New Media, New Technologies and New Communication Opportunities for Deaf/Hard of Hearing People

Chia-Ming Chang, Nottingham Trent University, United Kingdom

Abstract

New media communication technologies have been given increased prevalence in recent years and have brought new forms of communication in our lives such as Social Networking Service (SNS) and Smartphones. As part of this research it is shown there is a communication gap between Deaf/Hard of Hearing people and the hearing community. This paper focuses on the field of new media communication technologies (SNS and Smartphones),investigating the new communication methods by comparing traditional and social communication technologies and aims to explore new communication opportunities that bridge the communication gap between Deaf/Hard of Hearing people and the hearing community. The results of this study show SNS on Smartphones have opened new communication opportunities to Deaf/Hard of Hearing People by providing specific interfaces, such as in the case of the Facebook app on a Smartphone.

Introduction

Our everyday ways of interacting and communicating have been radically transformed through new forms of communication media and technologies, such as SNS and Smartphones. People are spending more time communicating through these means without face-to-face interaction (Turkle 2012). These new media communication technologies offer various communication features of 'non-speaking' communication such as text-based messages as well as multimedia contents. On the other hand, communication is the main problem of Deaf/Hard of Hearing people, as Vernon and Andrews (1990, p1) indicated 'the very essence of the disability of hearing impairment is its effects on communication and the resulting impact of communication on behavior.' People who are Deaf/Hard of Hearing use various forms to communicate and interact with the hearing community. However, the primary communication methods (sign language, limited speech with lip movements/reading)used in the Deaf/Hard of Hearing community are different from the primary communication method (speech) used in the hearing community. There might be a communication gap between Deaf/Hard of Hearing and hearing people. Arthur (2009, p.9) suggested 'the technology has obvious promise for impaired people,' the new media communication technologies might bring new communication opportunities to bridge the communication gap between these two groups. Perhaps the new forms of media and the advent of mobile technologies have changed to allow new possibilities for richer communication experiences between Deaf/Hard of Hearing and hearing people. The aim of this study is to explore new communication opportunities between Deaf/Hard of Hearing and hearing people by using new media communication technologies (SNS and Smartphones).The original contribution to knowledge in this study is a new understanding of how SNS and Smartphones provide new ways of communication and how SNS and Smartphones bridge the communication gap between Deaf/Hard of Hearing people and the hearing community. Comparison of traditional and social communication technologies and their specific communication interfaces is the primary method used in this study.

The research questions in this study are:

    (1) How do SNS and Smartphones provide new communication opportunities?

    (2) How does SNS on a Smartphone bridge the communication gap between Deaf/Hard of Hearing and hearing people?

New Media Communication

New media can be defined as digital media that Manovich (2011, p.19) suggested 'the popular understanding of new media identifies it with the use of a computer for distribution.' New media is a new form of electronic media where people can distribute information through digital devices and the Internet. New media brings new forms of communication to people through digital devices. Computer-Mediated Communication (CMC) is a new media communication that enables people to communicate in various ways through a computer, for example, Short Message Service (SMS), instant message (IM), email and online forums. Barnes (2003) has indicated that digital communication is ubiquitous in our daily lives. New media and new technologies are bringing new forms of communication to enrich change people's communication methods and behaviours as Baym, Zhang and Lin (2004) have pointed out people's communication behaviours have been transformed. However, the computer and the Internet are not really 'new' media technologies as the Internet as we currently know it has been developing for around 30 years since itwas started by Tim Berners-Lee who proposed the World Wide Web (WWW) in 1984. In this study, SNS and Smartphones are defined as 'new' media communication technologies because they have become extremely popular and have opened various new forms of communication in recent years.

