algorithm ensures that the player knows all of the letters that make up items in the syllable and word content. This principle may reflect a good design choice, as it ensures, for example, that players' progression is not overextended. However, the adaptation engine needs to serve two distinct purposes. Besides preventing students from progressing too fast, it must also correctly and effectively identify items as known to ensure a steady rate of progression and avoid students being held back (which may cause them to become bored). GraphoGame has a single algorithm for all players, which means that this serves as a significant factor in progression.

The players' progression as observed over the 25-week play period opens up interesting inquiries, such as how much content should be included in relation to the total play period and how long and how frequently should the students play the game. The discrepancy found here between the regular group and the at-risk group brings additional questions to the fore, such as whether, and if so how, the adaptation engine could/should be altered to promote better learning in players of varying skill levels, or whether the learners' progression would be better served by developing multiple versions of that engine. Although answering those questions falls outside the scope of this paper, my surfacing the questions has resulted from the juxtaposition of the study of game design and content with the study of outcomes of use, suggesting that the overall design of the present paper, with two studies of different types, has been a fruitful one.

The Activity of Playing GraphoGame

Activity theory establishes that human activity occurs in social contexts. From this perspective, the activity of playing GraphoGame may expand beyond the direct interaction between

students and the game. On the one hand, the teachers who used GraphoGame as part of early reading instruction extrinsically influenced the activity, as did the researchers who determined how GraphoGame should be engaged (e.g., 10-minute play sessions 3-4 times a week). On the other hand, GraphoGame's developers and content designers intrinsically influenced the activity through the design of the game (e.g., adaptation design, trial presentation, content organization). In other words, some actors influenced the immediate environment of play, whereas others extended their influence through GraphoGame's code. A shared motive between the influencing actors may be that playing GraphoGame helps students on their path toward learning to read by strengthening their knowledge of letter-sound correspondences. As the students act with the game by following their own objectives (e.g., solving tasks, earning coins) and using the various tools the game offers, they, perhaps inadvertently, work towards this motive.

CONCLUSIONS

The median progression through GraphoGame in terms of items known was approximately 50%, with the at-risk group progressing significantly more slowly than the regular group. The juxtaposition of the two studies carried out yielded three factors that may provide part of the explanation for this finding: (a) the amount and structure (types and dimensions) of the content established the boundaries for maximum progression, whereas (b) the time spent playing the game and (c) the way the adaptation engine worked influenced how far through the game the students progressed. The factors discussed are not weighted in terms of their influence on progression. This does not mean that they are of equal influence, but rather that their relative importance is not considered here. Further, the progression as measured is not intended to reflect the quality of the factors discussed.

This approach to research is important yet underrepresented in the research field, where the prevailing approach is to measure output from use without regard to the underpinning factors behind this output. Drawing connections between specific game-design components and output can be beneficial in many ways. For teachers, insights of such connections may inform them of better ways of deploying the game in the classroom. For example, knowing that at-risk pupils progress significantly slower may be used to provide them with additional play time or adult supervision during play. For game developers, there are insights that may inform of ways to improve the game. For example, the content in the game may benefit from being restructured and the possibility of different versions of the game to better suit different players may also be considered.

To draw such connections, game design needs to be researched and understood with equal emphasis as on designing appropriate research means to capture data about players' interaction with specific game components. As this research has demonstrated, such connections can reveal important and actionable data that may be implemented to improve similar interventions. Further, this research revealed knowledge that may lead to better informed decisions by those who use GraphoGame, for example, as part of language instruction in the classroom or when designing studies.

Although various factors influencing progression have been brought to light, much still resides unknown in the black box. For instance, what activities are the students engaged with in the 4 minutes during each play session when they are not actively engaged with trials? Further, does the knowledge GraphoGame holds in its data banks align with knowledge measured outside of the game? Last, what are the reasons for the discrepancy in progression

between the regular and at-risk students? These are questions where the answers are still obscured, and thus warrant further research.

IMPLICATIONS FOR RESEARCH

This paper provides an example of how studies of game design and outcome from use may be juxtaposed. This research also highlights how such an approach may yield insights about a game that are beneficial to researchers, game developers, and educators. Although my data highlight the benefits for GraphoGame, other serious games could benefit as well. Similar studies should be carried out to establish a broader understanding of which components in a game are linked to outcome as measured. Even mainly experimental studies can be expanded in scope to include knowledge that may feed back into design or be applied in educational settings. Researchers should strive to develop methodologies specifically designed to enable the drawing of parallels between game design and outcomes from use.

ENDNOTES

1. The nine game modes are balloon game, fishing game, flow game, basic game, ladder game, pirate game, race game, star game, and basic GraphoGame. Each game mode has slight variations in game play and how the multiple-choice tasks work.
2. The likelihood of letter content is between 33% and 100%. If the player knows all the letters, the likelihood is between 5% and 100%.
3. If the player performance is higher than 0.7, the likelihood of each type of content is recalculated in favor of word content. Further, if the performance is even better (higher than 0.9), the likelihood of syllable content is capped at 30%.
4. The recalculated formula for the likelihood of words takes into consideration the percentage of known syllables and the current performance with syllable content. Higher values indicate higher probability for word content.
5. The chance for word content equals 1 minus the chance for letters and syllables.

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APPENDIX A: LEARNING CONTENT

These tables show the items and dimensions for each content type in the Norwegian version of GraphoGame.

Letter Items (3 dimensions)

1. i, l, s, o, e, a, m, r
2. u, t, b, f, n, v, k, å
3. h, p, d, g, æ, y, ø, j

Syllable Items (22 dimensions)

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 2. at, av, en, et, ik, ul, ur, ål, år, ås ~ er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 3. ta, be, fe, te, ni, ti, vi, bo, mo, to, ru, lå, må, rå, så ~ at, av, en, et, ik, ul, ur, ål, år, ås 4. ut, ku, åk, åt, få, nå, tå ~ ta, be, fe, te, ni, ti, vi, bo, mo, to, ru, lå, må, rå, så 5. ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bøl, kø, mø, på ~ ut, ku, åk, åt, få, nå, tå 6. du, by, fy, ny, bæ, hæ, øk, øm, ør, dø ~ ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bøl, kø, mø, på 7. lam, lar, sal, ler, mer, ser, les, sel, ser, rom, som, mor, ror, los, mos, ros, mot, ris, lim 8. lat, mat, lav, rav, lag, sag, sak, men, ren, sen, let, lek, let, lev, lik, rik 9. sik, lin, liv, rim, riv, siv, rot, lur, rur, mur, sur, lus, mus, sur 10. rop, lyr, myr, syr, lyn, lys, syk, syl, syn, syr, syt, lær, nær, sær, løk, søk 11. røm, søm, mør, rør, sør, røv, møt, søl, söt, måk, råk, mål, lår, mår, rår, sår | <ol style="list-style-type: none"> 12. lås, låt, lån, råd 13. kav, nav, tak, tap, tar, fet, vet, ber, fik, vik, fis, nil, vin, bom, kom, tom 14. vom, bor, kor, for, kos, bok, bot, tok, tom, kul, bur, kur, tur, nut, tut 15. tid, bod, tog, byr, fyr, tyr, fyk, nys, nyt, vær, bær, tær, vær, bøk, tøm, bør 16. før, tør, kåk, våk, bål, kål, nål, tål, får, kår, når, tår, vår, bås, vås, båt 17. det, hat, han, har, den, pen, het, der, her, dis, gir, dor, hos, gul, hul, jul 18. dur, jur, duk, dum, dun, dus, hus, jus, pus, dyr, hær, døm, dør, hør, døv, død 19. hål, går, hår 20. ei, øy, au, ai ~ er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 21. kai, sau, rau, tau, lei, nei, sei, bøyy, eng, ung 22. hai, hoi, hei ~ ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bøl, kø, mø, på |
|---|---|

Note: Items following ~ are picked only as distractors.

Word Items (90 dimensions)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. sale, lese, sele, more, lose, mose, rose, rise, lime, late, mate, rave, lage 2. sage, sene, leve, like, rike, line, rime, rive, rote, lure, mure, sure, rope 3. lyne, lyse, syke, syre, syte, lære, nære, sære, søke, møre, røre, røve, møte 4. søle, søte, måke, måle, såre, låse, låte, låne, råde, kave, tape, fike, vike 5. fise, bore, kore, fore, kose, kule, tute, fyre, fyke, nyse, nyte, være, tære 6. føre, våke, kåre, tåre, våre, våse, hate, hane, hare, pene, gire, gule, dure 7. dyre, døde, kake 8. inn, finn, katt, satt, sett, sitt, bitt, ditt, mitt, mett, pytt, nøtt, natt, titt 9. sopp, sokk, rett, vått, kopp, hopp, topp, mopp, søtt, surr, kott, latt, møkk | <ol style="list-style-type: none"> 10. tørr, tøff, røff, biff, paff, puff, nøff, loff, voff, rigg, pugg, pigg, mygg 11. rygg, vegg, logg, legg, rakk, pakk, pukk, nikk, møkk, vekk, sekk, dykk, dokk 12. bukk, dekk, bekk, hakk, lakk, hekk, voll, null, møll, rull, tull, tall, fyll 13. fall, byll, ball, vinne, penn, tynn, tonn, tinn, tenne, tann, sånn, munn, fonn 14. finne, lønn, rodd, ridd, papp, pupp, napp, lapp, narr, pass, lass, puss, tass 15. buss, boss, bass, gass, ratt, nett, tett, tatt, fått, kutt, kott, matt, nebb 16. mobbe, jobbe, kubbe, rydde, redd, vidde, sydde, gidde, lodd, ledd, loppe, lamme 17. romme, losse, risse, matt, menn, renn, lett, lekk, rikke, rotte, murre, surre 18. sykkel, løkke, søkke, rømme, møtte, søtt, takk, tapp, vinn, bomme, komme, tomme |
|--|--|

- | | |
|--|--|
| 19. nytt, dette, hatt, hann, denne, penn, gull, dukke, dumme, pusse, dømme | 58. rede, redde |
| 20. ul, ull, | 59. reke, rekke |
| 21. ak, akk | 60. ripe, rippe |
| 22. tet, tett | 61. same, samme |
| 23. tut, tutt | 62. sipe, sippe |
| 24. tyn, tynn | 63. slipe, slippe |
| 25. tør, tørr | 64. søke, søkke |
| 26. os, oss | 65. tele, telle |
| 27. mur, murr | 66. vane, vanne |
| 28. fin, finn | 67. vase, vasse |
| 29. søt, søtt | 68. vipe, vippe |
| 30. sur, surr | 69. gran, grand |
| 31. tak, takk | 70. gren, grend |
| 32. pen, penn | 71. grin, grind |
| 33. pir, pirr | 72. hån, hånd |
| 34. ven, venn | 73. mil, mild |
| 35. bake, bakke | 74. lin, lind |
| 36. bøte, bømte | 75. lun, lund |
| 37. duke, dukke | 76. mel, meld |
| 38. halen, hallen | 77. ran, rand |
| 39. ire, irre | 78. sen, send |
| 40. kake, kakke | 79. sil, sild |
| 41. knipe, knippe | 80. syn, synd |
| 42. kul, kull | 81. tin, tind |
| 43. lake, lakke | 82. ven, vend |
| 44. leke, lekke | 83. vin, vind |
| 45. lese, lesse | 84. von, vond |
| 46. lose, losse | 85. laus, saus, leir, leik, leit, meis, taus, feil, neie, bøye, føye, køye, nøye |
| 47. luke, lukke | 86. tøye, eng, ung, bang, fang, lang, sang, tang, seng, ring, ting, ving, tung, haik |
| 48. mase, masse | 87. heil, heis, peile, peis, hoie, gøye, høye, naust, gang, pang, heng, pung, syng |
| 49. møte, møtte | 88. kjas, kjø, kjøp, sjø, sju, sjuk, sjal, sjef, sjakk, skje, kjapp, sjokk ~ kav, kø, kår, sør, sur, sang, seng, sol, sal, ser |
| 50. nepe, neppe | 89. hjelp, hjelm, hjørne, gjær, gjesp, gjedde, skjul, skjenn, skjedd ~ her, hør, jul, går, sur, ser, seng |
| 51. nise, nisse | 90. sjakt, sjark, sjau, skjørt, skjold, skjerm, skjorte, skjerf ~ saft, sau, sot, ser |
| 52. nyte, nytte | |
| 53. nåde, nådde | |
| 54. pine, pinne | |
| 55. pute, putte | |
| 56. rape, rappe | |
| 57. rate, ratte | |

Note. Dimensions 20–84 are minimal pairs. Items following ~ are picked only as distractors.

APPENDIX B: PROGRESSION TABLES

The following tables show the number of items known at each of the five measuring points (M1 ... M5) for all items combined and items for each content type. The tables show both the item count and the percentage of total items. Further, these data are divided between the regular group and the at-risk group, and include the 25, 50 (median) and 75 percentiles, as well as the minimum and maximum values.

Table B1. Overall User Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	13	1.7	22	3.0	23	3.1	40	5.4	47	6.4
	25 percentile	70	9.5	124	16.9	198	27.1	249	34.1	280	38.3
	50 percentile/Mdn	114	15.6	193	26.4	282	38.6	320	43.8	363	49.7
	75 percentile	189	25.8	292	40.0	375	51.3	489	66.9	507	69.4
	Maximum	332	45.4	500	68.4	663	90.8	703	96.3	706	96.7
At Risk	Minimum	5	0.6	9	1.2	4	0.5	8	1	13	1.7
	25 percentile	23	3.1	39	5.3	58	7.9	80	10.9	87	11.9
	50 percentile/Md	42	5.7	60	8.2	107	14.6	131	17.9	166	22.7
	75 percentile	53	7.2	104	14.2	139	19.0	163	22.3	222	30.4
	Maximum	77	10.5	150	20.5	228	31.2	255	34.9	297	40.6

Table B2. Letter–Content Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	12	50.0	14	58.3	13	54.2	15	62.5	18	75.0
	25 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	50 percentile/Mdn	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	75 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	Maximum	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
At Risk	Minimum	5	20.8	9	37.5	4	16.6	8	33.3	13	54.2
	25 percentile	15	62.5	18	75.0	24	100.0	21	87.5	23	95.8
	50 percentile/Mdn	20	83.3	23	95.8	24	100.0	24	100.0	24	100.0
	75 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	Maximum	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0

Table B3. Syllable–Content Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	0	0.0	8	2.9	10	3.7	24	8.8	29	10.7
	25 percentile	46	16.9	100	36.8	174	64	224	82.4	250	91.9
	50 percentile/Mdn	90	33.1	169	62.1	251	92.3	263	96.7	266	97.8
	75 percentile	165	60.7	259	95.2	266	97.8	270	99.3	270	99.3
	Maximum	271	99.6	271	99.6	272	100	272	100	272	100
At Risk	Minimum	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	25 percentile	9	3.3	19	7.0	34	12.5	56	20.6	67	24.6
	50 percentile/Mdn	23	8.5	37	13.6	83	30.5	111	40.8	142	52.2
	75 percentile	30	11	80	29.4	115	42.3	140	51.5	198	72.8
	Maximum	53	19.5	126	46.3	203	74.6	232	85.3	266	97.8

PLAYERS' PROGRESSION THROUGH GRAPHOGAME, AN EARLY LITERACY GAME: INFLUENCE OF GAME DESIGN AND CONTEXT OF PLAY

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Abstract: Researchers of serious games frequently investigate outcomes of play but overlook the underlying game-design components that drive those outcomes. In this paper, I aim to show how game design and context of play influence progression through GraphoGame, an early-literacy game. This is done by means of two intersecting studies. The first study shows how the game can be represented by a model that explicitly hypothesizes how the interaction between the player and the game drives progression. The second study explores user data generated by first graders ($N = 137$) who played the game over a period of 25 weeks as part of early literacy instruction. The juxtaposition of these two studies reveals factors that influence progression. I also highlight an underdeveloped area within the research field and point to the benefits that bridging game design and outcomes of play may hold for researchers, game developers, and educators.

Keywords: *serious games, adaptive learning, game design, literacy games, GraphoGame*



INTRODUCTION

Digital games are now an integral part of popular culture, and, in recent years, the presence of such games in educational settings has grown as well. The educational setting includes not only entertainment games repurposed for educational use but also games specifically designed to promote specific learning outcomes, which are commonly referred to as serious games (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). In these games, the entertainment factors typically associated with digital games are secondary to the instructional ones yet employed to motivate players to achieve better learning outcomes (Wouters et al., 2013). Although serious games do not necessarily increase players' motivation and engagement levels, these games may lead to positive learning outcomes, especially if used as part of other instructional activities (Boyle et al., 2016; Connolly, Boyle, MacArthur, Hainey, & Boyle, 2010).

To date, most researchers of serious games have investigated the outcomes of play (Boyle et al., 2016; Connolly et al., 2010), whereas less attention has been paid to how these games work (Gaydos, 2015; Lämsä, Hämäläinen, Aro, Koskina, & Äyrämö, 2018). Although it is quite possible to conduct such research without a comprehensive understanding of how these games work, this lack of attention to the workings of games means that the specific components driving outcomes of play may be undistinguishable from one another. Hence any insights pertaining to the game itself will be restricted to the game as a whole. Clark, Tanner-Smith, and Killingsworth (2014) argued that the design of digital tools, not the digital medium itself, is the strongest predictor of learning outcomes, and they call for research exploring how design choices in digital games influence learning outcomes. This view is shared by Lämsä et al. (2018), who called for research into how game design influences learning in children with learning difficulties.

This paper contributes to this underdeveloped area within research into serious games by investigating possible connections between game design and user progression in the Norwegian version of GraphoGame. This game is described as “a technology-enhanced learning environment for learning to read” for children who are “in the early stages of their formal education” (U. Richardson & Lyytinen, 2014, pp. 39-40). For my research of game design and user progression, I conducted two studies. Based on an investigation of the literature, the first study presented a theoretical model for how progression may occur as a result of playing the game, whereas empirical research in the second study generated user data from the gameplay. Juxtaposing the findings from those two studies makes it possible to identify some underpinning factors related to game design and the context of play that drive the outcome measured—in this case, progression through the game.

Researching Serious Games

Part of the reason for the predominance of studies investigating outcomes of play may be that serious games are designed to promote specific learning outcomes, and so researchers may be inclined to examine whether the games do what they are supposed to do. Further, stakeholders and decision makers in the educational sector often call for research that investigates “what works” and best practices in relation to digital learning technologies (Biesta, Edwards, & Allan, 2014; Eisenhart, 2006), which may further influence researchers' choice of focus. Because of this emphasis on measuring output, experimental research designs are commonly used in

research into serious games. In the case of research into language learning, for example, the question asked may be whether a particular teaching strategy or activity enhances students' learning performance (Phakiti, 2014).

A systematic review of earlier research into the specific serious game studied here, GraphoGame, showed that most studies used experimental designs geared toward measuring reading outcomes from play (McTigue, Zimmer, Solheim, & Uppstad, 2019). As mentioned above, such research may be carried out without any scientific knowledge of the components that constitute the game because the object of study is the game itself, not its specific individual design elements. Hence the underpinning components that drive the output measured may remain unexplored.

A good metaphor for this is that of the black box, as explained by Latour (1987). This provides a useful framework when discussing how researchers deal with complex systems such as serious games. A black box metaphor is used here in the sense of an artifact for which knowledge exists about how to use it and about the outcome of using it, but for which there is a lack of understanding about how it works. Mark Richardson (2016, p. 661), in reference to Latour's (1987) use of the metaphor, explained that black boxes are found "where the outer skin [of an artifact] masks the inner workings and obstructs comprehension." The use of experimental research approaches may "thicken" this outer skin in that the game as a whole may be considered the object of study. What is more, in one common view, digital learning technologies are seen as tools designed to generate outcomes (Furberg & Lund, 2016). Hence, the tool itself will be of interest only in terms of the results generated by its use. Latour (1999, p. 304) touched on this phenomenon in his claim that the success of technology actually deters comprehension: "When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become."

Price, Jewitt, and Brown (2013) pointed out that the research approaches taken to digital technology are trailing because of the rapid changes seen in digital technology. The lack of effective investigative approaches capable of piercing the outer skin to unpack the components of a serious game is another reason why the scope of research may have to be restricted to observing the output (e.g., learning outcomes) from playing serious games. Researchers thus may be forced to use theoretical approaches not specifically designed with the affordances of digital technology in mind. For example, a vast amount of user data is generated by players' interaction with GraphoGame, but these data are rarely explored in-depth (McTigue et al., 2019). In this case, the sheer amount and complexity of the data, in and of itself, may obscure insight into the black box. Indeed, Saarela and Kärkkäinen (2017) pointed out that, even where high-quality data sets such as those from the Programme for International Student Assessment (PISA) are readily available, research making proper use of those data sets is surprisingly rare. However, in two related fields—learning analytics and educational data mining—approaches are being developed to facilitate the use of big data in educational settings, but the tools used have not become standard yet in researchers' toolboxes.

An Activity-Theory Perspective on Serious Games

Playing serious games involves a complex interplay of factors, such as patterns for players' interaction with the game and its components, cognitive processing during play, and factors

relating to the social context of play. Each of these may influence the outcome of use to varying degrees. Activity theory (see, e.g., Engeström, 1999; Leontiev, 1977; Vygotsky, 1978) may provide a lens through which to explore such factors. Nardi and Kaptelinin (2006, p. 10) laid out the premise of this theory: “People act as subjects in the world, constructing and instantiating their intentions and desires as objects. Activity theory casts the relationship between people and tools as one of mediation; tools mediate between people and the world.” This premise proposes that technology reaches beyond an isolated interaction between a person and an artifact (such as GraphoGame); rather, the use of technology, and by extension playing of serious games, embodies complex social dynamics. When it comes to the use of digital technology (e.g., serious games), this theory offers an approach enabling the coordination of various aspects of technology, such as physical interaction, conceptual interaction, and social-context interaction (Nardi & Kaptelinin, 2006).

