Media Protocols:

Reading the Mobile Perseus

by

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Abstract

For more than fifty years, Media Studies has been a growing field of scholarship. The argument of this thesis builds upon debates about whether the nature of media and technology depends on the content they deliver. Media used to be considered merely tools that conveyed information. The situation has been changing during the past half-century. Many scholars have begun to argue that media themselves have meanings and characteristics. In the thesis I borrow Lisa Gitelman's ideas about "protocols" to study how media work, especially how protocols work on e-reading devices. The aims of the study were to explain the various types of media protocols and how protocols affect both users and technologies.

Reading has been a significant interaction between people and the media. Now e-reading has taken a large part of our life. E-reading behaviours are not merely generated from previous reading habits, however, but are also affected by protocols borrowed from earlier generations of digital devices. By analyzing how protocols affect e-reading, I look specifically at two case studies: mobile Perseus and Watson Walk. One is an interface redesign project; the other is a literary walk app. The two apps provide new yet different ways of interactions in e-reading affected by protocols.

I conclude that e-readers are easy to use because they borrow protocols from older technologies and devices. For example, users who were familiar with PDAs and early tablets quickly adapted to e-readers and smartphones. My argument is that well-known protocols made that transition possible. This is how protocols continue to effect media, and the ways we use our devices.

Preface

The mobile Perseus project in Chapter 4 of this thesis was conducted by Laurentia Romaniuk, Sarah Vela, Mihaela Ilovan and the INKE research group, Interface Design team led by Dr. Stan Ruecker and Dr. Geoffrey Rockwell.

The Watson Walk in Chapter 4 of this thesis was conducted by Harvey Quamen, Matt Bouchard, Lucio Gutierrez and the EMiC UA.

Dedication

To my parents who have always granted me all the support and trust when I am facing every big decision in my life. I could not be the person I am without them.

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Chapter 1: Introduction

In 2011 an animated 15-minute short film called *The Fantastic Flying Books of Mr. Morris Lessmore* was released by Moonbot Studios, and won the best animated short film a few months later at the 84th Academy Awards. The short film tells a story about Mr. Morris Lessmore, a young bibliophile who loses his homeland in a storm. When he comes back he sees a woman flying past on books. He is then brought to a library by a flying book, where he sees walls of other flying books live and talk. At the end, he lives with the books, becomes the proprietor of the library, and starts writing again.

In 2012, after the success of the short film, Moonbot studios released an adapted book and an iPad app, *IMAG-N-O-TRON: "The Fantastic Flying Books of Mr. Morris Lessmore" Edition*.[1] In the book, Mr. Morris Lessmore is still a man who "wears a dapper brown suit and [has] an unconquerable cowlick" (Heller, 2012). What is new for most users by that time is that by accessing the camera on an iPad and placing the iPad on the book, the app brings users to the living world that Mr. Lessmore lives. Through the camera, readers can see not only what is shown in the printed book, but also the animations implemented with Augmented Reality. By using the app on an iPad, readers are able to repair the books, play the piano, or experience what it is like to tumble through a storm as Mr. Morris Lessmore did (Moonbot Studios, n.d., "The iPad App").

The book and the iPad app opened a gateway of electronic reading at that time by showing a new concept of reading that was more complex than plain and static texts or images. Consequently, it won the "iTunes Hall of Fame iPad App" (Moonbot Studios, n.d., "The

[1] See https://itunes.apple.com/ca/app/imag-n-o-tron-fantastic-flying/id534396897?mt=8

Fantastic Flying Books of Mr. Morris Lessmore"). Reading can be vivid and alive with some aids. Now technology such as Augmented Reality has been applied in many domains to enhance the usability and experience of reading, gaming, etc.

Moonbot Studios' book and app are popular among different age groups, from pre-school children to adults. Whether the app was intended exclusively for children is no longer significant. Its popularity among different age groups shows that the protocols which determine potential audiences have worked in every way. For the Moonbot Studios app, the protocols and the market work in a mutual way.

1.1 Protocols

Protocols are the concept put forward by Lisa Gitelman (2006) in her book *Always Already New*. In her book, she defines media as:

> socially realized structures of communication, where structures include both technological forms and their associated protocols, and where communication is a cultural practice, a ritualized collocation of different people on the same mental map, sharing or engaged with popular ontologies of representation. (p. 7)

Gitelman asserts that media are composed of two primary elements: technological platform and protocols. Technology is the physical platform that carries and implements media, while protocols are what media generates socially, culturally and economically. Generally speaking, it is an acknowledgement to many people that technology and media have changed our culture. Gitelman contends that culture has affected media as well. This is how protocols work in a medium. Protocols affect how a medium is formed, how it works, and how it targets specific audiences in a society.

1.2 Reading

Reading is one of the fundamental ways in which we learn about the world. We read books to gain knowledge and we read newspapers to follow current events. Reading now is not limited to plain texts and images, but also to videos, games, animations, etc. The definition of reading today is greatly expanded from interactions between people and texts to the interactions between people and most media. We read books, newspapers, websites, and captions on televisions and films. The development of multimedia allows us to read dynamically.