SNS is an online platform where users can create profiles and build personal connections with friends to communicate and interact via various forms of communication technologies. Ahn, et al. (2007, p.835) have indicated that 'The Internet has been a vessel to expand our social networks in many ways. Social networking services (SNSs) are one successful example of such a role.' SNS is a fast-growing communication medium on the Internet that people use to communicate and interact with each other. Richter and Koch (2008, p.96) pointed that 'the key intention for the usage of a SNS is to keep contact with friends or colleagues.' SNS is one of the new media communication technologies investigated in this research project that provides an online communication platform through digital devices. It is also a popular mobile app on mobile devices, The Nielsen Company (2013) has reported that SNS site Facebook is the most popular mobile app on Smartphones. There are large varieties of SNS sites on the Internet, some of which are very large, for example, the three largest SNS sites in the world—Facebook has 750,000,000 members, Twitter has 250,000,000 members and Linkedin has 110,000,000 members (eBizMBA, 2012).

The rapid development of mobile technologies has brought new forms of communication to people. In recent years, mobile phones are not just a communication device, it is a multi-function device. Goggin and Hjorth (2009, p.9) indicated the 'mobile phone increasingly becomes a platform for mobile media.' This study is focused on a specific mobile phone which is known as a Smartphone.The Smartphone is a mobile phone that offers more advanced functions than a feature phone, usually with bigger and multi-touch screen, better camera, faster Internet connection and a mobile application (app) catalogue. Apps are software that can be installed on a Smartphone that offers a wide range of functions, similar to software used on a desktop/laptop computer. Moreover, apps on Smartphone can be a gateway that people use to effortlessly access online services, for example, Facebook and Twitter. Webb (2010, p.65) suggested 'The mobile becomes a portal and the networks become data pipes that enable the basic connectivity.' Nowadays, people can convey and make information immediately available anytime and anywhere through Smartphones (Dominick 2009).

The Communication Gap Between Deaf/Hard Of Hearing People and The Hearing Community

There are many types of deafness with nuanced differences in their communication behaviours due to their communication abilities being different. The *Congenital Deaf*, for example, learn sign language as their primary communication method when they are born and the *Acquired Deaf* become deaf after first being able to hear and speak without impairment. According to the different level of hearing impairment all types of deafness can be divided into two groups—Deaf people and Hard of Hearing people. See Table 1.

Definition	Level of Hearing Impairment
Deaf	'Profound'—hearing loss can only hear sound equivalent to or over 95 decibel (dB).
Hard of Hearing	'Mild'—hearing loss can only begin to hear sound if it is between 20 and 40 dB. 'Moderate'—hearing loss can begin to hear sound between 41 and 70 dB. 'Severe'—hearing loss can begin to hear sound between 71 and 95 dB.
Hearing	No hearing loss.
Conversational speech can be measured as having a loudness of approximately	

60 dB
(see Middleton 2010, p.1-2)

Table 1. Definition of Deaf, Hard of Hearing and Hearing People

In other words, Deaf people can be defined as people with hearing loss who receive no useful linguistic information from sound and use in face-to-face communication sign language as their primary method; Hard of Hearing people can be defined as people with hearing loss who can still receive limited linguistically useful information from speech and use limited speech with lip movements/reading (also use some physical information as well as sign language as supplement) as their primary communication method (Barnett 2002). Communication is the main problem of Deaf/Hard of Hearing people.

Deaf/Hard of Hearing people using two systems to communicate, one is to communicate with Deaf/Hard of Hearing people and another is to communicate with hearing people (Schiff and Ventry, 1976). The communication methods used by Deaf/Hard of Hearing people not only depends on their communication abilities but also depends on people who they communicate with. Deaf/Hard of Hearing people are allowed to use their primary communication methods (sign language and limited speech with lip movements/reading) to communicate and interact with hearing people if hearing people can understand and use theses communication methods. However, there is a communication gap between Deaf/Hard of Hearing people and the hearing people as most of hearing people do not understand the communication methods used in Deaf/Hard of Hearing community (Bouvet 1990). Barnett (2002) proposed another two methods possibly used between Deaf/Hard of Hearing and hearing people—written communication and signed communication with interpreters.