The application of activity theory to research into serious games requires a change of perspective compared with typical experimental research. As Bannon and Bødker (1991, p. 241) pointed out regarding studying artifacts (e.g., GraphoGame), “We cannot study them as things, [sic] we need to look at how they mediate use.” In other words, the focus of research must shift from the game itself to the actions taken when users interact with the game. The application of this theory creates a need to pinpoint exactly what players are doing in their interactions with a serious game. As a result, aspects influencing gameplay that otherwise tend to be hidden inside the black box may be revealed.

At the core of this theory is the concept of activity. Leontiev (1977) broke down activities into three interconnected hierarchical levels. At the top of this hierarchy is the *activity* that a person engages in (such as playing a serious game). *Actions* are segments consciously chosen by a person (the subject) to attain goals (the object) that typically relate to the motivation underpinning the undertaken activity (such as solving a task in the game), whereas *operations* are aspects of engagement whose performance does not require any conscious thought (such as clicking a mouse button or drawing on tacit knowledge).

Su, Feng, Hsu, and Yang (2013, p. 2577) stated that activity theory provides “a useful framework for conceptualizing technology as a dynamic mechanism that conditions and enables development and change in learners and in the mechanism itself.” Thus, the perception of the object of study as “a whole” limits the research approaches taken. The activity theory-based model for analyzing serious games and conceptual design proposed by Carvalho et al. (2015) made a distinction among gaming, learning, and instructional activities, further highlighting how the process of playing the game involves actors other than the player, such as game designers and teachers. The player engages in gaming and learning activities, which have separate tools and objectives. Game designers influence the game intrinsically, whereas the teachers responsible for deploying the game influence it extrinsically. Hence, this model provides a way to break down the components of the serious game and identify how players, designers, and teachers engage with it. The premise of this approach—that human activities take place in social contexts—enables not only exploration of the various actors involved with the game (i.e., researchers, designers, and others) and their interaction with the player through the game’s components but also exploration of the agents actually present during the playing of the game (i.e., teachers and students).

Learning and Entertainment in Serious Games

Balancing learning and entertainment in a game can be a complex prospect. Arnab et al. (2015) called attention to the challenge of incorporating established pedagogical approaches into serious games, that is, accounting for differences in perspectives among game designers and educators of what a learning game should be. With game designers leading the development process, games may be entertaining but lack essential processes for knowledge acquisition. However, when educators are in charge, the game may be efficient as a learning tool but not fun or motivating to play (Marne, Wisdom, Huynh-Kim-Bang, & Labat, 2012). Nothing prevents these two approaches from coexisting, but it would require stakeholders (i.e., game experts and pedagogical experts) to share a common language (Marne et al., 2012). Even so, as serious games are intended to promote knowledge, pedagogical approaches should underpin the design.

GraphoGame emphasizes the serious element of serious games but also makes use of game elements intended to engage and motivate players. A synthesis of research on Graphogame (McTigue et al., 2019) showed that GraphoGame may support users in developing sublexical skills and improving letter–sound knowledge and phonological processing. However, these authors found that the game supported better word reading only with strong adult interaction during play. McTigue et al. (2019) also provided an overview of Graphogame’s theoretical grounding, which included the simple view (Gough & Tunmer, 1986) word reading (Ehri, 2005), psycholinguistic grain size theory (Ziegler & Goswami, 2005), and orthographic depth hypothesis (Katz & Frost, 1992).

The Present Studies

The present paper is based on two studies. The aim of the first study was to investigate how game design influenced players’ progression through the game. The related research question was how the interaction between player and game was operationalized. The second study drew upon the exposition of game elements discovered in the first study and sought to investigate the direct consequences of this game design. The aim was to document any progress that became evident in 137 Norwegian first graders playing GraphoGame four times a week for 25 weeks and to relate this progress to the design elements of the game. The related research question regarded what differences in progress could be seen between a group of students initially identified as being at risk of reading and writing difficulties and a group initially identified as not being at risk of such difficulties.

User data were collected at 5-week intervals. They showed how far the students progressed through the game during the timeline of play. The division of students into groups was based on the results of a screening test administered at the onset of schooling. The at-risk group consisted of students identified as being in danger of developing reading difficulties ($n = 17$) whereas the regular (not at-risk) group consisted of the remaining students ($n = 130$). This division was made to explore the possibility of different progression trajectories based on students’ starting point.

STUDY 1: OPERATIONALIZING GRAPHOGAME

The aim of this first study was to explore the influence of GraphoGame’s design on user progression. Hence, the primary research question sought to articulate how the interaction between player and game could be operationalized. In response to that question, a conceptual model detailing how progression occurs through GraphoGame was developed. This model pinpoints central design elements of the game, identifies how players interact with the game, and demonstrates how this interaction drives progression. The main function of this model is to make explicit certain components that would otherwise be hidden in the black box.

Theoretical Grounding for the Model

Generally speaking, the ways in which information flows between the player and the game influences how the interaction ultimately drives progression through play. Earlier models exploring the interaction between computers and humans provided inspiration for the operationalization of GraphoGame. Schomaker et al. (1995) presented a model providing a bird’s-eye view of the interaction information flow as it alternates between human and computer through the interface (Figure 1). In brief, the computer captures human output (e.g., touch, voice) from its input modalities (e.g., mouse, keyboard, touch screen, microphone), processes this information according to its programming (marked as “cognition” in the model), and produces output media. The user perceives those media through human input channels (e.g., visual, audible, and tactile) and then mentally processes that information, which leads to the next cycle of information flow. The computer, the interface, and the human can be considered separate spaces in this interaction. Although this is a simplistic model, it provided a starting point for laying out the various spaces and stages in the model presented in this study.

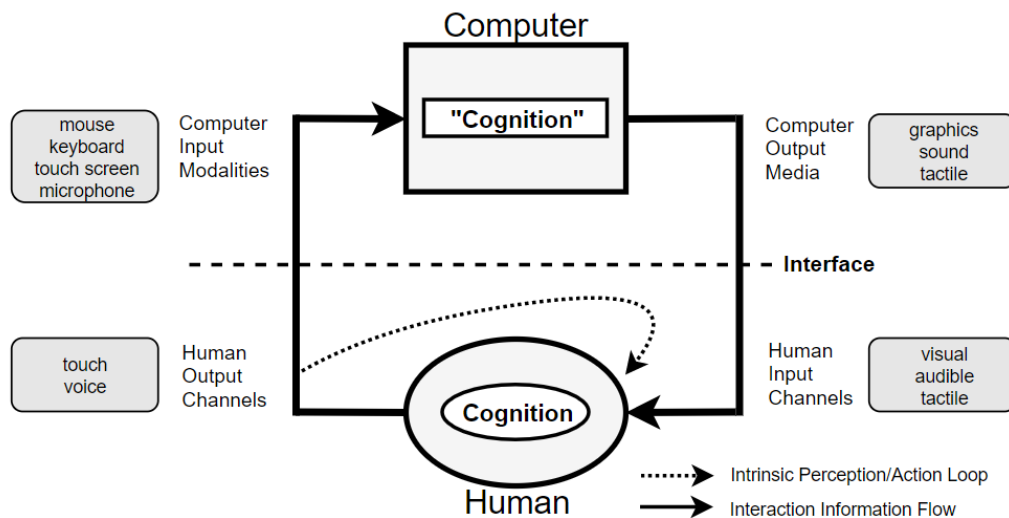


Figure 1. Basic model of human–computer interaction (adapted from Schomaker et al., 1995). This figure illustrates how information flows between computers and humans through various input and output channels, modalities, and media. Humans use their cognitive abilities to interpret the computer output and then take action by using their output channels. The computer processes this output through its programming (“cognition”) and provides output media through the interface.

Bienkowski, Feng, and Means (2012) described the structure of an adaptive-learning system reflecting the continuous interaction between a student and that system (Figure 2). This interaction generates user data that are stored in a database. Those data are analyzed by a predictive model that aggregates the data, presents the aggregate to teachers through a dashboard, and feeds data about the student to its adaptation engine. This engine generates output content that suits the individual requirements of the student. (Some adaptive-learning systems, but not that of the present version of GraphoGame, also include an intervention engine that allows teachers or administrators to directly influence the content delivered to the student.)

Interactive Model of Progression Through GraphoGame

GraphoGame provides a learning environment where players may practice sound–letter correspondences. The content is presented as multiple-choice tasks, which represent the learning activity. A game starts with the player selecting one of the nine possible game modes.¹ A game mode represents a series of tasks that share the same theme. Figure 3 shows an example of a task from the Balloon Game.

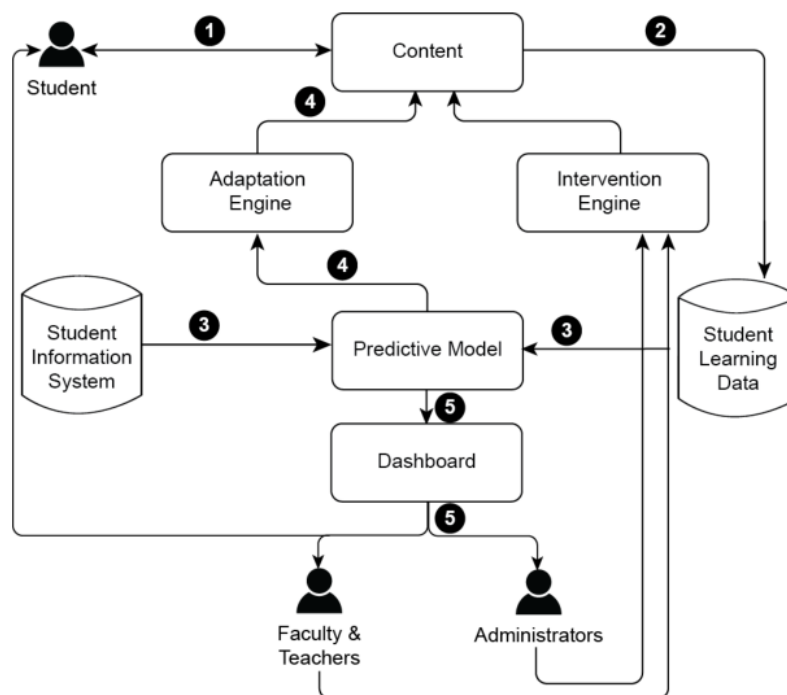


Figure 2. Diagram depicting data flow (the arrows) in a typical adaptive-learning system (ALS; Bienkowski et al., 2012). The model shows how students, administrators, and teachers interact with the various components of an ALS. The student interacts with the content (Line 1, bidirectional to emphasize the interaction aspect) and the outcome of this interaction is stored as student learning data (Line 2). These learning data, along with other student information, are funneled to the ALS’s predictive model (Line 3). This combined information is used to create new content through the adaption engine (Line 4), which completes the cycle between student and ALS. In addition, this information can also be accessed by students, teachers, and administrators through a dashboard (Line 5), providing insight into students’ performances. In addition, teachers and administrators may influence the content directly through the ALS’s intervention engine.

As the player is presented with the graphical elements, as seen in Figure 3, the sound representing the word *gå* [walk] is played out loud. The player's task is to select the word that corresponds with this sound from three possible choices (i.e., one target and two distractors). Following this task, the player is presented with another task until all tasks in the game level have been completed. The yellow bar at the bottom of the screen indicates how far through this game the player has progressed. At completion, the player gets to choose a new game mode. The player may complete several game modes during a single play session.

In the following, I propose a model that details how the interaction between players and the game drives progression. The model produced during the first study (Figure 4) consists of five stages of a cycle that are positioned across three spaces: the *game space* represents the programming and data-access layers of the game, the *interface space* details the way players and the game interact, and the *mind space* deals with how the player processes the information presented through the user interface.

The five stages of interaction are distributed across three independent but interlinked spaces. The game state represents the values stored in the game to represent players' current progress through



Figure 3. An example of a multiple-choice task in Graphogame.

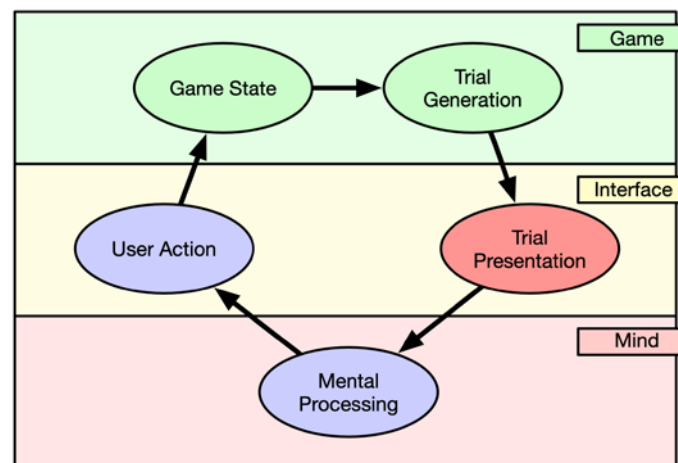


Figure 4. Five stages show the interaction between player and GraphoGame that drives progression through the game. The stages move from the program (game design), through the interface, and into the mind of the user, resulting in user reaction within the interface and a change in the game state. The cycle then repeats.

the game at any given time. Those values are used to generate trials (the learning task; *trial generation*), which are presented visually and aurally to the player through the user interface (*trial presentation*). The player then internally processes those visual and auditory cues (*mental processing*), which causes the player to take an action (i.e., a response to the perceived task) through interacting with the user interface (*user action*). Finally, the result of this action feeds and alters the game state, which in turn establishes the basis for the next trial, and so on. Progression through the game then takes place through continuous repetition of these stages of the model.

As an example of how these activity stages unfold, I present a case where the player first selects the Pirate Game on the selection screen shown between games. The first trial (Figure 5) is generated based on data relating to the player's current progression (i.e., based on prior play or from an initial level), taken from the game state. At the start of this trial, a recording of the sound /e/ is played and the letters *e*, *a*, *u*, *b* and *r* are shown on the screen. The player's task is to identify the letter (i.e., click *e*) that corresponds to the sound played. In this example, the player clicks on the correct item, and the game state is altered to reflect this. A new trial is then generated (Figure 6). The words *riv* [tear], *mur* [wall], *rot* [root] and *rim* [rhyme] are shown on the screen. The sound /riv/ is played and the player again makes the right choice by clicking on the balloon containing this word. After successfully completing the task, the player earns a reward (indicated by the coin appearing above the word *riv* after selecting it). The student then performs six more trials to complete the selected game mode. At this point, the player is presented with a new game-selection screen and may select a new game mode. In the following subsections, this example will be discussed in greater detail against the background of the individual stages of the model.

Game State

The game state represents the current state of various variables detailing a player's progression and performance in the game at any specific time during play. As the player interacts with the game, these values change to reflect the outcome of the player's actions. Two clusters of variables are discussed as part of the adaptive interaction cycle: *player knowledge* and *player performance*. The first of these clusters, player knowledge, includes variables that reflect how well the player knows the content of the game (a value assigned by the game that may or may not reflect a user's actual knowledge). These variables persist between game sessions. Each item in the game is

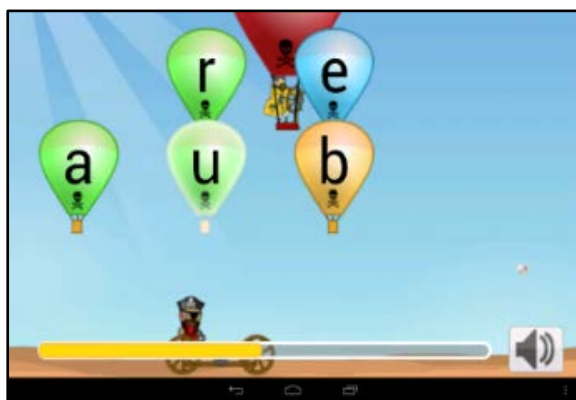


Figure 5. GraphoGame trial, player's initial trial.



Figure 6. GraphoGame trial, player's subsequent trial.

assigned a knowledge value, which is increased or decreased based on how the player responds in trials where that item is the target (i.e., the correct item). The amount of the incremental change is governed by the number of distractors (i.e., wrong items presented as options) in the trial. For example, the knowledge value of the target item *los* [pilot] will increase more after a successful trial if there were three distractors rather than two. Other variables are derived from the knowledge value of the items. For example, the game keeps track of how many items are known for each content type and for each group of items (dimension). Within the second cluster of variables, the game tracks player performance for each content type in the game (i.e., letter content, syllable content, and word content). Those values are based on performance in the last (up to) 10 trials, and they reset between play sessions. In other words, each time a player starts a new play session, his or her player performance needs to be re-established. The player's performance variable for each content type increases or decreases throughout a gaming session as the player makes correct or incorrect selections for that specific content.

The Norwegian-language version of GraphoGame includes a total of 730 items as targets and/or distractors that a student may encounter during play (see Appendix A). These items are divided into three content types: letter content (24 items), syllable content (272 items), and word content (434 items). The items are further organized into dimensions (i.e., item groups) in roughly an ascending order of difficulty. Letter Dimension 1 consists of the letters that are considered the easiest to learn, whereas Letter Dimensions 2 and 3 include more challenging letters. (Three letters of the Norwegian alphabet have been omitted: *c*, *q* and *z*; these letters appear infrequently in the Norwegian language and are typically not focused on at the onset of letter instruction.) Syllable content consists of two- or three-letter one-syllable words divided into 22 dimensions, each containing a median of 15 target items. The items included in a dimension were grouped together on the basis of specific criteria. For example, the items in Syllable Dimension 1 consist entirely of letters from Letter Dimension 1 (e.g., *er* [am/is/are], *is* [ice], *om* [about]); the items in Syllable Dimension 2 consist of letters from Letter Dimensions 1 and 2 (e.g., *at* [to], *av* [of], *en* [one]); and the items in Syllable Dimension 3 all start with a consonant (e.g., *ta* [take], *be* [pray], *fe* [livestock]). Word content consists of three- to six-letter words divided into 90 dimensions. A median of 12 targets are included in each dimension (excluding dimensions consisting of minimal pairs, i.e., words that differ with respect to a single sound, such as *ul* [howl] and *ull* [wool]). The first seven dimensions consist of three-letter words whereas Dimensions 8–19 include words with double consonants (representing a common spelling difficulty in Norwegian). Dimensions 20–84 consist of minimal pairs. Finally, Dimensions 85–90 include more difficult words including digraphs, that is, cases where several letters are used to represent a single sound.

Trial Generation

To generate trials, GraphoGame uses an adaptation engine. (This term encompasses all components of a game involved in the generation of trials.) Concretely, trials are generated by algorithms that use the current values of variables (i.e., the game state) as their starting point. The adaptation engine's task is to advance the player through the game while recalibrating the difficulty level if the player performs poorly. In other words, the adaptation engine predicts what will lead to the best outcome for the player and generates a trial based on this. Typically, it will tend to step up the difficulty level. However, if a player's performance drops below a certain threshold, the engine will generate easier trials to keep the player engaged. This accuracy

threshold varies across content types; it is 85% for letter content, 75% for syllable content, and 65% for word content.

Trial generation is a two-step process. In the first step, the adaptation engine selects a content type for the trial (i.e., letters, syllables, or words) based on player knowledge and player performance (see the game state stage). If the player is deemed to know fewer than 40% of the letters, the content type is restricted to letter content.² Beyond this threshold, there is a likelihood for initiating other content types, and this likelihood increases drastically once a player knows all 24 letters. The basic likelihood of syllable content is inversely proportional to the likelihood of letter content. For example (assuming no likelihood of word content, as is the case at earlier stages of game use), if the likelihood of letter content is 35%, then that of syllable content is 65%. If a player is performing well on syllable content,³ the likelihoods are recalculated⁴ in favor of word content. The likelihood of word content is calculated based on the combined likelihood of letter content and syllable content.⁵ For example, if the likelihood is 10% for letter content and 30% for syllable content, the likelihood of word content will be 60%.

The second step of trial generation is based on the outcome of the first step: The adaptation engine assembles a list of items (one target and one or more distractors), all from a single dimension of the content type selected at the previous stage. If the player is performing poorly, easier trials are generated, whereas if the player is performing well, more difficult trials are created. For example, Figure 7 shows a trial consisting of one target and four distractors from Syllable Dimension 9. The adaptation engine first created a list of suitable dimensions based on the percentage of known items in each dimension. For easy trials, known items are preferred; these are selected from dimensions with a percentage of known items greater than the target percentage for the content type in question. The opposite is true for difficult items. For instance, if a player knows 85% of the syllables in Syllable Dimension 3 and 45% of those in Syllable Dimension 4, a difficult trial may have an unknown word from Syllable Dimension 4 as target whereas the target of an easy trial may be a known item from Syllable Dimension 3. For syllable and word content, the number of distractors is increased by one after a correct answer and decreased by one after an incorrect answer to a maximum of four. For letter content, the maximum number of distractors is six.

Trial Presentation

After a trial has been generated, it is presented to the player through the user interface in visual and auditory forms. The interface can be seen as a mediating tool with which the player interacts as part of playing GraphoGame. The game area is assembled from graphical elements of various shapes and functions. Some of these can be interacted with (e.g., the objects representing items in Figures 6 and 7), but most are purely visual (e.g., the background image).

GraphoGame presents nine different game modes, each with a different visual profile and minor variations in gameplay. Figure 7 shows the game area for the Balloon Game, and Figure 8 shows that for the Pirate Game. In the Balloon Game, the player avatar is displayed on-screen; in the Pirate Game, a pirate with a cannon and a pirate flying a red balloon are displayed. The tile shapes that represent the items are also different: circle-shaped or shaped like hot-air balloons.

As the examples show, the presentation of the tasks varies. There are slight differences between the nine game modes available, but the core gameplay remains the same across all



Figure 7. Balloon Game, three syllable items.