Communication channels between Deaf, Hard of Hearing and hearing people can be divided into seven categories: (1) Deaf-to-Hard/Hearing, (2) Deaf-to-Hearing, (3) Hard of Hearing-to-Hearing, (4) Deaf-to-Deaf, (5) Hard of Hearing-to- Hard of Hearing, (6) Hearing-to-Hearing and (7) All Three, see Figure 1 below.
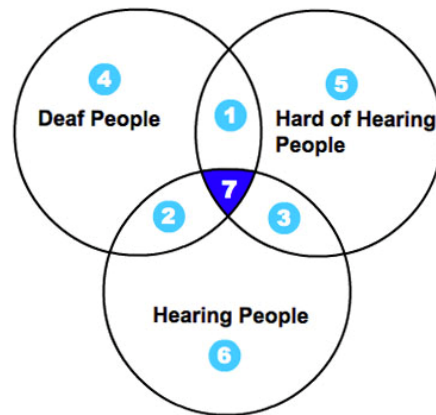
Figure 1: Categories of Communication Channels between Deaf, Hard of Hearing and

Hearing People

The Table 2 below shows there are four communication methods used and how they relate to the seven communication categories, the communication methods being: (1) Speech, (2) Sign Language, (3) Limited Speech (With lip movements/reading) and (4) Written Note (including graphic messages). These four methods are basic communication forms without any assistant (e.g. sign language interpreter). Written note is the only methods that can be used between these three groups. Limited speech can be used between Deaf/Hard of Hearing and hearing people, while speech only can be used by hearing people and sign language only can be used by Deaf people or sign language interpreters.

Communication Methods	Categories (see Figure 1)						
	1	2	3	4	5	6	7
1. Speech						√	
2. Sign Language				√			
3. Limited Speech (With lip movements/reading)			√		√		
4. Written Note (Include graphic messages)	√	√	√	√	√	√	√

Table 2.Communication Methods between Deaf, Hard of Hearing and Hearing People

It can be seen the methods of speech and sign language are the two main communication barriers between Deaf, Hard of Hearing and hearing people. Use of a sign language interpreter is a typical solution to solve this problem. The Table 3 below shows when sign language interpreters are provided the four methods are available to use on these seven communication categories.

Communication Methods	Categories (see Figure 1)						
	1	2	3	4	5	6	7
1. Speech		√	√			√	√
2. Sign Language	√	√		√			√
3. Limited Speech (With lip movements/reading)	√		√		√		√
4. Written Note (Include graphic messages)	√	√	√	√	√	√	√

Table 3.Communication Methods with Sign Language Interpreters between Deaf, Hard of Hearing and Hearing People

Although sign language interpreters can solve most of communication barriers between Deaf, Hard of Hearing and hearing people, sign language interpreters are not always provided during our daily communication. Moreover, some people feel awkward that interpreters play a role of mediator during more private communication (Barnett 2002). Sign language interpreters may be a good solution for specific communication (e.g. symposiums and workshops) but it may not be a good solution for common communication. On the other hand, limited speech with lip movements/reading is also a communication barrier for Hard of Hearing people because it only can transmit very limited information as Barnett (2002, p.670) indicated 'With English, many sounds are formed behind the lips, in the throat and mouth, making them indistinguishable on the lips. Without sound, at best only 30% of English is readable on the lips'.

Of the four communication methods discussed above it is shown that written note is the only method that logically can be used to communicate with Deaf, Hard of Hearing and hearing people, while the other three methods are still with some communication limitations.

Communication Technologies

Technology is an application of science that aims to make people's life better. Arthur (2009, p.11) indicated 'We place our hope in technology. We hope in technology to make our lives better, to solve our problems, to get us out of predicaments, to provide the future we want for ourselves and our children.' Arthur (2009, p.9) has pointed out that 'technology has obvious promise for impaired people'. Technology includes various types of implementation that support people's lives. Keating, Edwards and Mirus (2008, p.1067) have indicated that

'Digital technologies are influencing aspects of communicative behavior through new contexts for social interaction.' Digital technologies have created new contexts for human communication and interaction through new media.

Communication technologies can be divided into traditional and social communication technologies and will be discussed with reference to nine communication features (see Table 4 below). This study aims to explore the differences between traditional and social communication methods.