Figure 8. Pirate Game, five letter items.

game modes. For example, in the Balloon Game, a player receives auditory feedback if he or she selects the wrong item, but that item remains visible on the screen until the player correctly identifies the target. Consecutive unsuccessful trials in the Balloon Game will have one fewer distractors until there is only one item left, which ends the game. By contrast, if a player selects a distractor in the Worm Game, all distractors vanish, leaving only the target item on the screen. The player is then required to click on this item before proceeding to the next trial. Additional gameplay factors are programmed into the game, such as time limits, but they are not activated until a player has progressed quite far in the game.

GraphoGame also provides incentives to keep the players motivated. Players earn coins for each successful trial played, which they may use in the in-game shop to buy accessories with which to dress their avatar. Those accessories have no effect on gameplay but are included in the game as an incentive to keep on playing.

The game has a high degree of transparency, meaning a player who wants to engage the game finds few barriers to that goal. However, user agency is limited when playing the game. In fact, the only thing the player can do is to click on an object containing one of the items that are part of the trial.

Mental Processing

As the player perceives the visual and auditory presentation of the trials, the player's brain will process the incoming stimuli and prompt the player to interact with the game. To answer correctly without guessing, the player needs knowledge about the correspondence between the spoken letter or word and its visual representation. The player's perceptive faculties, both visual and auditory, are required to perform the task correctly or to expand knowledge after an incorrect answer. For each consecutive trial containing the same target, the player's knowledge should increase, making it more likely that the correspondence concerned is correctly identified.

These repetitions are intended to aid the player in mapping the spoken language to the written language, an important step toward learning to read (U. Richardson & Lyytinen, 2014, p. 43). GraphoGame applies a synthetic phonics approach, where speech sounds (letter content) are introduced first, which may then be used to decode words that include these sounds (U. Richardson & Lyytinen, 2014, p. 45). As players continuously process trials, their ability to read words is expected to improve steadily.

However, this view of knowledge expanding as a direct consequence of the interaction between player and game is not sufficient, as the knowledge that the players show when playing the game may also originate from outside of the game. Rather than restricting the perspective to include only the interaction between player and game and the context in which the game is employed as part of classroom play, it is preferable to take a broader language-learning perspective where the player of the game also will build skills of the type that are transferrable to other contexts. In addition to knowledge gained from playing GraphoGame, players also would strengthen their knowledge of phoneme–grapheme correspondence by participating in other teacher-guided activities aimed at developing letter knowledge and word recognition. Further, other language-learning strategies may be introduced outside of the phonics approach deployed by the game that may lead players to apply these strategies when playing the game. For example, some students may have developed orthographic reading skills, which is an applicable strategy when identifying word content.

Player Action

It may be assumed that a player's action is the outcome of the mental processes triggered by the visual and auditory input from the user interface. When players engage with the game through the user interface, they make choices by way of clicking on one of the items presented. This click results from a conscious or unconscious process occurring in the brain, something that can be observed only indirectly through actions taken. After mentally processing the trial, the player interacts physically with the user interface by selecting one of the items. This action, from the perspective of activity theory, represents the player's (i.e., the subject of the action) goal of selecting the correct item in a trial (i.e., the object of the action) by using the various tools available in GraphoGame.

The question of what lies behind the action of clicking on a specific item is complicated. In a somewhat simplistic reasoning, a player making the appropriate choice based on knowledge rather than luck must correctly identify the sound(s), must know the letter corresponding to each sound, and must properly match the sounds to the corresponding letters. These represent the necessary components to adequately decode the letters and words encountered in the game. This game-related outcome requires the player to possess an adequate level of knowledge, either learned from playing the game or from other sources outside of the game. The actions the student performs when faced with each new trial in the game will govern his or her progress through the game, as those actions adjust the current game state and hence change the premises for the next trial generation.

Model Summary

In the proposed model, five stages detail how the interaction between student and game takes place and how this interaction drives user progression. This operationalization of gameplay provides a way in which to interpret game data and to identify connections that might otherwise have remained hidden. Progress in a game is governed by the design of the content used and by the adaptation engine that facilitates the distribution of this content based on player interaction. Because this distribution of content is based on specific instructional methods (phonics), progression also may demonstrate the scaffolding of learning based on this method. The activity

of playing the game creates a learning environment that exploits the affordances of digital technology: storage and retrieval of data occurs instantly, and the data are used to assemble new, customized tasks on demand and in real time.

STUDY 2: PROGRESSION THROUGH GRAPHOGAME

In this second study, I investigated the effects of game design on student progression. The research question focused on what differences in progress could be seen between at-risk and other students. The availability of two groups based on their school-starting evaluation made it possible to explore whether their progression through GraphoGame varied depending on their baseline skill levels. The purpose of this study was to identify implications of GraphoGame's design as observed through the user data recorded from the students' actions. This ties in with the overarching aim of exploring how design and context of play influence measured output, which in this study is represented as progression through the game.

Method

Deployment and Participants

The Norwegian version of GraphoGame was developed to be part of the On Track intervention study. This was a randomized controlled trial aiming to investigate the effect of an early-intervention strategy to prevent the development of reading difficulties (Lundetræ, Solheim, Schwippert, & Uppstad, 2017). The participants in the present study belong to an On Track subsample from two schools where GraphoGame was played by all students in the classes ($N = 137$), not only by those identified at risk of developing reading and writing difficulties. All students received ordinary reading and writing instruction supplemented with the element of playing GraphoGame for specified amounts of time. The students were all first-graders and 5 to 6 years old; the majority of them were native Norwegian speakers.

The students underwent a set of diagnostic tests at the onset of schooling designed to identify those who might be at risk of developing reading difficulties. The tests were specifically developed for the On Track intervention study. Those screening tests provide an opportunity to differentiate GraphoGame players (as opposed to other interventions employed as part of the On Track program) and to explore the extent to which students' prereading skills influenced their progression through the game. This could provide insights into how learning may occur through the game based on existing knowledge at the start of the interventions; it also could yield information about how the adaptation engine adjusts content based on the players' previous knowledge. The screening tests included letter knowledge and rapid automatized naming as well as isolation and blending of phonemes (i.e., language sounds). Students scoring below the 30th percentile on any of these three tests were given one risk point for each test. They were also given one additional risk point if at least two close relatives reported having reading difficulties. Students obtaining three or more risk points in all were categorized as at risk. This yielded an at-risk group ($n = 17$) and a regular (not-at-risk) group ($n = 120$).

Data Collection

Progression data were segmented into five measuring periods of 5 weeks each (excluding holidays). Table 1 shows the time span for each period. The fourth and fifth periods were extended by one week owing to the winter holidays.

Two data sets were generated. The first was exported directly from the database containing students' user data for each of the five measuring periods and also for all periods combined. The exported data related to the number of days played, the number of trials played, and the time spent playing trials in the game. The second data set was manually collected from the GraphoGame website, where various types of aggregated data from the database are presented. This included game logs showing current progression in terms of items known at the onset of each trial played. The status of known items was given for the most recent play session for each student within each time period. In addition, known items were manually correlated to content type, as the list of known items did not show this information. If an item was found in more than one content type or dimension, the lowest one was used to indicate progress (see Appendix A for item lists).

Data Analysis

Progression was measured separately for the regular group and the at-risk group. Then the groups were compared to identify any significant differences. In testing the null hypothesis (H_0), I confirmed that no difference existed between the two groups in their progression as measured with the user data relating to known items that had been extracted. The significance threshold was set to .05.

Two approaches were taken to exploring the data, each yielding one block. The first block contained data for days played, trials played, and time spent playing. These data were presented for each measurement period as well as for the total timeline of play. Because of the difference in size and variance between the two groups, Welch's *t*-test (i.e., a test that does not require the assumption of equal variance) was used to test the validity of the null hypothesis.

The second block of data detailed players' overall progression and their progression for each content type. These data were presented as boxplots, which provide a clear picture of the distribution of player progression. Because boxplots use median values, the Mann–Whitney *U* test was used to test the null hypothesis for this block. Data that summarize a complete period

Table 1. Span of Time for Each of the Five Measuring Periods Used to Assess Progress.

Period	From	Until	Time span
P1	2014/10/13	2014/11/14	32 days
P2	2014/11/17	2014/12/19	32 days
P3	2015/01/05	2015/02/06	32 days
P4	2015/02/09	2015/03/20	39 days*
P5	2015/03/23	2015/05/05#	43 days*

Note. *The time span for the last two measuring periods were extended due to school holidays. #Students at School A ended gameplay 04/30 while students at School B ended gameplay 05/05.

are referred to as P1 ... P5, whereas measurement points (snapshots) of progression are referred to as M1 ... M5.

Results: Play Sessions, Trials Played, and Time Spent Playing

Table 2 shows that the regular group played more sessions ($M = 83.7$, $SD = 7.1$) than the at-risk group ($M = 79.1$, $SD = 8.0$). However, this difference was not significant ($p = .039$).

Table 3 shows the total number of minutes spent playing in the different measuring periods and in total across the timeline of play. The regular group ($M = 516$, $SD = 82$) played the game for slightly longer each session than the at-risk group ($M = 479$, $SD = 76$), but this difference was not significant ($p = .078$).

Table 4 shows the number of trials completed by the students during each measuring period and in total. The regular group played more trials ($M = 7260$, $SD = 1864$) than the at-risk group ($M = 5948$, $SD = 847$), and this difference was strongly significant at $p < .001$. During the intervention timeline, the at-risk group actually kept pace with the regular group during the first two periods (P1: $p = .557$ and P2: $p = .946$), but the difference between the groups was strongly significant throughout the rest of the intervention (P3: $p = .002$, P4: $p < .001$, P5: $p < .001$).

Table 5 shows the average number of minutes spent playing during each play session. The regular group ($M = 6.15$, $SD = 0.72$) and the at-risk group ($M = 6.04$, $SD = 0.57$) played for a similar duration per session; there is strong statistical support for this conclusion ($p = .481$).

Table 2. Number of Play Sessions in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	17.4	15.2	18.3	18.1	14.5	83.7
	<i>SD</i>	1.6	1.7	2.0	2.5	3.0	7.1
At Risk	<i>M</i>	16.8	15.8	17.3	16.7	12.6	79.1
	<i>SD</i>	2.5	1.3	2.1	3.0	4.1	8.0

Note. *M* = mean; *SD* = standard deviation

Table 3. Time Played, in Minutes, in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	114	92	115	109	86	516
	<i>SD</i>	18	17	21	27	29	82
At Risk	<i>M</i>	109	94	106	99	71	479
	<i>SD</i>	20	12	19	30	32	76

Note. *M* = mean; *SD* = standard deviation.

Table 4. Number of Trials Played in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	1648	1256	1567	1560	1229	7260
	<i>SD</i>	355	360	489	673	525	1864
At Risk	<i>M</i>	1598	1251	1298	1035	766	5948
	<i>SD</i>	323	268	272	330	310	847

Note. *M* = mean; *SD* = standard deviation.

Table 5. Time Played per Session, in Minutes, in Each Measuring Period (P1 to P5) and in Total.

Group		P1	P2	P3	P4	P5	TOTAL
Regular	<i>M</i>	6.51	6.02	6.25	5.98	5.86	6.15
	<i>SD</i>	0.80	0.88	0.93	1.04	1.28	0.72
At Risk	<i>M</i>	6.51	5.98	6.10	5.83	5.56	6.04
	<i>SD</i>	0.55	0.74	0.80	0.98	1.13	0.57

Note. *M* = mean; *SD* = standard deviation.

Results: Longitudinal Progression

Overall Progression

Overall progression (see Appendix B, Table B1) was measured in terms of the number of known items out of the total number of items in the game ($N = 730$) at each measuring point along the timeline. The boxplots shown in Figure 9 give an overview of total progression across the intervention period.

The boxplots indicate the percentages of known items (y-axis) for the regular group and the at-risk group at the five measuring points (x-axis). There were no outliers in either group. The regular group had progressed further than the at-risk group at all measuring points, and this difference was strongly significant at $p > .001$ in all cases. The interquartile range was fairly consistent along the timeline for both groups, with the at-risk group more closely clustered together. For the regular group as a whole, the range of progression covered almost the full inventory of items (especially towards the end of the intervention period), and a steady rise in median progression was seen throughout the period; the at-risk group progressed more slowly and had a more limited overall range of progression. Comparison of the two groups shows that regular group accelerated away from the at-risk group throughout the intervention: At M1, the average difference between the groups was 61 known items, but at M5 this had increased to 141 known items.

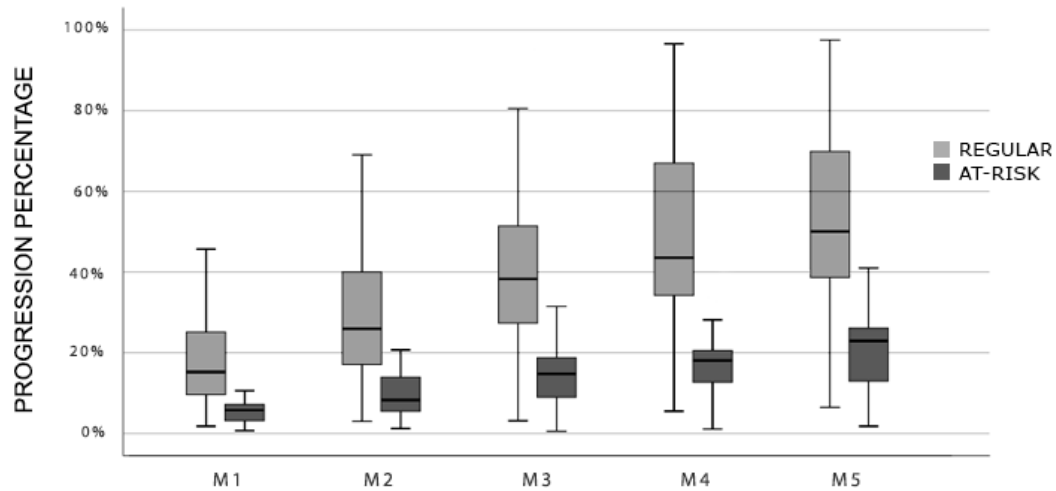


Figure 9. The figure shows boxplots of percentage overall progression for regular and at-risk students through GraphoGame at each of the five measuring points (M1 ... M5).

Letter Content Progression

Letter content (see Appendix A, Letter Items, and Appendix B, Table B2) is the first type of content encountered in the game, and progression to other types of content is held back until a player knows at least 40% of the letters. Given that M1 occurred after approximately 18 play sessions, the specific point where the students progressed from only letter content to letter and syllable content was not captured. The boxplots in Figure 10 show the median and percentile progression for known letters throughout the intervention period.

Most students in the regular group knew all letters at M1 and onwards ($Mdn = 24$). The at-risk group progressed more slowly, with a median of 20 known letters (83.3%) at the first measuring point (M1) and 23 (95.8%) at M2. Further along the timeline, most at-risk students knew all the letters ($Mdn = 24$). It should be noted that the outliers who can be seen in the regular group represent a small group of students (less than 5%) who progressed significantly more slowly than the rest of that group. There was a significant difference between the groups at all measuring points along the timeline ($p < .001$).

Syllable Content Progression

Syllable content (see Appendix A, Syllable Items, and Appendix B, Table B3) is the second content type encountered in the game. The boxplots in Figure 11 show the different patterns for the two groups' progression with regard to syllable content.

At M1, the regular group knew a median of 90 syllables (33.1%). This increased to 169 known syllables (62.1%) at M2 and to 251 known syllables (92.3%) at M3, at which point the regular group had thus largely mastered all of the syllable content. After this there was a plateau during the rest of the intervention period. For the at-risk group, the progression curve is rather linear throughout the intervention period. At M1, the median was 23 known syllables (8.5%). At M2, this had increased slightly to 37 known syllables (13.6%), and further along the timeline there

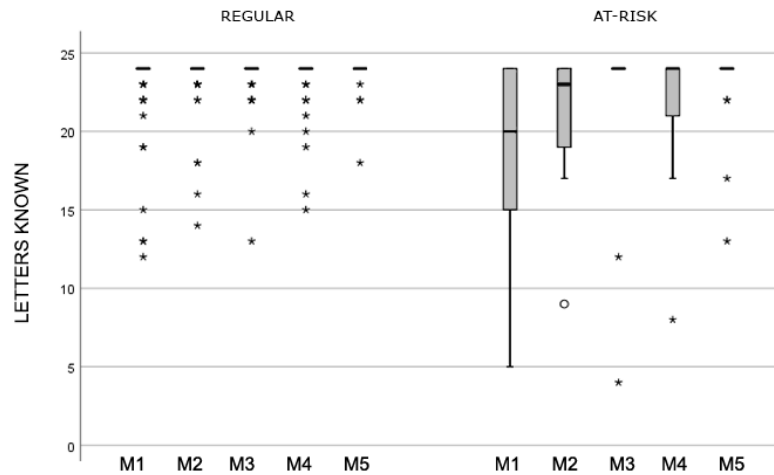


Figure 10. The figure shows boxplots of letter-content progression for regular and at-risk students through Graphogame at five measuring points (M1 ... M5). The y-axis shows how many letters were known out of a maximum of 24 letters.

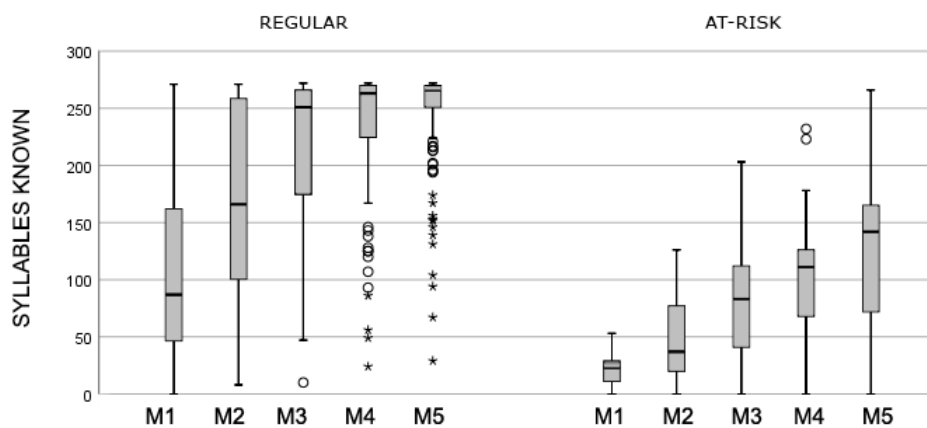


Figure 11. The figure shows boxplots of syllable-content progression for regular and at-risk students at five measuring points (M1 ... M5). The y-axis shows how many syllables were known out of a maximum of 272 syllables.

there was a steady increase: 83 known syllables (30.5%) at M3, 111 known syllables (40.8%) at M4, and 142 known syllables (52.2%) at M5. The interquartile range narrowed in the regular group, largely as a result of the plateau, but remained similar across the intervention period in the linearly developing at-risk group. Notably, syllable content was the content type where the members of the at-risk group spent most of their game-playing time, whereas most members of the regular group progressed past the syllable stage during the third measuring period. There was a significant difference between the groups in all five periods ($p < .001$). In contrast to letter content, which most players learned during the first period, progression with respect to syllable content was spread out across the periods to a greater extent.

Word Content Progression

Word content (see Appendix A, Word Items, and Appendix B, Table B4) is the last type of content encountered. This content type also accounts for most of the content in GraphoGame, which has 60% more word items than syllable items. The boxplots in Figure 12 show that only the regular group made any significant progress with word content.

At the first two measurement points, only a few students in the regular group (the outliers) had made any significant progress in terms of words known. At M3, the median for the regular group was 6 known words (1.4%), whereas at M4 the median had increased to 35 known words (8.1%). However, at that point, the upper quartile was already at 197 known words (45.8%). At M5, the median was 76 known words (17.6%) and there had been a slight increase in the upper quartile to 214 words (49.8%). The at-risk group made only negligible progress with respect to word content throughout the intervention period.

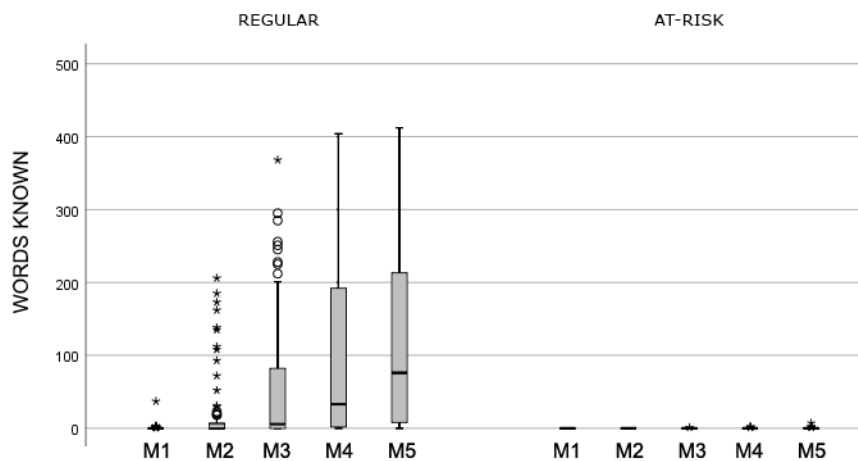


Figure 12. The figure shows boxplots of word-content progression for regular and at-risk at five measuring points (M1 ... M5). The y-axis shows how many words were known out of a maximum of 434 words.

GENERAL DISCUSSION

Players' progression through GraphoGame is inherently tied both to features of game design and to the context of play: The game design establishes the premises for progression, whereas playing the game realizes those premises. In the following subsections, I discuss the three overlapping factors that influence progression, namely content design, play time, and adaptation design. These factors were identified as a result of applying the knowledge obtained from Study 1 in order to contextualize the findings made in Study 2.

In reading the analysis below, I must emphasize that I do not make any strong claims about learning outcomes as a result of this research. It is impossible to know exactly, from the data collected, what the participants have internalized as a result of playing even though progression is operationalized using the measurements of the number of known items (out of all 730 items

available). Further, the factors that emerged from the juxtaposition of the two studies are not intended as a definite exploration of possible factors.

Progression Through GraphoGame

Content Design

Most students did not encounter the full range of content available during the play period, yet even so, progression unfolded differently in the regular group as compared to the at-risk group. At the last measuring point, after 25 weeks of play, the overall progression of the regular group fell just short of the halfway point in terms of items known (49.7%), with a mean of 7,292 trials played across 85 play sessions. For the at-risk group, progression at that point was less than a quarter (22.7%), with a mean of 5,986 trials played across 79.8 play sessions.

A closer look at progression for the individual content types provides a more nuanced picture. The transitions between content types show how quickly players moved from letter content via syllable content (two- or three-letter words) to word content (four- to six-letter words and minimal pairs). Most students in the regular group knew all of the letter content at the first measuring point (i.e., after an average of approximately 17 play sessions across 5 weeks), whereas many students in the at-risk group were still engaged with letter content at the second measuring point. In other words, it took the average at-risk student more than 30 play sessions across 10 weeks to progress past the letters. For syllable content, the regular group saw steady progression from the start, leading to a plateau, reflecting the fact that the majority knew most or all syllable content at the third measuring point (about 50 play sessions across 15 weeks). By contrast, the at-risk group manifested a linear progression throughout the play period, with a median progression just past the halfway point for syllables at the end of the 25-week period. When it comes to word content, only the regular group achieved any noticeable progression, and it was not until the third measuring point that the majority had made any significant progress. At the end of the play period, the median proportion of known word items was 17.6% for the regular group and zero for the at-risk group.

One possible interpretation of these results is that there is too much content in the game for the average pupil to encounter during an extended play period. However, other factors also need to be considered. The time spent playing and the workings of the adaptation engine cannot be separated from content design when discussing progression. In reality, both at-risk and regular students should be able to complete the game, given enough time, and progression might have been faster if the adaptive algorithms had been adjusted. That said, faster progression does not equal a better game. Even though no measurement specifically pertains to learning, the content of GraphoGame is designed and distributed in line with established theories of language learning that suggest that a slower pace of progression may be better in regard to long-term learning outcomes. In other words, content design is not just about the amount of content included, but also about instructional aspects leading to mastery of fundamental elements essential to reading.

The time factor can be seen as consisting of two aspects: how much time is spent playing and how the adaptation engine adjusts the measure of player performance between game sessions. In this case, playing GraphoGame was an activity carried out as part of regular classes, with 10 minutes allocated to play and 5 minutes for the teacher to start up the activity. The data collected show that of their 10 play minutes, players devoted approximately 6 minutes to engaging in trials. The data do not show how much time students devoted to other activities in

the game, such as browsing the in-game store or customizing their avatar, but this should account for a significant part of the remaining four minutes. Adding a single minute of effective gameplay to each play session would increase the total number of trials played during the entire play period by 800–1200, if all other factors remained the same.

The short bursts of play a few times a week are engulfed in large chunks of time when the students are not playing. During that time, knowledge may regress, meaning that what was known at the end of the last play session may not have been retained over time. As mentioned above, although the game stores knowledge about each item between play sessions, player performance resets at the start of each new session. Although player performance is not the only factor influencing content generation, this does mean that a player will have to perform a few trials before attaining his or her previous performance level. The likelihood of being presented with easier content from lower dimensions and content types is thus higher at the beginning of a new session. Considering that a typical play session involves only around 70–90 trials, this design choice may play a significant role for the pace of progression.

Adaptation Design

The adaptive algorithm in GraphoGame is calibrated to let players encounter items and correctly identify them enough times for it to be reasonably certain that the item in question has been mastered. In order to progress through the game, a player needs to know most items from lower dimensions and to perform better than the target percentage for each content type. This means that if a player makes a few wrong choices, the adaptation engine will provide already-known content from lower dimensions. This slows down the pace of progression but may result in better long-term learning outcomes as the adaptive algorithm ensures that the player knows all of the letters that make up items in the syllable and word content. This principle may reflect a good design choice, as it ensures, for example, that players' progression is not overextended. However, the adaptation engine needs to serve two distinct purposes. Besides preventing students from progressing too fast, it must also correctly and effectively identify items as known to ensure a steady rate of progression and avoid students being held back (which may cause them to become bored). GraphoGame has a single algorithm for all players, which means that this serves as a significant factor in progression.

The players' progression as observed over the 25-week play period opens up interesting inquiries, such as how much content should be included in relation to the total play period and how long and how frequently should the students play the game. The discrepancy found here between the regular group and the at-risk group brings additional questions to the fore, such as whether, and if so how, the adaptation engine could/should be altered to promote better learning in players of varying skill levels, or whether the learners' progression would be better served by developing multiple versions of that engine. Although answering those questions falls outside the scope of this paper, my surfacing the questions has resulted from the juxtaposition of the study of game design and content with the study of outcomes of use, suggesting that the overall design of the present paper, with two studies of different types, has been a fruitful one.

The Activity of Playing GraphoGame

Activity theory establishes that human activity occurs in social contexts. From this perspective, the activity of playing GraphoGame may expand beyond the direct interaction between

students and the game. On the one hand, the teachers who used GraphoGame as part of early reading instruction extrinsically influenced the activity, as did the researchers who determined how GraphoGame should be engaged (e.g., 10-minute play sessions 3-4 times a week). On the other hand, GraphoGame's developers and content designers intrinsically influenced the activity through the design of the game (e.g., adaptation design, trial presentation, content organization). In other words, some actors influenced the immediate environment of play, whereas others extended their influence through GraphoGame's code. A shared motive between the influencing actors may be that playing GraphoGame helps students on their path toward learning to read by strengthening their knowledge of letter-sound correspondences. As the students act with the game by following their own objectives (e.g., solving tasks, earning coins) and using the various tools the game offers, they, perhaps inadvertently, work towards this motive.

CONCLUSIONS

The median progression through GraphoGame in terms of items known was approximately 50%, with the at-risk group progressing significantly more slowly than the regular group. The juxtaposition of the two studies carried out yielded three factors that may provide part of the explanation for this finding: (a) the amount and structure (types and dimensions) of the content established the boundaries for maximum progression, whereas (b) the time spent playing the game and (c) the way the adaptation engine worked influenced how far through the game the students progressed. The factors discussed are not weighted in terms of their influence on progression. This does not mean that they are of equal influence, but rather that their relative importance is not considered here. Further, the progression as measured is not intended to reflect the quality of the factors discussed.

This approach to research is important yet underrepresented in the research field, where the prevailing approach is to measure output from use without regard to the underpinning factors behind this output. Drawing connections between specific game-design components and output can be beneficial in many ways. For teachers, insights of such connections may inform them of better ways of deploying the game in the classroom. For example, knowing that at-risk pupils progress significantly slower may be used to provide them with additional play time or adult supervision during play. For game developers, there are insights that may inform of ways to improve the game. For example, the content in the game may benefit from being restructured and the possibility of different versions of the game to better suit different players may also be considered.

To draw such connections, game design needs to be researched and understood with equal emphasis as on designing appropriate research means to capture data about players' interaction with specific game components. As this research has demonstrated, such connections can reveal important and actionable data that may be implemented to improve similar interventions. Further, this research revealed knowledge that may lead to better informed decisions by those who use GraphoGame, for example, as part of language instruction in the classroom or when designing studies.

Although various factors influencing progression have been brought to light, much still resides unknown in the black box. For instance, what activities are the students engaged with in the 4 minutes during each play session when they are not actively engaged with trials? Further, does the knowledge GraphoGame holds in its data banks align with knowledge measured outside of the game? Last, what are the reasons for the discrepancy in progression

between the regular and at-risk students? These are questions where the answers are still obscured, and thus warrant further research.

IMPLICATIONS FOR RESEARCH

This paper provides an example of how studies of game design and outcome from use may be juxtaposed. This research also highlights how such an approach may yield insights about a game that are beneficial to researchers, game developers, and educators. Although my data highlight the benefits for GraphoGame, other serious games could benefit as well. Similar studies should be carried out to establish a broader understanding of which components in a game are linked to outcome as measured. Even mainly experimental studies can be expanded in scope to include knowledge that may feed back into design or be applied in educational settings. Researchers should strive to develop methodologies specifically designed to enable the drawing of parallels between game design and outcomes from use.

ENDNOTES

1. The nine game modes are balloon game, fishing game, flow game, basic game, ladder game, pirate game, race game, star game, and basic GraphoGame. Each game mode has slight variations in game play and how the multiple-choice tasks work.
2. The likelihood of letter content is between 33% and 100%. If the player knows all the letters, the likelihood is between 5% and 100%.
3. If the player performance is higher than 0.7, the likelihood of each type of content is recalculated in favor of word content. Further, if the performance is even better (higher than 0.9), the likelihood of syllable content is capped at 30%.
4. The recalculated formula for the likelihood of words takes into consideration the percentage of known syllables and the current performance with syllable content. Higher values indicate higher probability for word content.
5. The chance for word content equals 1 minus the chance for letters and syllables.

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APPENDIX A: LEARNING CONTENT

These tables show the items and dimensions for each content type in the Norwegian version of GraphoGame.

Letter Items (3 dimensions)

1. i, l, s, o, e, a, m, r
2. u, t, b, f, n, v, k, å
3. h, p, d, g, æ, y, ø, j

Syllable Items (22 dimensions)

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 2. at, av, en, et, ik, ul, ur, ål, år, ås ~ er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 3. ta, be, fe, te, ni, ti, vi, bo, mo, to, ru, lå, må, rå, så ~ at, av, en, et, ik, ul, ur, ål, år, ås 4. ut, ku, åk, åt, få, nå, tå ~ ta, be, fe, te, ni, ti, vi, bo, mo, to, ru, lå, må, rå, så 5. ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bø, kø, mø, på ~ ut, ku, åk, åt, få, nå, tå 6. du, by, fy, ny, bæ, hæ, øk, øm, ør, dø ~ ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bø, kø, mø, på 7. lam, lar, sal, ler, mer, ser, les, sel, ser, rom, som, mor, ror, los, mos, ros, mot, ris, lim 8. lat, mat, lav, rav, lag, sag, sak, men, ren, sen, let, lek, let, lev, lik, rik 9. sik, lin, liv, rim, riv, siv, rot, lur, rur, mur, sur, lus, mus, sur 10. rop, lyr, myr, syr, lyn, lys, syk, syl, syn, syr, syt, lær, nær, sær, løk, søk 11. røm, søm, mør, rør, sør, røv, møt, søl, söt, måk, råk, mål, lår, mår, rår, sår | <ol style="list-style-type: none"> 12. lås, låt, lån, råd 13. kav, nav, tak, tap, tar, fet, vet, ber, fik, vik, fis, nil, vin, bom, kom, tom 14. vom, bor, kor, for, kos, bok, bot, tok, tom, kul, bur, kur, tur, nut, tut 15. tid, bod, tog, byr, fyr, tyr, fyk, nys, nyt, vær, bær, tær, vær, bøk, tøm, bør 16. før, tør, kåk, våk, bål, kål, nål, tål, får, kår, når, tår, vår, bås, vås, båt 17. det, hat, han, har, den, pen, het, der, her, dis, gir, dor, hos, gul, hul, jul 18. dur, jur, duk, dum, dun, dus, hus, jus, pus, dyr, hær, døm, dør, hør, døv, død 19. hål, går, hår 20. ei, øy, au, ai ~ er, is, om, or, os, la, sa, le, se, li, ri, lo, ro 21. kai, sau, rau, tau, lei, nei, sei, bøyy, eng, ung 22. hai, hoi, hei ~ ha, gi, og, do, jo, yr, yt, ly, ry, sy, gå, øl, øs, bø, kø, mø, på |
|---|--|

Note: Items following ~ are picked only as distractors.

Word Items (90 dimensions)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. sale, lese, sele, more, lose, mose, rose, rise, lime, late, mate, rave, lage 2. sage, sene, leve, like, rike, line, rime, rive, rote, lure, mure, sure, rope 3. lyne, lyse, syke, syre, syte, lære, nære, sære, søke, møre, røre, røve, møte 4. søle, søte, måke, måle, sære, låse, låte, låne, råde, kave, tape, fike, vike 5. fise, bore, kore, fore, kose, kule, tute, fyre, fyke, nyse, nyte, være, tære 6. føre, våke, kære, tære, våre, våse, hate, hane, hare, pene, gire, gule, dure 7. dyre, døde, kake 8. inn, finn, katt, satt, sett, sitt, bitt, ditt, mitt, mett, pytt, nøtt, natt, titt 9. sopp, sokk, rett, vått, kopp, hopp, topp, mopp, søtt, surr, kott, latt, møkk | <ol style="list-style-type: none"> 10. tørr, tøff, røff, biff, paff, puff, nøff, loff, voff, rigg, pugg, pigg, mygg 11. rygg, vegg, logg, legg, rakk, pakk, pukk, nikk, møkk, vekk, sekk, dykk, dokk 12. bukk, dekk, bekk, hakk, lakk, hekk, voll, null, møll, rull, tull, tall, fyll 13. fall, byll, ball, vinne, penn, tynn, tonn, tinn, tenne, tann, sånn, munn, fonn 14. finne, lønn, rodd, ridd, papp, pupp, napp, lapp, narr, pass, lass, puss, tass 15. buss, boss, bass, gass, ratt, nett, tett, tatt, fått, kutt, kott, matt, nebb 16. mobbe, jobbe, kubbe, rydde, redd, vidde, sydde, gidde, lodd, ledd, loppe, lamme 17. romme, losse, risse, matt, menn, renn, lett, lekk, rikke, rotte, murre, surre 18. sykkel, løkke, søkke, rømme, møtte, søtt, takk, tapp, vinn, bomme, komme, tomme |
|--|--|

- | | |
|--|--|
| 19. nytt, dette, hatt, hann, denne, penn, gull, dukke, dumme, pusse, dømme | 58. rede, redde |
| 20. ul, ull, | 59. reke, rekke |
| 21. ak, akk | 60. ripe, rippe |
| 22. tet, tett | 61. same, samme |
| 23. tut, tutt | 62. sipe, sippe |
| 24. tyn, tynn | 63. slipe, slippe |
| 25. tør, tørr | 64. søke, søkke |
| 26. os, oss | 65. tele, telle |
| 27. mur, murr | 66. vane, vanne |
| 28. fin, finn | 67. vase, vasse |
| 29. søt, søtt | 68. vipe, vippe |
| 30. sur, surr | 69. gran, grand |
| 31. tak, takk | 70. gren, grend |
| 32. pen, penn | 71. grin, grind |
| 33. pir, pirr | 72. hån, hånd |
| 34. ven, venn | 73. mil, mild |
| 35. bake, bakke | 74. lin, lind |
| 36. bøte, bømte | 75. lun, lund |
| 37. duke, dukke | 76. mel, meld |
| 38. halen, hallen | 77. ran, rand |
| 39. ire, irre | 78. sen, send |
| 40. kake, kakke | 79. sil, sild |
| 41. knipe, knippe | 80. syn, synd |
| 42. kul, kull | 81. tin, tind |
| 43. lake, lakke | 82. ven, vend |
| 44. leke, lekke | 83. vin, vind |
| 45. lese, lesse | 84. von, vond |
| 46. lose, losse | 85. laus, saus, leir, leik, leit, meis, taus, feil, neie, bøye, føye, køye, nøye |
| 47. luke, lukke | 86. tøye, eng, ung, bang, fang, lang, sang, tang, seng, ring, ting, ving, tung, haik |
| 48. mase, masse | 87. heil, heis, peile, peis, hoie, gøye, høye, naust, gang, pang, heng, pung, syng |
| 49. møte, møtte | 88. kjas, kjø, kjøp, sjø, sju, sjuk, sjal, sjef, sjakk, skje, kjapp, sjokk ~ kav, kø, kår, sør, sur, sang, seng, sol, sal, ser |
| 50. nepe, neppe | 89. hjelp, hjelm, hjørne, gjær, gjesp, gjedde, skjul, skjenn, skjedd ~ her, hør, jul, går, sur, ser, seng |
| 51. nise, nisse | 90. sjakt, sjark, sjau, skjørt, skjold, skjerm, skjorte, skjerf ~ saft, sau, sot, ser |
| 52. nyte, nytte | |
| 53. nåde, nådde | |
| 54. pine, pinne | |
| 55. pute, putte | |
| 56. rape, rappe | |
| 57. rate, ratte | |

Note. Dimensions 20–84 are minimal pairs. Items following ~ are picked only as distractors.

APPENDIX B: PROGRESSION TABLES

The following tables show the number of items known at each of the five measuring points (M1 ... M5) for all items combined and items for each content type. The tables show both the item count and the percentage of total items. Further, these data are divided between the regular group and the at-risk group, and include the 25, 50 (median) and 75 percentiles, as well as the minimum and maximum values.

Table B1. Overall User Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	13	1.7	22	3.0	23	3.1	40	5.4	47	6.4
	25 percentile	70	9.5	124	16.9	198	27.1	249	34.1	280	38.3
	50 percentile/Mdn	114	15.6	193	26.4	282	38.6	320	43.8	363	49.7
	75 percentile	189	25.8	292	40.0	375	51.3	489	66.9	507	69.4
	Maximum	332	45.4	500	68.4	663	90.8	703	96.3	706	96.7
At Risk	Minimum	5	0.6	9	1.2	4	0.5	8	1	13	1.7
	25 percentile	23	3.1	39	5.3	58	7.9	80	10.9	87	11.9
	50 percentile/Md	42	5.7	60	8.2	107	14.6	131	17.9	166	22.7
	75 percentile	53	7.2	104	14.2	139	19.0	163	22.3	222	30.4
	Maximum	77	10.5	150	20.5	228	31.2	255	34.9	297	40.6

Table B2. Letter–Content Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	12	50.0	14	58.3	13	54.2	15	62.5	18	75.0
	25 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	50 percentile/Mdn	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	75 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	Maximum	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
At Risk	Minimum	5	20.8	9	37.5	4	16.6	8	33.3	13	54.2
	25 percentile	15	62.5	18	75.0	24	100.0	21	87.5	23	95.8
	50 percentile/Mdn	20	83.3	23	95.8	24	100.0	24	100.0	24	100.0
	75 percentile	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0
	Maximum	24	100.0	24	100.0	24	100.0	24	100.0	24	100.0

Table B3. Syllable–Content Progression at Each Measuring Point.

Group		M1		M2		M3		M4		M5	
		count	%	count	%	count	%	count	%	count	%
Regular	Minimum	0	0.0	8	2.9	10	3.7	24	8.8	29	10.7
	25 percentile	46	16.9	100	36.8	174	64	224	82.4	250	91.9
	50 percentile/Mdn	90	33.1	169	62.1	251	92.3	263	96.7	266	97.8
	75 percentile	165	60.7	259	95.2	266	97.8	270	99.3	270	99.3
	Maximum	271	99.6	271	99.6	272	100	272	100	272	100
At Risk	Minimum	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	25 percentile	9	3.3	19	7.0	34	12.5	56	20.6	67	24.6
	50 percentile/Mdn	23	8.5	37	13.6	83	30.5	111	40.8	142	52.2
	75 percentile	30	11	80	29.4	115	42.3	140	51.5	198	72.8
	Maximum	53	19.5	126	46.3	203	74.6	232	85.3	266	97.8

PERSONAL CORRELATES OF PROBLEMATIC TYPES OF SOCIAL MEDIA AND MOBILE PHONE USE IN EMERGING ADULTS

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Abstract: *We investigated the occurrence of selected types of problematic social media and mobile phone use in emerging adults, specifically social media and mobile phone overuse, phubbing, creeping, and catfishing. Contemporaneous relations with age, gender, and Big Five personality traits were examined. The participants comprised 459 Slovenian emerging adults, aged 18 to 29 years (68% female). The results suggest that problematic behaviors associated with social media and mobile phone use, with the exception of catfishing, are relatively common among young people. The examined behaviors were negatively related to age, and overuse of mobile phones, social media, and creeping were more prevalent in females than males. The Big Five personality traits, most notably high neuroticism and low conscientiousness, uniquely predicted problematic social media and mobile phone use, after accounting for age, gender, and time spent on social media. Mobile phone overuse and phubbing were also associated with high extraversion and low openness, while low agreeableness was related to creeping and catfishing.*

Keywords: *social media overuse, mobile phone overuse, phubbing, catfishing, creeping, personality.*

INTRODUCTION

In today's world, digital technology has become an integral part of people's lives. It enables communication, socializing, information search, learning, and entertainment. The most frequently used electronic devices among young people are mobile phones and laptops. In Slovenia, 99% of individuals between 16 and 34 years of age use mobile phones; among them, more than 97% use smartphones (Republic of Slovenia, Statistical Office [SURS], 2017a). These percentages are similar to those in other European countries (Statista, 2018) and the USA (Pew Research Center, 2017a). Furthermore, more than 90% of young Slovenians use the Internet every day or nearly every day, with 91% of 16- to 24-year-olds and 77% of 25- to 34-year-olds participating in social media (Republic of Slovenia, Statistical Office [SURS], 2017b). Again, this is similar to other European countries (Eurostat, 2018) and the USA (Pew Research Center, 2017b). Although it would be hard to imagine life nowadays without the Internet or mobile phones, their use can be problematic and harmful. In this study, we explored the occurrence of selected (but by no means exhaustive) types of social media and mobile phone use that are described in the literature as addictive or problematic online behaviors. To update the extant understanding of factors contributing to these behaviors, we investigated the role of age, gender, and personality traits in excessive use of social media and mobile phones, phubbing, catfishing, and creeping among Slovenian emerging adults.