Communication Features	Explanation
(1) Text Message	Text message includes texts and simple symbols.
(2) Multimedia Message	Multimedia message includes texts, photos, audios and videos.
(3) One-to-One Messaging	One-to-one messaging is private message system that people can send messages to a single person.
(4) One-to-Many Messaging	One-to-many messaging is private message system that people can send messages to two or more people.
(5) Broadcast Messaging	Broadcast messaging is public information distribution system that people can send messages to a specific media platform that all people can read and reply it.
(6) Real Time Messaging	Real time messaging in this study is defined as an instant message transmitting process that people can send and receive messages instantly when people are online.
(7) Non-Real Time Messaging	Non-real time messaging in this study is defined as a message transmitting process that people can send offline messages and not to expect to get reply instantly. For example, Email.
(8) Social Communication Interfaces	Social communication interfaces are specific interfaces designed to allow people easily to communicate by sharing, receiving and reading information with text-based and multimedia contents.
(9) Integrated Multimedia Contents	Integrated multimedia contents provide a service that people can create their own contents and store it online, such as profile, blog or multimedia album that people can use as a part of communication.

Table 4. Nine Communication Features

Email and SMS are two basic traditional communication technologies. Email is an electronic mail system that people use to send and receive information through digital devices. Dabbish, et al. (2005) indicated 'Email as a Task-Management Tool' that people originally used for business for example as a formal letter in organisations. Nowadays, people also use it as a tool to communicate with friends in their personal lives. SMS is a short message telecommunication system on mobile phones using text that people use to communicate with each other. It is the simplest and easiest text-based communication technology on mobile phones. On the other hand, social communication is a new form of communication technology that people use to communicate with each other via social media. SNS is one of the successful social media (Ahn, et al. 2007). Facebook and Twitter are the two largest SNS sites in the world and allow people to share and connect with people through a variety of communication features. The Table 5 below shows availability of the 9 communication features on Email, SMS, Facebook and Twitter.

Communication Features / Availability	Email	SMS	Facebook	Twitter
(1) Text Message	√	√	√	√
(2) Multimedia Message	√	√	√	√
(3) One-to-One Messaging	√	√	√	√
(4) One-to-Many Messaging	√	√	√	
(5) Broadcast Messaging			√	√
(6) Real Time Messaging			√	
(7) Non-Real Time Messaging	√	√	√	√
(8) Social Communication Interfaces			√	√
(9) Integrated Multimedia Contents			√	

Table 5. Communication Features of Email and SMS

The table shows Email and SMS provide five same communication features:(1) Text Message, (2) Multimedia Message, (3) One-to-one Messaging, (4) One–to-more Messaging and (7) Non-real Time Messaging. The advantages of traditional communication technologies are simple and easy to use as they are pure communication tools, while Facebook fully provides the nine communication features and Twitter provides six communication features: (1) Text Message, (2) Multimedia Message, (3) One-to-one Messaging, (5) Broadcast Messaging (7) Non-real Time Messaging and (8) Social Communication Interfaces.

Social communication technologies fully include communication features of traditional communication technologies. Broadcast messaging, real time messaging, social communication interfaces and integrated multimedia contents are four specific communication features of social communication technologies. These extra communication features have opened new communication opportunities.

Communication Interfaces

Gibson (1979, p.127) originally introduced the term affordance is 'the "values" and "meanings" of things in the environment can be directly perceived'. It is such as a substance that can afford an action in the environment. Rogers, Helen and Preece (2011, p.29) suggested affordance is used to 'refer an attribute of an object that allows people to know how to use it.' For example, a door handle affords pulling, a cup handle affords grasping, and a mouse button affords pushing. Affordance in interaction design is to explain how interfaces on an interactive product obviously should be used, such as buttons/icons afford clicking and scrollbars afford moving up and down on web pages (Rogers, Helen and Preece 2011). In addition, Gaver (1991, p.97) indicated 'the concept of affordances can provide a useful tool for user-centered analyses of technologies.' The traditional and social communication technologies on digital devices are created using principle of interaction design. Rogers, Helen and Preece (2011, p.9) explained interaction design is 'designing interactive products to support the way people communicate and interact in their everyday and working lives.' This part of the study is concerned with how the interfaces are designed that present the communication features.