Emerging adulthood represents the developmental period from one's late teens through the twenties, observed specifically in societies that emphasize education, professional training, individual choice, and personal independence (e.g., Arnett, 2000; Fierro Arias & Moreno Hernández, 2007; Nelson, Badger, & Wu, 2004; Sirsch, 2018). This period of the lifespan is characterized by more freedom and independence than adolescence, yet with fewer obligations and responsibilities than adulthood. Emerging adults are thus allowed an extended period of time to explore possible life choices (e.g., Arnett, 2006; Crocetti & Tagliabue, 2016). They especially focus on concerns related to work, intimate relationships, and worldviews. Emerging adults consider continuing their education or trying different jobs, taking over responsibilities for themselves, making important life decisions, and defining their social roles. They also spend more time using media than doing anything else, with a substantial portion of the day spent on social media, other Internet sites, and mobile phones (Coyne, Padilla-Walker, & Howard, 2013). Emerging adults may use online media to facilitate developmental processes, including identity, intimacy, and autonomy (Coyne et al., 2013), but at least some of them may be vulnerable to developing mobile phone and social media addiction. While media use has been quite extensively studied in young people, particularly among college students, new forms of media and associated behaviors are emerging swiftly and remain unexplored. In addition, a better understanding is needed of factors contributing to media-related behaviors in diverse populations.

Selected Types of Problematic Social Media and Mobile Phone Use

Social media sites provide users an opportunity to receive appreciation, approval, and opinions from social contacts, and to experience satisfaction due to entertainment, passing time, and very quick virtual feedback (Andreassen, 2015; Karadağ et al., 2015). However, social media, especially visual social media (e.g., Instagram, Pinterest, YouTube, Facebook), is negatively associated with mental health, particularly in young people. Namely, social media (over)use is

associated with poor sleep quality, anxiety, depression (Royal Society for Public Health, 2017), body image concerns, and internalizing symptoms (Marengo, Longobardi, Fabris, & Settanni, 2018). Such associations may be due to social comparison as social media sites are an ideal context for (mainly upward) social comparison, which tends to be related to higher levels of depressive symptoms (for an overview, see Liu et al., 2017). Moreover, excessive use of social media may put the users at risk for addiction.

Social media addiction is a type of behavioral addiction reflecting problematic Internet use, although it is not (yet) formally recognized in common diagnostic taxonomies (Andreassen, 2015; Bjornsen, 2018; Shensa et al., 2017).¹ Similar to chemical addictions, behavioral addictions have common core symptoms, like tolerance (i.e., a diminished response to an activity resulting from repeated use, thus requiring increased engagement to achieve the former effect), withdrawal problems, conflict, salience (i.e., the activity dominates one's thinking, feelings and behavior), relapse, and mood modification (Andreassen, 2015). Social media addiction also includes obsessive, uncontrollable thoughts about social media sites and persistent uncontrollable use of social media (Bjornsen, 2018). Individuals' proneness towards social media addiction can be partly explained by their impulsivity, sensation seeking, low inhibitory control, and poor decision-making abilities (Billieux & Van der Linden, 2012). Likewise, Holmgren and Coyne (2017) documented that social media addiction is negatively associated with cognitive, behavioral, and emotional self-regulative capacities. In the current study, we also included a one-item measure of average daily time spent using social media in order to provide a more complete assessment of the relations between demographic variables and the five types of problematic social media use.

Similar to social media addiction, *mobile phone addiction* is a nonchemical (behavioral) addiction, defined as a problematic and excessive use of one's mobile phone. It includes using mobile phones longer than intended, constantly checking messages, and staying awake due to late-night phone use (Smetaniuk, 2014). With the development of social networking applications for smartphones, social media addiction and mobile phone addiction became even more intertwined, with social networking applications contributing significantly to mobile phone addiction (Salehan & Negahban, 2013). Although social media and mobile phone addiction are related, with both representing an overuse of information and communication technologies (Beranuy, Oberst, Carbonell, & Chamarro, 2009), important distinctions can be identified. Social media can be accessed on devices other than mobile phones, whereas mobile phones can be used for purposes unrelated to social media. Moreover, the distinction between problematic social media versus mobile phone use is also supported by different correlates (Beranuy et al., 2009; Ehrenberg, Juckes, White, & Walsh, 2008; Khang, Kim, & Kim, 2013). Mobile phone addiction in young people shows negative associations with academic performance (e.g., Hawi & Samaha, 2016) and positive associations with psychological distress (Beranuy et al., 2009), anxiety, insomnia (Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007), and other symptoms of poor mental health (Babadi-Akashe, Zamani, Abedini, Akbari, & Hedayati, 2014).

Mobile phone addiction further positively correlates with *phubbing* behavior (Chotpitayasunondh & Douglas, 2016). This behavior is considered problematic because it refers to using mobile phones during real-life interactions in a way that interrupts and interferes with the interaction (Bjornsen, 2018; Chotpitayasunondh & Douglas, 2016). Phubbing is described as an individual's withdrawal from interpersonal communication (Chotpitayasunondh & Douglas, 2016; Karadağ et al., 2015). Research indicates that smartphone use is associated with lower

quality of face-to-face interactions (Rotondi, Stanca, & Tomasuolo, 2017); phubbing also is associated with lower satisfaction in intimate relationships (J. A. Roberts & David, 2016; Wang, Xie, Wang, Wang, & Lei, 2017). Despite the fact that phubbing may denote disrespectful and inconsiderate social behavior (thus, inappropriate), it has recently become more acceptable (Chotpitayasunondh & Douglas, 2016).

Another problematic behavior that has emerged along with the increase in computer- and smartphone-mediated communication is deception. One type of deception is *catfishing*, that is, altering of one's identity in social media (Drouin, Miller, Wehle, & Hernandez, 2016). The behavior can range from a rather innocuous enhancement of one's physical features to appear more attractive, to assuming a different social role than one's actual self, to outright pretending to be a completely different person in order to manipulate others online for personal gain (Bjornsen, 2018; Drouin et al., 2016). In other words, for some, their online identity is an intentional construction of the self and may or may not be similar to one's offline self. At times, people may alter their online presentation in order to conform to social norms and prevent social criticism (Bjornsen, 2018). Nowadays, social media users commonly expect that others lie online about appearance, age, activities, interests, and gender (Drouin et al., 2016). Nevertheless, presenting a false self on social media is associated with insecure attachment and lower self-esteem (Gil-Or, Levi-Belz, & Turel, 2015) and may create distrust and suspicion among social media users (Kaskazi, 2014).

Creeping (also known as lurking, snooping, or passive social media browsing) refers to following what is happening in someone's life by viewing his/her updates and activity on social network profiles (photos, posts, other people's comments) without that person knowing and without posting anything on the site (Bjornsen, 2018). It involves consuming information without any attempts to provide social connection (Chen, Fan, Liu, Zou, & Xie, 2016). Creeping carries a negative, invasive connotation even though it could be considered the new normal for social media users. Nevertheless, it is associated with various negative outcomes, such as taking time away from healthier face-to-face interaction and work, sleep deprivation, depression (Baker & Algorta, 2016; Frison & Eggermont, 2016; Lup, Trub, & Rosenthal, 2015), a decline in self-esteem due to social comparisons (Underwood & Ehrenreich, 2017), and lower levels of subjective well-being (Chen et al., 2016; Verduyn et al., 2015).

The first goal of our research was to examine the occurrence of the five types of problematic online behaviors among emerging adults in Slovenia. These behaviors reflect relatively new and unexamined aspects of the lives of emerging adults and thus prompted an exploratory approach to learn more about their occurrences. We focused on emerging adults, who use the Internet and mobile phones at least as frequently as adolescents yet more frequently than older adults (Eurostat, 2017; Pew Research Center, 2017a, 2017b).

The Role of Age and Gender in Problematic Social Media and Mobile Phone Use

Research suggests that social media addiction may be more widespread in certain demographic groups. Generally, women and younger adults may be more likely to show signs of social media addiction, although the results across studies are not strongly consistent (for an overview, see Andreassen, 2015). The role of gender in mobile phone addiction also remains rather inconclusive: Some studies, for instance, found no significant gender differences (Bianchi & Phillips, 2005; Kwon et al., 2013), whereas others report mobile phone addiction is more common among females

(Khang, Woo, & Kim, 2012; J. A. Roberts, Yaya, & Manolis, 2014). In contrast, studies report a consistent relation between mobile phone addiction and younger age (Bianchi & Phillips, 2005; Khang et al., 2012). Phubbing is more frequent among females, smartphone owners, and social media users (Chotpitayasunondh & Douglas, 2016; Karadağ et al., 2015). In addition, mobile phone and social media addiction are more strongly related to phubbing among women, whereas Internet and gaming addiction are a more salient influence among men (Karadağ et al., 2015).

With regard to catfishing and related behaviors, studies most often investigated gender differences in the level of deception used in the context of online dating sites (e.g., Guadagno, Okdie, & Kruse, 2012). Generally, no differences between men and women were found, although the specific content of the deception may depend on gender. For example, Toma, Hancock, and Ellison (2008) reported that men systematically overestimate their height and women underestimate their weight in their online dating profiles. Age differences are studied less often, but some evidence suggests that online deception may be more common during adolescence and emerging adulthood than later on (Caspi & Gorsky, 2006). Because both preadult periods are characterized by young people's search for identity (e.g., Arnett, 2000), catfishing may present a form of identity exploration, that is, an expression of one's possible identities and/or the attempt to receive social feedback regarding the self. However, when emerging adults gradually form their identity, the need for exploration decreases, which may result in a decline in catfishing behavior. Creeping may also be more frequent in younger individuals who are more likely to be passive observers than active participants on Facebook and other social media sites in comparison to older users (Pempek, Yermolayeva, & Calvert, 2009). Few studies explore the role of gender in creeping behavior. For example, Frison and Eggermont (2016) reported no differences between high school boys and girls regarding passive Facebook use.

In sum, research suggests that age and, at least to some extent, gender significantly contribute to most of the selected problematic types of social media and mobile phone use. We thus hypothesized (H1) that females would exhibit higher levels of social media and mobile phone overuse, as well as phubbing, but we expected no gender differences in catfishing and creeping. We further proposed (H2) that emerging adults' age would be negatively related to mobile phone and social media overuse, phubbing, creeping, and catfishing. Additionally, we expected that time spent on social media would be positively associated with other measures of social media use (H3).

The Role of Personality in Problematic Social Media and Mobile Phone Use

An individual's behavior can be seen as a function of the person, the situation, and the person-situation interaction (e.g., Funder, 2008). A common approach to conceptualizing the person is focused on personality traits, that is, dispositional tendencies toward feeling, thinking, and acting in a certain way across time and situations (Costa & McCrae, 1980). The organization of personality traits can be well captured by five basic dimensions as summarized within the Big Five model (Goldberg, 1990) or the five factor model (Costa & McCrae, 1992): *extraversion* represents a tendency toward positive emotionality, sociability, and activity; *agreeableness* refers to prosocial characteristics, such as kindness, thoughtfulness, empathy, altruism, trust, and humility; *conscientiousness* depicts socially desired impulse control reflected in an achievement orientation and reliability; *neuroticism* describes a tendency towards negative emotionality, including anxiety, fear, irritability, and over-reactivity; and *openness* captures individual differences in the breadth, depth, and complexity of one's mental activity (John, Naumann, &

Soto, 2008). The five personality traits have substantial concurrent and longitudinal value in explaining a range of life outcomes across the lifespan (e.g., Paunonen & Ashton, 2001).

Recent studies also suggest an important role of personality traits in problematic mobile phone and social media use. Specifically, a person's propensity toward mobile phone addiction consistently predicts levels of extraversion (Andreassen et al., 2013; Augner & Hacker, 2012; Bianchi & Phillips, 2005; Hong, Chiu, & Huang, 2012; Smetaniuk, 2014) and neuroticism (Augner & Hacker, 2012; Ehrenberg et al., 2008; Hong et al., 2012; J. A. Roberts, Pullig, & Manolis, 2015). Moreover, Andreassen et al. (2013) reported negative associations between mobile phone addiction and agreeableness and openness, and J. A. Roberts et al. (2015) revealed a negative association between mobile phone addiction and conscientiousness, which is mediated through attention impulsiveness. Other studies indicate that social media addiction is associated with extraversion, low conscientiousness (Andreassen et al., 2013; Andreassen, Torsheim, Brunborg, & Pallesen, 2012; Wilson, Fornasier, & White, 2010), neuroticism (Andreassen et al., 2012), and low openness to experience (Andreassen et al., 2013).

To the best of our knowledge, no previous study has investigated the role of the Big Five traits in the phubbing, catfishing, or creeping. We found only one study on psychological correlates of phubbing (Chotpitayasunondh & Douglas, 2016), suggesting that self-control negatively relates to mobile phone addiction, which further contributes to phubbing. Because self-control represents one of the markers of conscientiousness (Costa & McCrae, 1992; Nettle, 2007; B. W. Roberts, Chernyshenko, Stark, & Goldberg, 2005), the trait may play a significant role in phubbing. With regard to catfishing, Drouin et al. (2016) found positive associations between extraversion and honesty on social media (an opposite of catfishing). Drawing parallels between online and offline behavior, real-life stalking is associated with extremely low agreeableness, and moderately low conscientiousness and emotional stability (Kamphuis, Emmelkamp, & de Vries, 2004), suggesting a possible role of these personality traits in online creeping.

To extend the knowledge on the role of personality traits in different online behaviors, we examined the ability of the Big Five traits to concurrently predict emerging adults' problematic mobile phone and social media use, over and above age, gender, and time spent on social media. Specifically, we expected (H4) that high levels of both social media and mobile phone use would be related to extraversion, neuroticism, and low conscientiousness, while mobile phone addiction would also show negative relations with openness. We refrained from formulating any specific hypothesis regarding phubbing, catfishing, and creeping due to the severely limited theoretical and empirical foundation.

METHOD

Participants

We collected data from a convenience sample of 459 Slovenian emerging adults (68% females) between the ages of 18 and 29 years ($M = 22.32$ years, $SD = 2.22$). They were predominantly students (84.5%); 11.4% were employed and 4.1% unemployed. Most respondents (62.7%) lived semi-independently (i.e., partly with parents and partly alone or with a partner), 27.9% resided with parents, and 9.4% had moved out of the parental home. The participants reported they spent on average 159 minutes ($SD = 140$) per day on social media.

Measures

The Manolis/Roberts Cell-Phone Addiction Scale (MRCPAS; J. A. Roberts et al., 2014) includes four items rated on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). The items tap into addictive behaviors such as mobile phone overuse and irritability when one's mobile phone is not in sight or the mobile phone's battery is almost exhausted. An example item is "I get agitated when my cell phone is not in sight." We obtained the scale score by averaging the item scores, with higher scores reflecting higher levels of mobile phone addictive behaviors. A confirmatory factor analyses by the authors of the scale showed a single factor structure and a satisfactory internal consistency of the scale ($\alpha = .87$ for the overall sample, and .84 and .88 for males and females, respectively). Good internal consistency of the scale was also found in the present study ($\alpha = .84$).

The Social Media Addiction Scale (SMAS, Karadağ et al., 2015) contains 10 items rated from 1 (*never*) to 5 (*always*) on a 5-point Likert scale. The items describe one's constant checking his/her social media accounts: following activities—current events, popular videos, and trendy topics—sharing personal things, checking the accounts of known and unknown people, wondering whether or not one's friends read his/her posts. An example item is "I check over my social media accounts whenever possible." We averaged the item scores to obtain the scale score, with higher scores suggesting higher levels of social media addictive behaviors. Karadağ et al. found that the 10 items loaded over .40 onto two factors (sharing, $\alpha = .82$, and control, $\alpha = .79$), but they based their further analyses on a summary score. The overall scale score contributed to a Facebook addiction score and showed a positive relation to phubbing and mobile phone addiction in their study participants. The internal consistency of the scale in our study was $\alpha = .81$.

The Phubbing Scale (modified from the Partner Phubbing Scale, J. A. Roberts & David, 2016) measures "phone snubbing." The modified Phubbing Scale (Bjornsen, Simpkins et al., 2017) evaluates one's perception of his/her own phubbing behavior (in contrast to the original scale, which assessed the experience of being phubbed by one's partner). An example item in the revised scale is "During a typical mealtime that I spend with other people, I pull out and check my cell phone." Participants rate the items on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). We averaged the item scores into the scale scores, with higher scale scores suggesting more frequent phubbing. The confirmatory factor analysis by the authors of the original scale (J. A. Roberts & David, 2016) showed a single factor structure for the nine items and excellent internal consistency of the scale in two samples ($\alpha = .93$ and .92). In a separate sample, the reliability estimate of the Phubbing Scale was $\alpha = .86$; the criterion-related validity was supported by a positive correlation of the scale scores with neuroticism, as well as negative correlations with conscientiousness and agreeableness (Bjornsen, 2016). The internal consistency of the scale in our study was satisfactory ($\alpha = .77$).

The Creeping Scale (Bjornsen, Simpkins et al., 2017) measures how often someone browses social media sites of others without their knowledge. The scale measures 7 items that are rated on a 7-point Likert scale ranging from 1, *strongly disagree*, to 7, *strongly agree*. An example item is "I creep on people I don't know in order to decide if I want to contact them or become friends." The item scores were averaged into the scale scores (higher scores reflect higher levels of creeping). The scale showed a high internal reliability with the US sample ($\alpha = .91$) and a good internal reliability in the present study ($\alpha = .85$).

The Catfishing Scale (Bjornsen, Simpkins et al., 2017) measures the degree to which people pretend to be different than they actually are or are a completely different person on social media,

including modifying their posts (pictures or text) in order to be perceived as a different person, usually better than they are in reality. The scale includes six items, which are rated on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). An example item is “I pretend to have a different personality on social media so people will like me.” The mean of the item scores represented the scale score; higher scores indicate higher levels of catfishing. The scale was found reliable with the US students ($\alpha = .78$) as well as with our participants ($\alpha = .79$).

The Big Five Inventory (BFI; John, Donahue, & Kentle, 1991) consists of 44 items measuring five factors of personality: extraversion (8 items), agreeableness (9 items), conscientiousness (9 items), neuroticism (8 items) and openness (10 items). Respondents rate each item on a 5-point Likert scale (1 = *disagree strongly*; 5 = *agree strongly*). We derived the scale scores by averaging the respective item scores. John and Srivastava (1999) reported α coefficients between .79 and .88 as well as sufficient convergent validity. The BFI was validated with a large Slovenian sample (Avsec & Sočan, 2007). Internal reliabilities of the five personality scales in our study were satisfactory, with α s of .82 for extraversion, .72 for agreeableness, .83 for conscientiousness, .81 for neuroticism, and .78 for openness.

All measures were translated into Slovenian and all participants were Slovenian. Thus we expected all respondents were linguistically capable of answering the survey questions. The survey presented to the participants contained all the measures as well as an informed consent agreement and questions regarding demographic information.

Procedure

We collected data in the period between October 2016 and May 2017 through an online survey application. Students from the departments within the Faculty of Arts, University of Ljubljana, and the Faculty for Education, University of Primorska, were asked to participate and to recruit another emerging adult. Additionally, participants were recruited via various Facebook profiles (the invitation was posted on researchers' personal profiles, students' group profiles, etc.).

The data were collected anonymously online. Before completing the survey, the respondents provided an informed consent agreement regarding the study. Then, they were asked about their background information. Next, the questionnaires measuring the five problematic aspects of social media and mobile phone use and personality dimension were presented. The instructions provided at the beginning of the survey contained an explanation of the term social media: “The term social media is used as a hypernym for messaging and use of websites or applications, such as Snapchat, Facebook, Twitter, Kik, Pinterest, Vine, Tumblr, Google Plus, YouTube, LinkedIn, etc.” The other terms investigated in this study were generally avoided in the survey. The survey took approximately 15 minutes to complete. The participants received no compensation for completing the survey.

RESULTS

The results are presented according to the aims and hypothesis of the present study. First, we performed descriptive analyses to gain an insight into the occurrence of social media and mobile phone overuse, phubbing, creeping, and catfishing among emerging adults in Slovenia. In order to investigate the associations of these five problematic aspects of social media and mobile phone use, we carried out correlation and hierarchical regression analyses.

Descriptive Analyses

The descriptive statistics across the variables under study and intercorrelations among them are presented in Table 1. In order to compare the mean values on measures of problematic social media and mobile phone behaviors, we conducted one-sample *t*-tests comparing the data to the neutral point on each scale (i.e., a score of 3 or 4, depending on the scale). The comparatively low mean value on the Catfishing Scale ($t = -70.60$, $df = 458$; $p < .001$) is noteworthy. In actuality, 33.3% of the participants reported that they never engaged in catfishing behavior and 48.7% of them indicated very low levels of catfishing. The mean values for the remaining problematic social media and mobile phone behaviors are all somewhat below the midpoint of the respective rating scales (ts -45.03, -7.27, -46.95 and -15.35 for social media addiction, mobile-phone addiction, phubbing and creeping, respectively, all $dfs = 458$, all $ps < .001$).

As displayed in Table 1, the five types of problematic social media and mobile phone use were moderately and positively interrelated, with the highest correlations between social media addiction and creeping and between mobile phone addiction and phubbing. We found modest negative associations between age and social media and among mobile phone addiction, phubbing, and creeping. All five types of problematic social media and mobile phone use related negatively to agreeableness and conscientiousness and were positively associated with neuroticism. In addition, catfishing was negatively linked to extraversion, whereas mobile phone addiction and phubbing were negatively associated with openness.

The Role of Gender, Age, Time Spent on Social Media, and Personality Traits in Problematic Social Media and Mobile Phone Use

We performed a series of hierarchical regression analyses to investigate the contribution of personal characteristics (gender, age, and personality traits) and time typically spent on social media to each of the concurrently measured five types of problematic mobile phone and social media use. The predictors were entered in three blocks. The first block included background variables (age and gender), the second block included time spent on social media on a typical day, and the third block comprised the five personality traits. Results in Table 2 (Total R^2) show that the measures of personal characteristics jointly explain from 11% to 24% of the variance in the outcome variables (effect size f^2 from .12 to .32). According to Cohen (1992), f^2 values between .02 and .15 represent small effect sizes, whereas effect sizes between .15 and .35 are regarded as moderate. Age and gender explained small, but statistically significant portions of the variance in problematic social media and mobile phone use, except for catfishing. Time typically spent on social media explained statistically significant additional portions of variance (from 1% to 7%) in all of the criteria under study after accounting for age and gender. Personality traits significantly improved the portion of variance explained across the criteria measures, uniquely explaining from 6% to 9% of the variance, over and above the variance accounted for by age, gender, and time spent on social media.

After all variables were entered in the regression models, the following relations between predictor and criterion variables were obtained. Social media addiction scores were associated with the female gender: more time spent on social media, lower levels of conscientiousness, and higher levels of neuroticism. Mobile phone addiction scores were associated with a younger age,

Table 1. Descriptive Statistics and Correlations of Types of Problematic Social Media and Mobile Phone Use with Age, Time Spent on Social Media, and Personality Traits.

	Time on SM	SMA	MPA	Phubbing	Creeping	Catfishing	E	A	C	N	O
Age	-.18*	-.17*	-.26*	-.15*	-.19*	-.06	.03	-.04	.16*	-.11	.08
Time on SM		.30*	.31*	.19*	.15*	.17*	.02	.01	-.17*	.05	-.06
SMA			.53*	.51*	.64*	.39*	-.06	-.14	-.24*	.24*	-.05
MPA				.58*	.50*	.32*	-.02	-.17*	-.24*	.29*	-.15*
Phubbing					.38*	.30*	-.01	-.16*	-.19*	.24*	-.17*
Creeping						.41*	-.12	-.21*	-.22*	.29*	-.11
Catfishing							-.17*	-.19*	-.17*	.25*	-.10
Min		1.10	1.00	1.00	1.00	1.00	1.25	2.11	1.00	1.00	1.80
Max		4.40	7.00	4.78	6.71	4.83	4.88	5.00	5.00	4.88	4.90
M		2.75	3.46	2.52	3.11	1.57	3.56	3.80	3.63	2.80	3.61
SD		.60	1.58	.68	1.24	.74	.68	.53	.64	.66	.59

Note. Time on SM – time typically spent on social media per day, SMA – social media addiction, MPA – mobile phone addiction.

E – extraversion, C – conscientiousness, N – neuroticism, O – openness.

Possible scores range from 1 to 5 for SMA, Phubbing, and personality traits, and from 1 to 7 for MPA, Creeping and Catfishing.

* $p < 0.001$

Table 2. Summary of the Regression Analyses: Background Characteristics, Time Spent on Social Media, and the Big Five Predicting Five Types of Problematic Social Media and Mobile Phone Use

	Social Media Addiction	Mobile Phone Addiction	Phubbing	Creeping	Catfishing
Step 1	$\Delta R^2 = .06^{***}$	$\Delta R^2 = .09^{**}$	$\Delta R^2 = .02^{**}$	$\Delta R^2 = .06^{***}$	$\Delta R^2 = .01$
Age	-.15 ^{***}	-.24 ^{***}	-.15 ^{**}	-.18 ^{***}	-.05
Gender	-.17 ^{***}	-.14 ^{**}	-.04	-.14 ^{**}	-.05
Step 2	$\Delta R^2 = .07^{***}$	$\Delta R^2 = .06^{***}$	$\Delta R^2 = .03^{***}$	$\Delta R^2 = .01^*$	$\Delta R^2 = .02^{**}$
Age	-.11 [*]	-.20 ^{***}	-.12 [*]	-.16 ^{**}	-.03
Gender	-.15 ^{**}	-.12 ^{**}	-.02	-.13 ^{**}	-.03
Time on SM	.27 ^{***}	.26 ^{***}	.17 ^{***}	.10 [*]	.16 ^{**}
Step 3	$\Delta R^2 = .06^{***}$	$\Delta R^2 = .09^{***}$	$\Delta R^2 = .09^{***}$	$\Delta R^2 = .09^{***}$	$\Delta R^2 = .08^{***}$
Age	-.08	-.16 ^{***}	-.08	-.13 ^{**}	-.01
Gender	-.13 ^{**}	-.10 [*]	.00	-.11 [*]	-.01
Time on SM	.24 ^{***}	.23 ^{***}	.14 ^{**}	.08	.15 ^{**}
Extraversion	.05	.14 ^{**}	.16 ^{**}	.03	-.06
Agreeableness	-.09	-.09	-.07	-.13 ^{***}	-.11 [*]
Conscientiousness	-.14 ^{**}	-.13 ^{**}	-.11 [*]	-.11 [*]	-.05
Neuroticism	.15 ^{**}	.22 ^{***}	.21 ^{***}	.18 ^{**}	.16 ^{**}
Openness to Experience	.03	-.09	-.12 ^{**}	-.03	-.01
Total R^2 (Adj. R^2)	$R^2 = .19^{***}$ (.17)	$R^2 = .24^{***}$ (.23)	$R^2 = .14^{***}$ (.13)	$R^2 = .16^{***}$ (.14)	$R^2 = .11^{***}$ (.09)

Note. Standardized regression coefficients are presented. Gender was coded 0 for female and 1 for male. Time on SM refers to time typically spent on social media per day.

* $p < .05$, ** $p < .01$, *** $p < .001$

the female gender, more time spent on social media, higher levels of extraversion and neuroticism, and lower levels of conscientiousness. Phubbing was associated with more time spent on social media, higher levels of extraversion and neuroticism, and lower levels of conscientiousness and openness. Creeping was associated with a younger age, the female gender, higher levels of neuroticism, and lower levels of agreeableness and conscientiousness. Finally, catfishing was associated with more time spent on social media, lower levels of agreeableness, and higher levels of neuroticism.

DISCUSSION

The present study explored five types of problematic behaviors related to social media and mobile phone use in Slovenian emerging adults. In addition to social media and mobile phone overuse, we examined the occurrence of phubbing, creeping, and catfishing, a set of recently conceptualized online behaviors. Furthermore, we explored the associations between age, gender, average daily time spent using social media, and the Big Five personality traits and problematic social media use. Average time spent on social media was measured in order to help disentangle the effect of personality from the effect of mere social media use and, thus, to provide a clearer view on the role of Big Five traits in predicting the examined behaviors over and above emerging adults' daily social media activity. In support of H3, average time typically spent on social media was indeed found to significantly predict all of the problematic social media behaviors under study. Yet, personality traits explained additional variance beyond average time on social media.

The Occurrence of the Five Types of Problematic Social Media and Mobile Phone Use

Levels of social media and mobile phone overuse, as well as phubbing, occurred in our participants to an extent that was similar to a sample of Turkish university students (Karadağ et al., 2015). On average, the Slovenian emerging adults checked their social media accounts and followed activities or current events (indicators of social media addiction) rarely to sometimes. They showed moderate levels of problematic use of mobile phones (becoming nervous when the mobile phone was not in sight or its battery nearly exhausted, indicators of mobile phone addiction), and reported that they rarely to sometimes ignore a person or their social surroundings by busying themselves with a phone or other mobile device (indicators of phubbing).

Consistent with Karadağ et al.'s (2015) findings, we obtained moderately positive intercorrelations among social media addiction scores, mobile phone addiction scores, and phubbing. Emerging adults who reported higher levels of behavior indicative of social media addiction also reported higher levels of behaviors reflecting mobile phone addiction. Due to the correlational design of our study, we certainly cannot make any conclusions about the directionality of the relationships as they may run in either or both directions—in other words, social media addiction behaviors leading to mobile phone addiction behaviors and/or the other way around. Furthermore, the two types of behavior may be related due to a common third factor (e.g., one's proneness towards behavioral addictions). Likewise, they may go hand in hand due to the fact that people commonly access their social media accounts by using mobile phones (SURS, 2017a). As could be expected, phubbing, that is, a tendency to ignore others by using

one's mobile phone (Karadağ et al., 2015), was associated specifically with indicators of mobile phone addiction, while creeping and catfishing were related particularly to social media addictive behaviors. Again, caution is needed when interpreting the direction of these associations.

The average level of self-reported creeping in our participants was low to moderate, suggesting that, from time to time, they browse someone's social media sites without that person's knowledge and without posting anything on the site. While both creeping and catfishing represent socially undesirable behaviors (Drouin et al., 2016; Underwood & Ehrenreich, 2017), levels of creeping were higher in our study than levels of catfishing. Possibly, the passive nature of creeping behavior as opposed to the active deception involved in catfishing makes the former less objectionable or at least easier to admit than the latter. Moreover, our results suggest that creeping and catfishing are also positively associated with excessive engagement in social media and mobile phone behaviors.

Catfishing refers to people pretending to be different on social media than they are in reality (Bjornsen, 2018). Thus, it can be considered a deceptive behavior since it reflects a modification of one's identity. Even though people nowadays expect that others lie about their characteristics on the Internet (Drouin et al., 2016), our participants reported that they never or almost never altered their identity on social media. A comparable level of catfishing was found in a sample of U.S. college students (Bjornsen, Poredoš, Puklek Levpušček, Zupančič, & Kavčič, 2017). However, we cannot be certain whether the Slovenian participants avoided catfishing or were simply less willing to admit to such behavior.

The Role of Age and Gender in Five Types of Problematic Mobile Phone and Social Media Use

Gender plays a significant role in various digital technology-associated behaviors, such as preference for online activities (Ha & Hwang, 2014), Internet addiction (Geser, 2006; Jang & Ji, 2012), self-control (Nakhaie, Silverman, & LaGrange, 2000), and communication etiquette (Forgays, Hyman, & Schreiber, 2014). In line with research from different countries and diverse cultural backgrounds (e.g., Andreassen et al., 2013; Baron & Campbell, 2012; Geser, 2006; Karadağ et al., 2015), our female participants scored higher on both social media and mobile phone addiction behaviors, partially supporting H1. Females also exhibited higher levels of creeping than males, which we did not predict. Although creeping is considered a potentially problematic online behavior, its passive nature (in contrast to catfishing) may make it somewhat less socially controversial or objectionable, especially in female emerging adults. Higher levels of creeping among females may also, at least partly, reflect their more frequent engagement in social media and mobile phone use. It should be noted, however, that females reported higher levels of social media and mobile phone addictive behaviors and creeping, even after taking into account the emerging adults' age, time spent on social media, and personality traits. Contrary to our prediction based on the extant research, gender did not significantly predict phubbing. Even though previous research suggests that females may be more likely to engage in phubbing (Chotpitayasunondh & Douglas, 2016; Karadağ et al., 2015), those in our sample may have (relative to males) somewhat suppressed this socially undesirable activity due to the presence of other people in the context of phubbing or were simply more affected by the social desirability bias than males. Thus, the gender differences, if they actually exist, were neutralized.

Younger people use social network sites (Chou, Hunt, Beckjord, Moser, & Hesse, 2009; Kuss & Griffiths, 2011; McAndrew & Jeong, 2012) and the Internet in general (Bernier &

LaFlamme, 2005) more often than older people. As impulsivity and addictive behaviors are also more common among younger age groups (Griffiths, 1996), extant studies correspondingly report negative relations between age and both mobile phone addiction (Andreassen et al., 2013; Bianchi & Phillips, 2005; Khang et al., 2012; Smetaniuk, 2014) and social media addiction (Andreassen et al., 2013; Karadağ et al., 2015). Our results generally concur with those findings and extend them to other types of problematic social media and mobile phone use (except for catfishing), supporting H2. However, the associations between age and social media overuse and phubbing notably diminished after taking into account time spent on social media and personality traits. This suggests that the respective characteristics may explain age-related differences in levels of social media addiction and phubbing. Nevertheless, the lower rates of mobile phone overuse and creeping among older emerging adults was evident even after taking into account gender, time spent on social media, and personality. Although the relations between emerging adults' age and problematic social media and mobile phone use were rather modest, the outcomes suggest that, within the period of emerging adulthood, mobile phone addiction and creeping may decrease as young people approach adulthood.

The Role of Personality Traits in Five Types of Problematic Mobile Phone and Social Media Use

As expected (H4), concurrently assessed personality traits uniquely predicted problematic mobile phone and social media use in a manner supporting five out of seven predictions, over and above the emerging adults' background characteristics and time typically devoted to social media activity. This concurs with the notion that dispositional tendencies to feel, think, and act in a certain way across time and contexts represent a crucial source of a wide range in human behavior (e.g., Funder, 2008), which our results now extend to recently identified behaviors associated with new information–communication technologies. Furthermore, our study reveals that the emerging adults' self-reports on the five basic personality traits differentially predict the types of disruptive or problematic mobile phone and social media use, supporting the distinctiveness of these online behaviors.

In addition to previous research demonstrating neuroticism as a risk factor in a variety of behavioral addictions, including social media addiction (Andreassen et al., 2013) and mobile phone addiction (Augner & Hacker, 2012; Ehrenberg et al., 2008; Hong et al., 2012; J. A. Roberts et al., 2015; Smetaniuk, 2014), the trait played an overarching role across the five behaviors under study (in support of H4). Communication through mobile phones and social media, as opposed to in-person communication, may be more common among emerging adults with higher levels of neuroticism due to social anxiety (Ehrenberg et al., 2008), general proneness towards anxiety, lack of self-confidence, reliance on avoidant coping strategies, and ruminative identity exploration (Luyckx, Klimstra, Duriez, Schwartz, & Vanhalst, 2012).

Lower levels of conscientiousness in our participants predicted higher levels of both social media and mobile phone addictive behavior (supporting H4), as well as higher levels of phubbing and creeping. The findings are consistent with the previously documented role of conscientiousness in social media addiction (Andreassen et al., 2012, 2013; Wilson et al., 2010), mobile phone addiction (J. A. Roberts et al., 2015), and phubbing (Chotpitayasunondh & Douglas, 2016). It seems that individuals with poor levels of voluntary impulse control, inhibition, and capability in delaying immediate gratification—manifested in low levels of

discipline, organization, determination, and perseverance—tend to spend more time on social media and mobile phones and more time creeping others online and are more likely to interrupt real-life social interactions by attending to their mobile phones. Our results also are congruent with the idea that social networks serve as an opportunity for individuals low in conscientiousness to procrastinate (Gosling, Augustine, Vazire, Holtzman, & Gaddis, 2011), which may be relevant not only for social media use but for mobile phone use as well.

Extraversion specifically predicted mobile phone overuse (in line with H4) and phubbing in our sample. The positive association between extraversion and mobile phone overuse supports previous findings (Andreassen et al., 2013; Bianchi & Phillips, 2005; Smetaniuk, 2014) and appears consistent with the extraverts' need for socializing (e.g., John et al., 2008). Thus, they seem likely to use mobile phones as a medium to seek out and maintain a wide range of social contacts (Andreassen et al., 2013; Gosling et al., 2011). Moreover, due to their inclination to strive for rewards and stimulation in general (Costa & McCrae, 1992), extraverts may use mobile phones for nonsocial stimulation purposes as well (Bianchi & Phillips, 2005).

Whereas past research indicates positive relations between openness and frequency of social media use (Correa, Hinsley, & De Zuniga, 2010), social media and mobile phone use is no longer regarded as a novel activity by young people. Thus, curiosity and susceptibility to novel, diverse experiences (high openness) may no longer predispose individuals to more frequent use of social media. Indeed, more recent findings by Andreassen et al. (2013) showed an inverse relation of openness with mobile phone overuse. Accordingly, we expected that openness would negatively predict mobile phone addictive behaviors (H4), but the negative association was not statistically significant. The results suggest, in line with the outcomes of other studies (Ehrenberg et al., 2008; J. A. Roberts et al., 2015), that openness may not be a crucial factor in mobile phone overuse. Nonetheless, the trait may play an important role in emerging adults' (less frequent) phubbing. Our findings showed that the less broad-minded emerging adults, who are less likely to accept new ideas and activities and/or try new behaviors, are more likely to engage in socially inappropriate phubbing than their more open-minded peers.

Finally, agreeableness displayed negative associations with creeping and catfishing. As the trait is particularly important in establishing and maintaining positive interpersonal relationships, it seems that more helpful, friendly, trusting, pleasant emerging adults tend to avoid mobile phone and social media behaviors that could harm their relationships. Hence, agreeableness may represent a protective factor against problematic online behaviors (Andreassen et al., 2013). Also, higher levels of empathy in agreeable individuals (Nettle, 2007) could inhibit them from doing things they perceive as unpleasant. Although all of the types of online behaviors we examined may be considered socially undesirable, our results imply that this may be particularly the case for creeping and catfishing.

Limitations and Future Directions

Certain limitations of the present study should be highlighted. The data were based on self-report measures, which are subject to various biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). One possible bias is the social desirability bias, although it may have been lessened by the anonymous online data collection procedure we applied in our study. However, the possibility of a common method bias² remains. In addition, the study relied on a convenience sample of Slovenian emerging adults, overrepresented by females, younger emerging adults, and university

students, limiting the generalizability of the results. Due to the sampling and data gathering procedure, the sample may have suffered from self-selection bias. We speculate that emerging adults who daily devote more time engaging in online activities were more likely to participate. Based on their personality tendencies, one could also expect that more extraverted, agreeable, and open individuals were more likely to fill out the survey. However, as practically all emerging adults in Slovenia use smartphones (SURS, 2017a), spend time online daily (SURS, 2017b), and seem to spend a notable portion of the day on social media, other Internet sites, and mobile phones (Coyne et al., 2013), we would not expect large discrepancies in the results if a different procedure was employed. Further, we did not ask the participants to report on the specific social media platforms they use, which could be related to problematic mobile phone and social media use, though it is less likely to affect the association of background and personality characteristics with the studied behaviors.

Our cross-sectional and correlational study design precludes any causal conclusions or inferences on directionality of the relationships obtained. Longitudinal studies using cross-lagged panel designs are needed to elucidate the direction of associations found in this and previous studies. Finally, the links between the Big Five and the problematic aspects of social media and mobile phone use were rather modest, suggesting that other psychological characteristics may be involved. Promising sets of personal characteristics to be investigated in the future are specific personality traits, such as the Dark Triad: narcissism, Machiavellianism, and psychopathy (e.g., Buckels, Trapnell, & Paulhus, 2014; Fox & Rooney, 2015), and measures of executive function (e.g., Billieux, 2012; Zhou, Zhou, & Zhu, 2016). Likewise, future studies with large age-heterogeneous and gender-balanced samples could further examine possible moderating roles of age and gender in the relations between personality traits and problematic use of social media and mobile phones.

CONCLUSIONS

Taken together, the results of the present study indicate that behaviors associated with problematic use of social media and mobile phones (except catfishing) are relatively common among emerging adults in Slovenia. Nevertheless, the prevalence of those behaviors may have been somewhat underestimated due to social desirability bias (King & Bruner, 2000). Our findings further suggest that the respective online behaviors tend to be lower among older than younger emerging adults (partly due to a lower amount of time spent on social media) even within the limited age range, and that females engage in slightly higher levels of both social media and mobile phone overuse and creeping than males. In addition, we documented a unique contribution of the Big Five personality traits to the five types of problematic social media and mobile phone use. High neuroticism and low conscientiousness appeared to be the main personality risk factors. The Big Five also showed differential relations with emerging adults' problematic use of social media and mobile phones, implying that various problem behaviors associated with modern technology and their factors should be studied separately. In addition, these results suggest that each personality trait can be regarded as a risk or a protective factor in various human behaviors. For example, while extraversion is generally considered a desirable trait in Western societies (e.g., Cain, 2012) and is associated with some positive outcomes (e.g., subjective well-being; Steel, Schmidt, & Shultz, 2008), it may predispose individuals to higher levels of mobile phone use and phubbing.

IMPLICATIONS FOR APPLICATION

The present study reveals age-related decline in social media and mobile phone overuse, phubbing, and creeping within emerging adulthood, with a negative age effect on mobile phone overuse and creeping remaining evident even after accounting for time typically spent on social media and personality traits. Additionally, females reported higher levels of social media and mobile phone overuse and creeping than males. Thus, educators and policy makers should target their prevention and intervention programs not only on adolescents and/or boys, but also on (younger) emerging adults, especially females. The findings regarding the role of personality in problematic aspects of social media and mobile phone use suggest that education and intervention would benefit from taking into account individuals' personality traits. For example, educators might inform young people (and general public) why individuals with certain personality configuration may be more susceptible to social media and mobile phone overuse. More precisely, young people high in neuroticism and/or low in conscientiousness should be identified and focused on as they seem to be particularly at risk for problematic behavior related to social media and mobile phone and the potential consequences. For example, individuals high in neuroticism might benefit from learning effective strategies of coping with anxiety in order to prevent spending a lot of time on social media and/or mobile phone; behavior modification techniques could be used with individuals low in conscientiousness in order to increase focus on important goals, develop habits that decrease chances for social media and mobile phone overuse (e.g., leaving the mobile phone in another room when studying), and so on.

Lastly, although our measurement of catfishing was primarily exploratory, and participants reported comparatively lower levels of this behavior compared to the other problematic behaviors, we note that higher levels of this behavior were significantly associated with lower agreeableness, higher neuroticism, and more time spent on social media. The limited extant research (Gil-Or et al., 2015; Kaskazi, 2014) indicates that presenting a false identity on social media may be connected to, or contribute to, pathological traits. We therefore suggest that clinicians who work with emerging adults that spend comparatively more time on social media may want to pay special attention to the presence of catfishing or similar behaviors.

ENDNOTES

1. The DSM-5 added a subsection on "Non-substance-related disorders" to the category of "Substance-related and Addictive Disorders," but presently the only condition with defined criteria is the gambling disorder. Other conditions were also considered with the problematic use of the Internet (including gaming, social networking, etc.) noted as potentially addictive (Potenza, 2014). The addictive nature of social media is indicated mainly by the mental preoccupation and negligence of other aspects of social functioning, and possibly also abstinence symptoms when faced with sudden cessation of social networking (Pantic, 2014). Similarly, mobile phone addiction shares a number of criteria similar to those of dependence in psychiatric classifications (Kwon et al., 2013). The focus of this study is on self-reported occurrence of behaviors reflecting excessive use of social media and mobile phones and not on clinical diagnosis of addiction. However, as previous studies of these behaviors (and associated questionnaires) tend to apply the term addiction we cautiously use it as well.
2. The common method bias refers to the possibility that associations between variables measures are attributable, at least in part, to the same measurement method (in our case, all variables were assessed

by questionnaires) rather than solely to associations between constructs the measures are assumed to represent (Podsakoff et al., 2012).