There are many kinds of interfaces that have been classified, Rogers, Helen and Preece (2011) indicated Graphical User Interface (GUI) is a versatile interface primarily used to support all manner of computer-based activities such as SNS on Smartphones that allow people to interact with a digital device through visual icons and indicators. The Table 6 and 7 below are the homepage interfaces of the Facebook app and SMS on a Smartphone. The main difference of the interface between Facebook app (social communication) and SMS (traditional communication) is the homepage interface on Facebook app provides eleven versatile features while the homepage interface on SMS only provides three basic features.
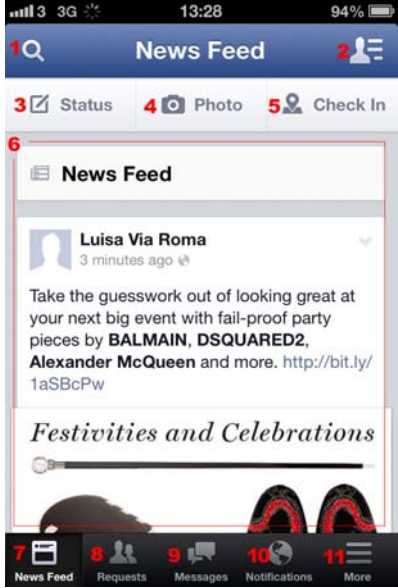
Interfaces of Facebook App	Features/Affordances
	1. Search: it allows users to search people or information from users' network and outside. **2. Friends:** it allows users to communicate with friends through sending messages. **3. Status:** it allows users to post broadcast information. **4. Photo:** it allows users to post photos. **5. Check In:** it allows users to present their current location. **6. Display Area:** it allows users to read information and give comments. **7. News Feed:** it presents new information posted by friends or subscribed pages. **8. Requests:** it allows users to add people into their network as friends. **9. Messages:** it allows users to send real time and non-real time messages. **10. Notifications:** it notices users new activities happened on their relevant contents e.g. friends give a comment. **11. More:** further supports that allow users to organise their social network with extra features.

Table 6. Homepage Interfaces of Facebook App

Interfaces of SMS	Features/Affordances
	1. Edit: it allows users to edit (delete) the receiving messages. **2. Write Messages:** it allows users to send messages. **3. Message Archive:** show all receiving messages

Table 7. Homepage Interfaces of SMS

The eleven features on the Facebook app combine three specific interfaces.

(a) Multimedia Contents Display Interface

The multimedia contents display interface is the main part of the homepage on Facebook app that provides a big display area allowing people to read and post information (text-based and multimedia contents) with broadcast messages also appearing.

(b) Posting Interface

The various inputting interface supports different ways to post information via different shortcuts such as the Status, Photo and Check In (see Table 6) that allows people to post multimedia contents easily.

(c) Multi-function Organisation Interface

The multi-function interface combines various features in a single page that provides multiple functions user easily communicate with friends and builds their social network. The multiple functions also include traditional communication technologies and editing tool for organising their social network.

These three specific interfaces enable people to communicate in ways which combine social and traditional communication technologies (see Table 5).

Conclusion

The results of this study show new media communication technologies (SNS on Smartphones) are able to open new communication opportunities as well as reduce the communication gap between Deaf/Hard of Hearing people and the hearing community. This is because SNS provides social communication technologies through its specific interface design such as the case of Facebook app with three specific interfaces: (a) multimedia contents display interface, (b) posting interface and (c) multi-function organisation interface. These interfaces provide new forms of communication that allows people to easily send and receive information via using the traditional and the social communication technologies. It has opened a new way of communicating for the Deaf/Hard of Hearing, as the main communication methods (text-based and multimedia contents messages) used on SNS are mostly accessible between Deaf, Hard of Hearing and hearing people. Moreover, Smartphone technologies such as bigger

screens, better cameras, faster Internet connections and mobile apps support the new forms of communication much better than previous feature phones. In this study, it has been shown that SNS and Smartphones have brought new communication opportunities to the Deaf/Hard of Hearing.