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EXPLORING INDIVIDUAL DIFFERENCES AMONG TEACHERS' ICT ACCEPTANCE: A PATH MODEL AND THE ROLE OF EXPERIENCE

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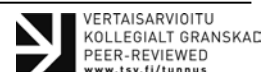
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Abstract: *This research tested a path model in which constructive beliefs, components of the technological acceptance model, and perceived enjoyment directly and indirectly predicted information and communication technology (ICT) integration into educational practices. We analyzed whether experience played a moderating role in this nomological network of associations. The sample comprised 374 Italian teachers ($M_{age} = 38.69$, $SD = 5.30$, $F = 198$) divided into two groups: the first with 20 or fewer years of teaching experience and the second with 21 or more years. They completed a questionnaire comprising a socioanagraphic section and the following scales: the Teacher's Beliefs, the Intrinsic Motivation, the Extrinsic Motivation, the Perceived Ease of Use, the Behavioral Intention to Use Computer and the ICT Class Use. Results showed positive correlations between ICT integration and the variables of interest and generally confirmed the mediated and moderated relationships. Suggestions were provided to enhance a successful ICT integration.*

Keywords: *teachers, hedonic and utilitarian motivation, ICT integration, constructivist beliefs.*

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INTRODUCTION

The use of information and communication technologies (ICTs) in education has become a relevant and much discussed issue over the last years. Although ICTs provide avenues for proactive teaching and active learning, produce knowledge more quickly, and create spaces for interaction and information sharing (Livingstone, 2012), “teachers are a little bit frightened about using of these tools.... The teacher is without any training how to use the whiteboard ... teachers do not know how to use it and what are its advantages and disadvantages” (Kubiato, 2017, p. 4). Indeed, the shift from traditional education programs toward technological classrooms has been slow and sporadic. Hence, an urgent need exists in preparing teachers to incorporate technology into their future lessons.

The integration of ICTs into the learning environment has been hindered by some obstacles, such as the two types of barriers defined by Ertmer (1999). The first-order barriers, which are extrinsic to teachers and can be removed via governmental policies, refer to the lack of adequate access, time (Legrain, Grillet, Gernigon, & Lafrenière, 2015; Reddy & Srivastava, 2003), bandwidth, training, and institutional support (e.g., Galanouli, Murphy, & Gardner, 2004; Ofulue, 2011). Conversely, second-order barriers are intrinsic to teachers and comprise pedagogical and technology beliefs and willingness to change (e.g., Inan & Lowther, 2010; Koehler & Mishra, 2008; Lane & Lyle, 2011; Y. Liu & Szabo, 2009).

Consequently, a large body of research has focused on how the use of technologies might support teaching practice (Bitonto Roselli, Rossano, Monacis, & Sinatra, 2010). Two general categories of professional computer use have been identified (Hogarty, Lang, & Kromrey, 2003; van Braak, Tondeur, & Valcke, 2004): (a) supportive computer use is related to the use of computers for proactive and administrative tasks, such as preparing worksheets, student administration and evaluation, and keeping track of pupils’ learning progress, and (b) the class implementation of computers to support the teaching/learning processes, such as demonstration, drill and practice, instruction, and differentiation.

The influence of personal factors on ICT integration also has been taken into account (e.g., de Palo et al., 2012; Kahraman & Yilmaz, 2018; Teo, 2011) primarily in the context of preservice teachers (Scherer, Tondeur, Siddiq, & Baran, 2018; Tondeur, Aesaert, Prestridge, & Consuegra, 2018). But the relationship between motivational factors and cognitive processes, such as teaching constructivist beliefs, teacher self-efficacy, computer effectiveness, and so forth, has not been investigated thoroughly (H. Liu, Lin, & Zhang, 2017), especially when considering the linkage between hedonic and utilitarian aspects and constructivist beliefs, and when considering the Italian school contexts (Sinatra, Limone, & Contini, 2017).

One stream of research among theoretical models explaining consumers’ acceptance of new technologies and their intentions for use has focused upon Davis’ technology acceptance model (TAM; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989), which is based on the theory of reasoned action (TRA; Fishbein & Ajzen, 1975). According to the TRA, individuals’ behavior is determined by their intention to perform it. The intention itself is influenced by the individuals’ attitudes and beliefs toward the behavior. Consequently, the TAM posits that perceived usefulness concerns the degree to which the user believes that using technology will improve his/her work performance; this component is crucial for technology acceptance. In contrast, perceived ease of use explains how effortless he/she perceives using the technology will be. Indeed, the higher the level of perceived ease of use and perceived usefulness, the higher the

tendency to adopt technological innovations; conversely, the lower the management of the benefits produced by innovation, the higher the difficulty of acceptance and use of technology.

Researchers have proposed and tested several competing models of the TAM, as well as models based on the theory of planned behavior, to explain and predict acceptance and use of ICTs. About a decade ago, Venkatesh and Bala (2008) synthesized a complete nomological network of the determinants of users into the integrated model of technology acceptance, known as TAM3. This model includes key factors and moderators, such as experience, to predict behavioral intention to use a technology and the actual technology use in organizational contexts. Performance expectancy, effort expectancy, and social influence were found to influence behavioral intention to use a technology, whereas behavioral intention exerts an influence on the using behavior.

From a more general perspective on human–computer interaction, classroom ICT integration could be associated with the emotional aspects of an individual's experience with technologies and, therefore, to the satisfaction of utilitarian and hedonistic needs. In this vein, it is worth noting that the hedonistic use of technology should be understood as the result of a process justifying a past or future action or behavior. Following Campbell's (cited in Van der Heijden, 2004) suggestion that the hedonic experience is connected to pleasure and excitement, Van der Heijden proposed the user acceptance of hedonic information system model to examine the variations in consumer behavior in regard to the utilitarian and hedonic use of information systems. This model posits that a utilitarian information system is designed to increase the user's task performance while encouraging efficiency, whereas a hedonic, pleasure-oriented system is a function of the degree to which the user experiences enjoyment when using the system. As a consequence, high levels of extrinsic motivation, operationalized as perceived usefulness, dominate the first system and high levels of intrinsic motivation, operationalized as perceived enjoyment, are significant determinants of the second one.

Lastly, constructivist beliefs have been individualized as a further meaningful factor influencing ICT integration because they affect teachers' decision-making processes about learning objectives and contents, organizational issues, the selection of media, the choice of instructional strategies, and the adoption of approaches toward assessment and evaluation. In fact, hypothesizing that learning occurs when learners are the makers of knowledge and meaning, the constructivist approach suggests that teachers' beliefs may be strong predictors of class use of computers (Higgins & Moseley, 2001; Tondeur, van Keer, van Braak, & Valcke, 2008). This contrasts with the traditional perspective that assumes learners receive information passively, which in turn may impact negatively on integrated ICT use (Hermans, Tondeur, van Braak, & Valcke, 2008).

In light of the issues described above, we sought in the current research to provide a deeper analysis of individual differences among teachers' ICT acceptance with reference to utilitarian and hedonic uses of information systems. For this purpose, we employed a path model to examine whether the cognitive factor of constructive beliefs directly predicted the key components of the TAM (perceived usefulness, perceived ease of use, and perceived enjoyment of ICT use) and the ICT integration within the classroom (H1). Moreover, we expected that the key constructs of the TAM mediated the relationships between constructive beliefs and ICT integration within the classroom (H2), and that perceived enjoyment mediated the relationship between constructive beliefs and teachers' ICT integration (H3). Following Van der Heijden's (2004) suggestion that work environments could be associated almost exclusively with utilitarian information systems, and given that interaction with the technological system is subordinate to the achievement of external goals,

we felt a reasonable hypothesis was that perceived ease of use was less central to the prediction of intentions to use a system than perceived usefulness (H4).

Finally, on the basis of the TAM3 (Venkatesh & Bala, 2008), we intended to examine through this path model whether the variable of experience, that is, years teaching, moderated the relationships between perceived ease of use and behavioral intention to use (H5) and between perceived ease of use and perceived usefulness (H6).

METHOD

Participants

The sample of this research was recruited from primary and secondary schools in three Italian regions selected on the basis of their convenience and/or accessibility. The sample comprised 374 teachers ($M_{age} = 38.69$, $SD = 5.30$; $F = 198$) who attended a training course in ICTs in the period between November 2017 and January 2018. This single course took place at various times during that time period (i.e., the people attended multiple sessions of the single course) and aimed at helping teachers learn how to create engaging and interactive multimedia contents and presentations, at digitally assessing students' knowledge, at learning the basic concepts of distance learning and e-learning, and at exploring the best options for a successful ICTs integration into their classroom.

Data Collection and Analysis

The data collection period took place in the week prior to the training course. The teachers participated voluntarily and responded to the pencil-and-paper questionnaire anonymously. The completion of the battery took approximately 20 minutes. The scales had been translated into Italian by two authors of this paper who are experts in both Italian and English and then, to assure accuracy, back-translated into English by a native English-speaker well familiar with Italian.

The methodological approach to the data involved descriptive and causal analyses. For the descriptive analyses, minimum, maximum, means, and standard deviations of each score were calculated. The sample was divided into two groups on the basis of the years of teaching experience, that is, the first group possessed 20 or fewer years ($n = 201$) of teaching experience and the second group had 21 years or more ($n = 173$). Mean differences between the two groups were calculated by using an independent samples *t*-test. Bivariate correlations were applied to analyze the associations among the variables of interest. The associations among the variables of interest were tested by path analysis; the years of teaching experience also were included within this model. Data analyses were conducted using SPSS and Mplus.

The Scales

The battery comprised a socioanagraphic section (i.e., gender, age, and school category) in addition to the five scales. All the scales are rated on a five-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*).

The Teacher's Beliefs Scale–Constructivist Teaching (TBS-CT; Woolley, Benjamin, & Woolley, 2004) is designed to assess teachers' beliefs related to the student-centered pedagogical perspective (Sang, Valcke, van Braak, Tondeur, & Zhu, 2011; Tondeur et al., 2008). It is composed of seven items (e.g., "I involve students in evaluating their own work and setting their own goals"; "I make it a priority in my classroom to give students time to work together when I am not directing them"). The instrument showed a sufficient level of reliability (Cronbach's $\alpha = .66$).

The Intrinsic Motivation–Computer Enjoyment Scale (Davis, 1989) measures the extent to which the activity of using the computer is perceived as enjoyable. The scale comprises three items (e.g., "I find using a computer to be enjoyable") and the internal consistency level was high (Cronbach's $\alpha = .91$).

The Extrinsic Motivation–Perceived Usefulness (Davis, 1989) is composed of six items assessing the degree to which a person believes that using a particular system would enhance his/her performance (e.g., "Using electronic mail enhances my effectiveness on the job"). The internal consistence was high (Cronbach's $\alpha = .90$).

The Perceived Ease of Use Scale (Davis, 1989) comprises six items that assess the degree to which a person believes that using technology would be free of difficulty or effort (e.g., "My interaction with a computer is clear and understandable"). The internal consistency was high (Cronbach's $\alpha = .88$).

The Behavioral Intention to Use Computer Scale (Davis, 1989) is composed of three items (e.g., "Assuming I had access to a computer, I attend to use it") measuring the likelihood that a person will adopt computer applications. The internal consistency level was high (Cronbach's $\alpha = .89$).

The ICT Class Use Scale (ICT-class; van Braak et al., 2004) consists of eight items (e.g., "I use ICT for independent work/ individual learning") assessing the frequency (from never to daily) of the didactic use of computers in the classroom. The internal consistency level was high (Cronbach's $\alpha = .83$).

FINDINGS

The results of the descriptive analyses are reported in Table 1. No mean differences emerged between the two groups of the teachers in the scores of constructivist beliefs, $t(372) = 1.17$, $p = .829$; intrinsic motivation, $t(372) = .192$, $p = .893$; perceived ease of use, $t(372) = -.204$, $p = .598$; and classroom use of technology, $t(372) = 1.17$, $p = .160$. Conversely, differences emerged in the scores of both perceived usefulness, $t(372) = -.232$, $p = .020$, and behavioral intention to use computer, $t(372) = 1.74$, $p = .010$. Teachers with 20 or fewer years of experience obtained higher scores ($M = 20.01$, $M = 14.01$, respectively) than those of the second group ($M = 18.89$, $M = 12.58$, respectively).

Correlations

Findings from bivariate correlations provided the first picture of the interrelationships among the constructs: All associations with the classroom use of technology were strong and positive. Moreover, teachers' ICT integration was strongly related to perceived enjoyment and TAM factors (Table 2).

Table 1. Descriptive Statistics: Mean and Standard Deviation of the Total Sample and of the Two Categories of Teaching Experience for Each Variable.

	Total Sample		20 years		21+ years	
	Min–Max	Mean (SD)	Min–Max	Mean (SD)	Min–Max	Mean (SD)
Age	28–57	38.69 (5.30)	31–60	44.95 (5.88)	43–62	54.77 (3.93)
Years of teaching experience	1–41	20.11 (9.09)	1–20	12.53 (5.20)	21–41	27.69 (.808)
C_beliefs	15–35	28.20 (2.19)	18–35	26.42 (3.16)	15–32	25.90 (3.15)
PE	3–15	12.22 (2.22)	3–15	12.25 (2.20)	6–15	12.19 (2.24)
PEU	6–25	18.83 (3.47)	6–25	18.78 (3.41)	6–25	18.88 (3.55)
PU	6–25	18.10 (3.02)	6–25	24.32 (3.67)	15–24	23.79 (3.59)
BIUC	8–15	12.78 (1.69)	8–15	12.99 (1.62)	8–15	12.58 (1.727)
ICT-CU	22–40	37.25 (5.17)	22–40	33.83 (3.99)	26–40	33.20 (3.505)

Note. C_beliefs = Constructivist beliefs; PE = Perceived Enjoyment; PEU = Perceived Ease of Use; PU = Perceived Usefulness; BIUC = Behavioral Intention to Use Computer; ICT-CU = Integration Computer Technology-Classroom Use.

Table 2. Bivariate Correlations Among The Variables Related to ICT Integration Within The Classroom.

	PE	PEU	PU	BIUC	ICT-CU
C_beliefs	.418**	.336**	.390**	.408**	.534**
PE	-	.573**	.451**	.397**	.507**
PEU	.573**	-	.402**	.490**	.505**
PU	.451**	.402**	-	.512**	.472**
BIUC	.397**	.490**	.512**	-	.566**

Note. ** $p < .001$; C_beliefs = Constructivist Beliefs; PE = Perceived Enjoyment; PEU = Perceived Ease of Use; PU = Perceived Usefulness; BIUC = Behavioral Intention to Use Computer; ICT-CU = Integration Computer Technology-Classroom Use.

Path Model

The path model exhibited good fit to the data, $\chi^2 = 44.280$, $df = 12$, $p < .001$, RMSEA = .067, 90% CI = .020 - .076, CFI = .927, SRMR = 0.68, and included a number of significant paths. Figure 1 displays the model that presents the interrelationships between the variables of interested.

As the path model demonstrates, constructivist beliefs predicted directly and positively perceived enjoyment of the computer class which, in turn, was also positively predicted by perceived enjoyment, perceived usefulness and behavioral intention to use a computer. This behavioral

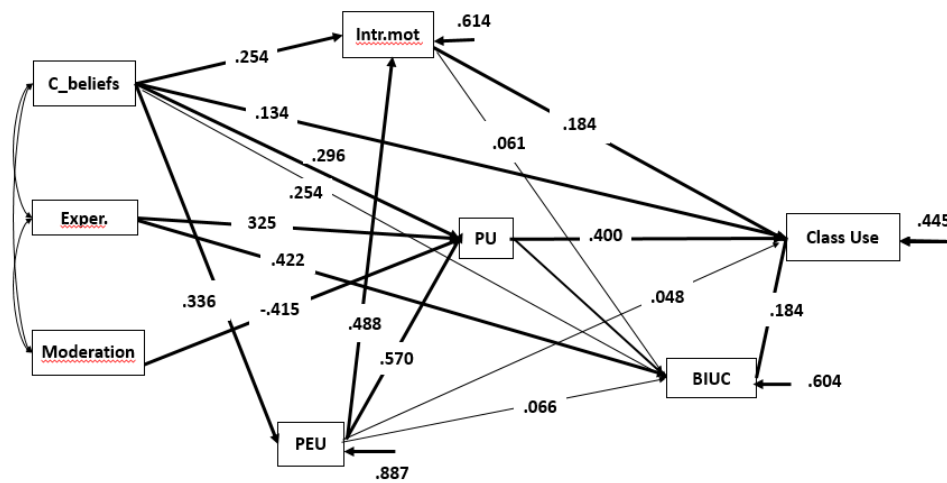


Figure 1. Observed path model of antecedents and mediators of the computer class use.

Note. Direct and indirect paths, whose values are standardized regression weights for predicted relationships. Values associated with endogenous (Intr.mot, PU, PEU, BIUC) and indicator variable (Class use) are error variances. **C_beliefs** = Constructivist beliefs; **Intr.mot** = Intrinsic motivation (operationalized as perceived enjoyment); **PU** = Perceived Usefulness; **PEU** = Perceived Ease of Use; **BIUC** = Behavioral Intention to Use Computer; **Class Use** = Computer Class Use; **Exper.** = Experience. Significant paths are in bold.

intention was positively predicted by perceived usefulness. Perceived ease of use positively predicted perceived enjoyment and perceived usefulness.

Teaching experience proved to be a positive predictor of perceived usefulness and a negative predictor of behavioral intention to use computer. Moreover, this experience moderated the relationship between perceived ease of use and perceived usefulness (Table 3).

As for the indirect effects (Table 4), results showed several interesting relationships. First, the relationship between constructivist beliefs and computer use in the classroom was mediated by perceived enjoyment (intrinsic motivation), perceived usefulness, perceived ease of use, and behavioral intention to use computer. The relationship between perceived ease of use and computer classroom use also was mediated by perceived enjoyment (intrinsic motivation), perceived usefulness and behavioral intention to use computer. Third, the relationship between perceived usefulness and computer classroom use was mediated by behavioral intention to use computer and, finally, the relationship between constructivist beliefs and behavioral intention to use computer was mediated by perceived usefulness alone and together with perceived ease of use.

DISCUSSION

The current research sought to explore individual differences in ICT integration in classroom among Italian teachers by examining a path model in which constructivist beliefs, perceived enjoyment together with perceived usefulness of computer, and perceived ease of use (Davis, 1989; Davis et al., 1989) explained the use of technology in teaching. Moreover, the moderating role of

Table 3. Standardized Regression Beta of Direct and Moderating Paths and Their Significance.

	B	p
Dependent variable: ICT CLASSROOM USE		
C_beliefs	.134	.015
BIUC	.184	.011
Int.mot	.184	.001
PEU	.048	.407
PU	.400	.000
Dependent variable: BIUC		
Int.mot	.066	.407
PEU	.061	.511
PU	.440	.000
C_beliefs	.123	.163
Experience	-.422	.005
Moderation	.003	.529
Dependent variable: PEU		
C_beliefs	.336	.000
Dependent variable: Int.mot		
C_beliefs	.254	.000
PEU	.488	.000
Dependent variable: PU		
C_beliefs	.296	.000
PEU	.570	.000
Experience	.325	.018
Moderation	-.415	.006

Note. **C_beliefs** = Constructivist beliefs; **Int.mot** = Intrinsic motivation (operationalized as perceived enjoyment); **PEU** = Perceived Ease of Use; **PU** = Perceived Usefulness; **BIUC** = Behavioral Intention to Use Computer.

teacher experience also was tested in line with the TAM3 model proposed by Venkatesh and Bala (2008).

Overall, the findings supported the hypotheses. Descriptive results showed differences in years of teaching experience, that is, teachers with 21 or more years of experience seemed to see no need to question or change their professional practice, and thus they were unlikely to adopt the use of ICTs within their classrooms. Compared to teachers with more years of experience, those with 20 years or fewer years of teaching experience seemed to have a positive attitude toward the use of ICTs in the classroom and to perceive the effectiveness of ICT integration in supporting both teaching and pupils' learning. These results might be justified by the fact that teachers with more years of experience could not have had much formal computer training during their higher education studies, and thus, they were more inclined to exhibit a limited use of technological tools or to discount ICTs potential benefits. These findings were consistent not only with investigations showing that ICT use decreases with teaching experience (Bebell, Russell, & O'Dwyer, 2004; Inan & Lowther, 2010; van Braak et al., 2004) but also with Prensky's (2001) suggestion that

Table 4. Direct, Total and Indirect Effects.

	B	p
Effects from CONSTRUCTIVIST BELIEFS to ICT CLASSROOM USE		
Total	.493	.000
Total indirect	.359	.000
Specific indirect		
Via Int.mot	.047	.005
Via PEU	.016	.408
Via BIUC	.023	.155
Via PU	.118	.001
Via Int.mot and PEU	.030	.002
Via BIUC and Int.mot	.003	.428
Via BIUC and PEU	.004	.530
Via BIUC and PU	.024	.061
Via PU and PEU	.076	.000
Via BIUC, Int.mot and PEU	.002	.438
Via BIUC, PU and PEU	.015	.036
Direct effect	.134	.015
Effects from INTR. MOTIVATION to ICT CLASSROOM USE		
Total	.196	0.001
Total indirect	.012	0.437
Specific indirect		
Via BIUC	.012	.437
Direct	.184	.001
Effects from PEU to ICT CLASSROOM USE		
Total	.429	.000
Total indirect	.381	.000
Specific indirect		
Via Int.mot	.090	.002
Via BIUC	.011	.530
Via PU	.228	.000
Via BIUC and Int.mot	.006	.437
Via BIUC and PU	.046	.030
Direct effect	.048	.407
Effects from PU to ICT CLASSROOM USE		
Total	.481	.000
Total indirect	.081	.031
Specific indirect		
Via BIUC	.081	.031
Direct effect	.400	.000
Effects from CONSTRUCTIVIST BELIEFS to BIUC		
Total	.385	.000
Total indirect	.262	.000
Specific indirect		
Via Int.mot	.017	.397
Via PEU	.020	.510
Via PU	.130	.001
Via Int.mot and PEU	.011	.408
Via PU and PEU	.084	.000
Direct effect	.123	.163

Note. **Int.mot** = Intrinsic motivation (operationalized as perceived enjoyment); **PEU** = Perceived Ease of Use; **PU** = Perceived Usefulness; **BIUC** = Behavioral Intention to Use Computer

teachers with less experience, being younger and born into a digital world, have been exposed to ICTs and thus possess more confidence than their older counterparts.

Results from bivariate correlations among psychological factors showed that ICT use in the classroom was positively linked to constructivist beliefs and the TAM factors. Accordingly, teachers with a more student-oriented approach seemed to consider ICTs as useful cognitive tools that encourage students to incorporate their critical-thinking, collaboration, communication, and problem-solving skills into their learning to solve authentic problems. This finding was in line with previous studies that revealed a positive relationship between teachers' beliefs and ICTs (Deng, Chai, Tsai, & Lee, 2014; Ertmer, Ottenbreit-Leftwich, & Tondeur, 2015; Prestridge, 2012).

As for the path model, results accounted for the role of cognitive factors in fostering the intrinsic motivation, perceived usefulness, and perceived ease of use which, in turn, predicted the intention to use computer in classroom, as well as the effective use of computer during lessons (H1). More specifically, teachers' attitudes and beliefs, especially when oriented to a constructivist approach to teaching, are significant antecedents of the extrinsic and intrinsic components of motivation for using computers in classroom.

When looking at the mediation relationships, the degree to which teachers believe that using technology will improve their performance (H2) and the degree to which they perceive effortlessness in using the technology mediated the effects of constructivist beliefs on the use of computers in classroom (H3). Interestingly, the relation between the constructivist beliefs and behavioral intention to use computers was mediated only by perceived usefulness, whereas perceived ease of use mediated that relationship only together with perceived usefulness.

Findings supported the hypothesis based on Van de Heijden's (2004) suggestion that a less central role of the perceived ease of use in predicting intentions to use a system in comparison to perceived usefulness in a work environment characterized almost exclusively by utilitarian information. Indeed, perceived usefulness directly predicted intentions to use a technological system, whereas perceived ease of use did not predict it (H4). Moreover, when considering the role of these two separate constructs in connection with the relationship between constructive beliefs and behavioral intention to use, results showed a significant mediating role of perceived usefulness but not of perceived ease of use. Conversely, when considering simultaneously both constructs as mediators, the linkage between constructivist belief and behavioral intention to use became significant. Furthermore, when looking for the associations between perceived ease of use and ICT integration via perceived usefulness and behavioral intention to use, results provided a significant mediated linkage.

Finally, on the basis of the TAM3 (Venkatesh & Bala, 2008), this path model intended to examine whether the variable of experience, that is, years teaching, moderated the relationships between perceived ease of use and behavioral intention to use (H5) and between perceived ease of use and perceived usefulness (H6). Findings confirmed the moderating role of experience in the relationship between perceived ease of use and perceived usefulness, but not in the relationship between perceived ease of use and behavioral intention to use computer.

This research has some limitations. First, because it was carried out with two groups of teachers, some with 20 or fewer years of experience and others with 21 or more years, further studies are needed to clarify why teachers' willingness of using ICT tools decreased with experience. Once the underlying reasons for the discrepancy is identified, strategies to awaken and support native digital teachers' enthusiasm should be promoted.

Second, as neither the participants' knowledge of computer usage nor their use of technological tools were analyzed, our results could have been affected. For instance, individuals who frequently use social networking media in their everyday lives have a high chance of accepting technology into their teaching and learning (e.g., Elkaseh, Wong, & Fung, 2016). Third, the learning contents provided by the training course could not be adapted enough or customized to users' needs, cognitive styles, computer attitudes, and so on (see, e.g., Behera, 2012; de Palo, Limone, Monacis, Ceglie, & Sinatra, 2018). Consequently, future research should pay more attention to these factors for facilitating human computer interaction and enhancing successful ICT integration into the classroom (Monacis et al., 2009). For example, not only pre- and postimplementation interventions should be planned to lead to greater user acceptance and system success, but also specific game-based trainings should be recommended and implemented. These actions could affect teachers' mood, reducing their anxiety and leading to a more hedonic and pleasure-oriented system. Finally, as data were collected by using self-reported questionnaires, which reflected teachers' own evaluation, results could have been affected by response bias.

IMPLICATIONS FOR RESEARCH, APPLICATION, OR POLICY

In light of the multiple policy initiatives adopted by the European Commission to promote digital technologies in teaching/learning contexts and to define the conditions for the future connected classroom (European Commission, 2018), an urgent need has surfaced in providing more up-to-date figures regarding ICT adoption into the classroom.

A key finding of this study is that experienced teachers seem to show some sort of resistance toward integrating ICT use within their classroom, as indicated by their responses regarding intention to use. This important finding can influence future technological plans made by governments for teacher education.

Our results can offer much to future research that deepens understanding of the underlying reasons for such resistance (e.g., personality or desire, generational, professional developmental, cultural, discipline-based, systemic) and what programs or processes can be identified to address the identified conditions. In the case of application of this study and future research in this area, programs can be designed to support those who need assistance in incorporating ICTs into their teaching pedagogy and if necessary, to, adapt the teaching environment at the individual class, school, school system, and professional education levels to facilitate accomplishing the goal. The same applies to software and hardware developers who might work collaboratively with educators to create technologies and programs better suited for teachers' pedagogical and evaluation needs, which might decrease objections if the teachers can see clear benefit to classroom teaching. Finally, at the policy level, in addition to governmental and organizational articulation of the challenges and definition of the goals to achieve better integration of ICTs within classroom learning, these agencies can provide the financial and logistical support for the training the teachers need to achieve the goals.

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BOOK REVIEW

Marshall, Jonathan Paul, Goodman, James, Zowghi, Didar, & da Rimini, Francesca (2015). *Disorder and the Disinformation Society: The Social Dynamics of Information Networks and Software*. London, UK: Routledge; 310 pages.

Reviewed by

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At a recent conference, an anthropologist commented that what was good about culture was that everyone has it—and that is the problem! The same may be said about information: Everyone has it and that is the problem! The book under review attempts to examine and unravel this paradox.

According to Bruno Latour (2014), humankind is now in the Age of Anthropocene, where human activity is the main shaper of the physical and social environment. Exactly when this age began is difficult to ascertain. It may have begun 500,000 years ago, when fire was first employed, or 10,000 years ago, when crop cultivation and animal husbandry became common practice. Some anthropologists date this age to the first water pump (1710), at the start of the Industrial Revolution. In any case, it now seems clear that human activity is the main determinant of the physical and social environments. A consequence of this is the increasing unpredictability of the future, as human intervention becomes a major factor in shaping it. The Age of Anthropocene must now include informationalism as the major source of intervention in the modern world. These interventions are the basis both of order and disorder in the present.

If the printing press marked the beginning of an informational society, more recent developments have multiplied its significance. Indeed, some writers are claiming that the Internet and new media have opened revolutionary paths to human development hitherto unknown. According to Barlow (1995, p. 36), “With the development of the Internet, and with the increasing pervasiveness of communications between networked computers, we are in the middle of the most transforming technological event since the capture of fire. I used to think that it was just the biggest thing since Gutenberg, but now I think you have to go back further.”

A similar claim was made by Pierre Levy (2011, p. 4): “I would therefore claim that we are approaching the dawn of a new civilization whose explicit aim will be to perfect collective human intelligence, that is to say, to pursue indefinitely the process of emancipation into whose path language has thrown us. If I have worked so hard at understanding the significance of cyberspace,



it is because it seems to me to be the most up-to-date tool available for improving our collective intelligence, the most recent path discovered for opening up our possibilities of collective choice.”

According to Masuda (as cited in Ling, 2009, p. 3), the Internet “will crystallize participatory democracy and result in a rich symbiosis of god and man, without the compulsion of power or law but by the voluntary cooperation of citizens.” Others make equally promising claims: “The Internet is the greatest revolution since the invention of the automobile except that its growth is 40 times faster. The Internet is the greatest invention of the century, if not ever.... The Internet is the greatest invention since the wheel” (Katz & Rice, 2002, p. 2). These millenarian expectations have so far been unfulfilled. Instead, a more sober, cautious, and even Luddite assessment of the digital world is emerging. The book under review presents an antinomial view of the current situation - information is its own aporia.

While the views above may be considered excessively optimistic, there is little doubt that humankind has entered a new era of informationalism. The promises of the new communication media tend to stress the benefits but downplay the negative aspects of the new technology. While the ability to communicate is generally beneficial, this assumes that people have control over who, what, when, and why they communicate. In reality, this control often is beyond most users, and instead the old power structures benefit by the ability to influence, shape, and keep track of people’s activities, particularly their digital meanderings. In a culture where consumption is an integral part of identity formation, the state and capital stand to gain more from the advances in communication than most individual users.

The authors of the book, *Disorder and the Disinformation Society: The Social Dynamics of Information Networks and Software*, argue that one must question who controls communicative structures and for what purposes. People’s lives increasingly depend on a world generated by media images and practices, but what interests motivate these images and practices? Do the new media encourage or do they constrain the democratization of everyday life? Is it possible to remain incommunicado in a social environment that increasingly instigates always staying in touch?

Moreover, communicative practices take place in a world marked by virtuality and radical alterities. Increasingly, people communicate with absent others, including nonhuman interlocutors. While technologically mediated communication often mimics face-to-face talk, its consequences are often radically different and unpredictable. Earlier boundaries separating culture from nature are transcended technologically. The Anthropocene and Informational Ages mark the domination of culture over nature.

These authors critically examine the basis of order in the so-called information society. As societies become more complex, the requirements for stability, maintenance, and reproduction also increase. A critical component of system maintenance is the production, dissemination, and integration of information. This is particularly significant in the information society, where access to information constitutes the basis of order. But a problem immediately arises: Who controls guarantees and implements information as the basis of order? The main argument advanced by the authors is that information always and necessarily produces counter-information or disinformation. This contradicting process occurs at all levels of the production, dissemination, and integration of information.

Information is both an important collective asset and a source of private profit. It must be shared as well as guarded. Although the generation of information and counter-information occurs in all social configurations, these are particularly crucial under advanced capitalism, not

only because of the excessive needs for information but also because of its commodification. A balance between the need to share information but also to limit its distribution cannot be accomplished given the conditions of late capitalism. Side by side with the flowering of novel and subversive information is the growing attempt to censure such expressions (e.g., SOPA, PIPA, ACTA¹). As an example, while the Freedom of Information Bill languishes in the House of Representatives (Congress) of the Philippines, that body quickly enacted a law against cybercrimes. Governments seem to be more concerned about controlling the free flow of information than in guaranteeing its access. While the new media are often perceived as a threat by government officials, ordinary citizens generally see them as emancipatory.

A hundred and fifty years after the Industrial Revolution commenced, humankind is on the threshold of another even more transformative period. The speed, extent, and reproducibility of information challenge notions of “original” and “past.” Neither seems relevant for the present. If modernity involved a transformation of the notion of time that allowed people to think globally following the introduction of time zone standardization, then new media may require a different notion of temporality as well. Constant connectivity negates spatiotemporal borders. Neither time nor space constrains life in the virtual present. Modern life is one of constant transit from an actual present to a virtual future.

Just as someone can contact anyone, anytime, anywhere, that someone also can be monitored anytime, anywhere by any one of many state and commercial organizations. As scholars have argued (e.g., Andrejevic, 2007; Leistert, 2012; Lyon, 2001), the state has enormous capacities to monitor its citizens’ online activities, practices supported also by commercial concerns. Thus, technologies are not just a means of communication, but also shape who we users are. The world not only is “mediafied,” but life transpires in and through these media of communication. As Daniel Miller (1997) argued, material accumulation is not just instrumental but also symbolic. The quest for individual identity requires a growing collection of material and virtual goods. When self-authorship is combined with a consumerist culture, one has entered capitalism’s utopia.

While technologies extend human capacity for agency, the acting subject during the practice is increasingly fragmented. People regularly interact with many absent others, many of whom are strangers: They join local, national, and global causes, and they participate in specialized interests such as Japanese wrestling, Caribbean cooking, or Spanish flamenco. Many of these online interactions are conducted individually. Moreover, the speed of technological change often does not allow sufficient time for collective norms to determine acceptable practices. Hence, children and the inexperienced are exposed to certain risks. Under these conditions, the notion of a singular, cohesive, consistent, or bounded self is impossible to maintain.

This expression of agency draws heavily on the expectations of others with whom each of us is increasingly and perpetually connected. It is becoming more difficult not to exercise agency, should that be one’s choice. Constant appeals from the market, the state, and even close friends to exercise agency is exhausting and makes solitude impossible. In a speech in 2010, Facebook’s Mark Zuckerberg said that people no longer expect privacy in their online activities (Paul, 2010). Thus, modern humans live within a paradox: The more choices people have in authoring their lives, the more dependent they become on the choices of others. The loss of solitude and privacy may be a high price to pay for this expanded agency. Perhaps it is time to reconsider the exercise of agency under conditions that are beyond a person’s control. The conditions above shape the production, dissemination, and use of information. As the authors,

Marshall et al., constantly reminded the reader, information is not just pure data but data contaminated with power, interest, and profit. These factors ensure that informationalism produces its own aporias.

In the 12 chapters of this book, the authors provide extensive references and examples of why informationalism produces both order and disorder. They begin by critiquing social theories ranging from Hobbes and Proudhon to Durkheim and Weber that mostly stress order over disorder. Even conflict is seen as a precursor of order, as the authors point to the creative arguments of anthropologist Gregory Bateson using examples from New Guinea. The rationalization of social life so necessary for modernity is intended to eliminate, or at least to minimize, disorder. Economists seem to be the most persuasive exponents of order in society, but their poor record of predicting market fluctuations make their claims suspect.

In several chapters dealing with seemingly more technical aspects of informationalism, such as software design, network compatibility, and computer functions, the authors provide convincing arguments and examples that technologies are themselves social projects open to elements of disruption due to the various hierarchies of power and control exercised by managers and technicians.

The crux of the problem with informationalism is its governing function within advanced capitalism. Data and knowledge, so crucial to capitalist growth and reproduction, is constrained and often hampered by the narrow requirements of immediate and exclusive profit. An irony of the Information Age is that while most of its highly educated workers play essential roles in advancing the system, intellectual work is often devalued.

Even in cases where information sharing and retrieval can be expected to benefit all users, such as peer-to-peer networks and academic researchers, disinformation arises due both to internal and external sources. For instance, competition and the pressures to publish often require academics to favor more exclusive practices, but at the expense of maximizing exchanges and collaboration. Taken to the extreme, these practices can lead to plagiarized sources and even data fabrication in favor of certain theoretical positions.

The book concludes with extensive examples of organizations using the Internet to pursue issues connected with global justice. The full potential of new media to challenge mainstream informationalism has been achieved successfully by a range of nongovernmental organizations, such as the People's Global Action,² resulting from the opposition to the neo-liberal policies of the United States of America. More recent expressions of similar movements are Occupy³ and the political opposition in the Middle East during the Arab Spring.⁴ But even these successful examples had to cope with internal dissensions and disinformation. They demonstrate that attempts to employ informationalism for radical transformations have their own limits.

Despite the book's extensive bibliography, the authors overlooked references that support their argument. Critics of the information society have been around for some time. Turkle (2012) and Marche (2012) have presented popular critiques of informationalism. Bauman (2010) argued how identities are now fabricated rather than inherited. Leistert (2012) wrote a powerful critique of the new communications technologies. Based on globally extensive research and drawing heavily on Foucault, Leistert claimed that mobile media is a medium of and for pastoral control that engages users in chatting and jabbering. Mobile media thus become part of "rendering instrumental rationalities and is a technology that enabled authorities to imagine and act upon the conduct of persons individually and collectively, and in locales that were often distant" (Miller & Rose, 2008, p. 16). Its pervasive presence has taken a pastoral mode.

Leistert (2012) referred to David Lyon's work, the *Surveillance Society* (2001). For Lyon, "All societies that are dependent on communication and information technologies for administrative and control processes are surveillance societies" (Lyon, 2001, p. 1). Surveillance, the underside of information society, "is any collection and processing of personal data, whether identifiable or not, for the purposes of influencing or managing those whose data have been garnered" (Lyon, 2001, p. 2). Thus, surveillance is part of a managerial program: It not only collects data, but also, in a managerial way, uses these data in programs and action plans on the surveilled.

"Surveillance capacities are used to sort and shift populations, to categorize and to classify, to enhance the life chances of some and to retard those of others" (Lyons, 2001, p. 4). As a result, surveillance is a discriminating political technology that consists of both care and control, and "is now routinely practiced by a range of agencies including, but as well going well beyond, the state" (p. 30). Facebook, Google, and Tweeter are the most familiar and relatively benign examples of surveillance. Technology generates a lifestyle that refashions the original in hitherto unexpected ways. Technology and society exist in a dialogical relationship.

Foucault (2004/2007, p. 21) argued that apparatuses of security are productive; they "work, fabricate, organize, and plan a milieu ... in which circulation is carried out." The new media technology with its devices, infrastructure, and economy are all results of such a milieu, where the circulation of communication takes place. Such communicative exchanges occur within a climate of free expression even as their accumulation is a basis for surveillance.

Pariser (2011) pointed out that future behavior will be shaped by algorithms collected from past behavior. The Internet becomes an algorithmic program based on past clickstreams. Algorithmically shaped social norms lead to a form of information determinism. The limitless collection of data and its storage lay the bases for a new and more extensive regime of control. Data retention does not block communication flows nor disturb productivity and circulation. Instead, it takes advantage of the flow of signs initiated by liberal rule. While data retention operates population-wide, it invokes a different relation towards its members who are considered a risk.

Andrejevic (2007, p. 177) argued that this limitless accumulation of data led to the formation of a Total Information Awareness Office.⁵ This data-gathering process is often a fishing expedition, designed to generate suspects by sifting through the data and identifying potentially high-risk individuals. The data gathered acts as a baseline of behavior where any deviation from the norm triggers suspicion and further investigation. Data retention is a materialization of an excess that is nurtured by (among other technologies) mobile media as it invokes a general mass surveillance.

If fingerprinting solved the problem of individual identity in a growing and shifting population of the 1880s, new technologies amplify this identifying capacity in greater detail. Digital fingerprints reveal all previously recorded interactions and organizations assess the viability of these actions and interactions using algorithmic criteria. This machinable assessment of behavior replaces real-world actions with their algorithmic equivalents, generating new forms of knowledge with little direct relationship to their ontological source. Citizens must assess the emancipative, liberal possibilities of digital media against a growing interest in state and/or corporate surveillance of their actions. A major feature of modernity is a self-reflectivity fulfilled in the new technology. Yet this reflectivity also represents an essential structural component of modern governmentality.

Disorder and the Disinformation Society: The Social Dynamics of Information Networks and Software provides an important contribution to the literature challenging the often-hegemonic claims of the information society. Its basic thesis is relatively simple and convincing: Any attempts at establishing order generate their own aporias and result in forms of disorder. Most of the literature on the information society praises its advantages and seldom mentions the disruptions that are intrinsic to the new order. The gains of the growth of information cannot be denied and constitute an essential element of contemporary life. However, social and individual experiences of disorder at all levels of society must be seen as the counterpart of an imposition of information on social life. The rationalization of social life so beloved by Weber and Durkheim, as they witnessed the transformations from an emergent to a mature capitalist global order, has to be reassessed as its elements increasingly intrude into aspects of the inner-life world, that is, one's interior and self-reflective attitude toward life. Informationalism is an attempt to redefine culture in its own terms, thereby subverting the very basis of social life not dependent on purely monetary gains. Marcel Mauss' (1969) notion of the gift as an essential counterpoint to instrumental exchange is particularly apt in appreciating the significance of notions such as a public commons and open data in the age of informationalism.

Although this book was published 4 years ago, it is still topical—perhaps even more now than before. This book is an important antidote to the often-soporific claims of the information society and worthy of a serious read.

ENDNOTES

1. The Stop Online Piracy Act (SOPA) and its Senate counterpart the PROTECT IP Act (PIPA) were a series of bills promoted by Hollywood in the US Congress that would have created a blacklist of censored websites. These bills were defeated by an enormous online campaign started by Electronic Frontier Foundation and a handful of other organizations, which culminated in the Internet Blackout on the January 18, 2012. Meanwhile, The Anti-Counterfeiting Trade Agreement (ACTA) was a proposed multinational treaty for establishing international standards for intellectual property rights enforcement. The agreement aims to establish an international legal framework for targeting counterfeit goods, generic medicines, and copyright infringement on the Internet, and would create a new governing body outside existing forums such as the World Trade Organization, the World Intellectual Property Organization, and the United Nations.
2. The People's Global Action on Migration, Development, and Human Rights has been active since 2006 in engaging dialogue on issues of importance to human rights since 2006. More information is available at peoplesglobalaction.org
3. The Occupy movement is an international organization advancing social and economic equality and the promotion of true democratic values around the world. More information is available at https://en.wikipedia.org/wiki/Occupy_movement
4. The Arab Spring movement occurred in numerous countries in the Arab world in 2011, represented by protests and civil unrest that, in many cases, brought about changes in governance (Blakemore, 2019)
5. A program established within the U.S. Defense Advanced Research Projects Agency following the September 11th attacks, the Information Awareness Office was intended to mine vast amounts of data on individuals with the goal of identifying potential terrorists from their technology-based and online activities (Staples, 2005).

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