References

Ahn, Y., Han, S., Kwak, H., Moon, S. and Jeong, H., (2007). Analysis of topological characteristics of huge online social networking services. In: Proceedings of the 16th international conference on World Wide Web, ACM, pp. 835-844.

Arthur, W.B., (2009). The Nature of Technology: What it is and how it evolves. London: Free Allen Lane.

Barnes, S.B., (2003). Computer-mediated communication: Human-to-human communication across the Internet. Boston: Allyn and Bacon.

Barnett, S., (2002). Communication with deaf and hard-of-hearing people: a guide for medical education. Academic Medicine, 77 (7), 694-700.

Baym, N.K., Zhang, Y.B. and Lin, M.C., (2004). Social interactions across media.New Media & Society, 6 (3), 299.

Bouvet, D., (1990). The Path to Language: Bilingual Education for Deaf Children. Clevedon: Multilingual Matters.

Dabbish, L.A., Kraut, R.E., Fussell, S. and Kiesler, S., (2005). Understanding email use: predicting action on a message. In: Proceedings of the SIGCHI conference on Human factors in computing systems, ACM, pp. 691-700.

Dominick, J.R., (2009). The dynamics of mass communication: media in the digital age. 10th ed. New York: McGraw-Hill.

Ebizmba, (2012). Top 15 Most Popular Social Networking Sites | June 2012. eBizMBA [online], 29 May. Available at: http://www.ebizmba.com/articles/social-networking-websites [Accessed: 14 June 2012].

Gaver, W.W., (1991). Technology affordances. In: Proceedings of the SIGCHI conference on Human factors in computing systems: Reaching through technology, ACM, pp. 79-84.

Gibson, J., (1979). The Theory of Affordances, The Ecological Approach to Visual Perception. New Jersey: Lawrence Erlbaum Associates, pp. 127-143.

Goggin, G., and Newell, C., (2003). Digital disability: The social construction of disability in new media. New York: Rowman& Littlefield Pub Inc.

Keating, E., Edwards, T. and Mirus, G. (2008).Cybersign and new proximities: Impacts of new communication technologies on space and language. Journal of Pragmatics, 40 (6), 1067-1081.

Manovich, L., (2001). The Language of New Media. London: The MIT Press.

Middleton, A., (2010). Working with deaf people: a handbook for healthcare professionals. [eBook]. Cambridge, UK ; New York: Cambridge University Press, Available: Nottingham Trent University Library [Accessed 11 November 2011].

Richter, A., and Koch, M., (2008).Functions of social networking services. In: Proc Intl Conf on the Design of Cooperative Systems COOP, Institutd'EtudesPolitiquesd'Aix-en-Provence, pp. 87-98.

Rogers, Y., Helen, H. and Preece, J., (2011). Interaction Design: Beyond Human-Computer Interaction. 3rd ed. Chichester: John Wiley distributor.

Schiff, N.B., and Ventry, I.M., (1976). Communication problems in hearing children of deaf parents.Journal of Speech and Hearing Disorders, 41 (3), 348.

The Nielsen Company, (2013). Tops of 2013: Digital [online], 16 December. Available at: http://www.nielsen.com/us/en/newswire/2013/tops-of-2013-digital.html [Accessed: 21 March 2014].

Turkle, S., (2012). Sherry Turkle: Connected, but alone? TED Talks [Online]. Available at http://www.ted.com/talks/sherry_turkle_alone_together.html [Accessed 4 April 2012].

Vernon, M.C., and Andrews, J.F., (1990). The psychology of deafness: Understanding deaf and hard-of-hearing people. New York: Longman.

Webb, W., (2010).Being mobile [smartphone revolution]. Engineering & Technology, 5 (15), 64-65.