Developed in the 20th century, electronic reading, also known as e-reading has become more significant and common during the last two decades. As e-reading devices evolve from PDAs (Perseonal Digital Assistants) to e-readers and tablets, the concept of e-reading evolves as well. E-reading is not merely the interaction between readers and authors, but also the interaction between readers and devices. "Playing with the devices" is also a part of e-reading. Therefore, studying the interactions between readers and their devices is one way to understand the different protocols of various e-reading devices.

Reading is a bidirectional action. We choose what to read while books choose their own specific readers. When consumers are choosing books, the elements that influence our choices include genre, author, etc. However, books also have targeted readers determined by authors and publishers. The bi-directionality of reading partly depends on the protocols preset in the two terminals.

1.3 Summary

My thesis studies the relationship between protocols and media through reading behaviour (specifically focusing on electronic reading). *Protocols* in this thesis play a crucial role when it

comes to media studies. Marshall McLuhan and other media scholars have suggested that media/artifacts/technology are not neutral since they embody the meanings from both the designers/inventors, as well as from the users while media are being employed. Based on these theories, in this thesis I will borrow the concept of "protocols" from Lisa Gitelman's media theory, and protocol categories classified by Corinne Dalelio. Media have characteristics designated by both designers and audiences, and media protocols can change through time or within different cultures.

Through the evolution of media, e-readers (and tablets) can be typical examples through which we can study media protocols, especially when we expand the definition of reading beyond printed texts. While e-readers and tablets have much in common, they also have different protocols that each shape the reading process. In this thesis, I will argue that two examples, a Kindle and an iPad, have different protocols even though they are both popular e-reading devices.

I use two mobile apps to conduct case studies in Chapter 4. The mobile Perseus was designed by Implementing New Knowledge Environments in 2013. As a reading-based mobile app which is in the stage of designing, the experience of the mobile Perseus is a typical instance of how e-reading protocols affect the way developers work to design a mobile app, and how to balance the features by following the guidelines to attract and serve targeted audiences. The other example, the Watson Walk app, focuses on touring with reading as a secondary feature.

Chapter 2: Media and Protocols

2.1 Media

The entire history of media probably emerged not long after human activities began, even before language was invented. History does not say much about immaterial media such as storytelling. As one of the first physical media in history, printed books have a controversial traceable timeline in history. The Gutenberg Bible, printed by Gutenberg in 1455, is considered to be the first movable type Latin book in western society. Gutenberg is also known as the founder of mass printing, but the Chinese had already invented movable type printing four-hundred years earlier (McMahon, Jones, & Foster, 2016). The oldest surviving book is reportedly the Diamond Sutra, published in 868 AD in China (McMahon et al., 2016). It is debatable that since the Diamond Sutra was printed in woodblock printing, whether it is considered as "printed" is still underdetermined (McMahon et al., 2016). With the invention of mass printing, information could be spread much faster to the public in a physical form, hence opening the door to mass media. However, it is more accurate to say that the origins of media began at an earlier time, when humans discovered language and learned to communicate.

Media became a system and culture mainly in the western world (Kittler, 1996). Although the word "media" was not used until the 1920s, its development had begun as early as in the 17th century when printed books became popular, and newspapers started (Briggs & Burke, 2010). Mass media now means not only books and newspapers, but also sound and visual media such as radio and television, as well as various types of representations derived from the Internet.

In Canadian philosopher Marshall McLuhan's theory, media are all human artifacts and technologies ("Media Communications," 2012). McLuhan's point of view is far wider than what

we today consider as a medium, or what is studied in this thesis. To explain a medium as a carrier of a message, or the message itself, is to see a medium as a one-way communication. In fact, a medium builds a two-way interaction between senders and receivers, so the communications are mutual. We are familiar with media representations such as broadcast and the Internet. But what can be counted as a medium and what cannot? To simplify, a medium is a "channel of communication, a means through which people send and receive information" ("Defining the Mass Media," 2011). This is a straightforward definition, but not precise enough.

By this definition, people can be easily confused between a medium and a technology. Media are frequently considered equivalent to technology. They are essentially different. For instance, back in the days when computers were only a set of huge calculators, they were hardly a kind of medium to people. Scientists used them as tools to simplify the process of calculation, not to communicate with other people. When computers became portable, affordable to the masses, and capable of accessing of the Internet, they quickly became the most significant means of modern communication. We write, read, and communicate on computers. Technology makes media possible. Books and newspapers were created because of the printing press; broadcast came to the world because of the invention of radio.

In Gitelman's media theory, mentioned in 1.2, the two primary physical compositions of media are technological forms and protocols. Technological forms is the term used to describe the appearance of how media present themselves. They are the carriers and platforms that implement communication and interaction. Protocols are the social and cultural rules that technology must follow in order to function. These two components are the fundamental structures through which communications are realized. For example, printed books as a primary medium, depend on paper, printing presses and ink as technological platforms in order to

operate. Meanwhile, how the readers obtain and use books are the protocols. They buy books in stores, with money; they read by sunlight or with lights on, and they use fingers to flip pages. People from different areas may read in different orders, and they also need literacy to understand the book. All the social and cultural rules generated by printed books are what Gitelman calls "protocols."

The evolution of any medium is tied to technological development. Books, newspapers and magazines exist because of the invention of movable type printing. Radios (and televisions) work by electromagnetic waves, but before the invention of the crystal detector, they worked one-to-one -- that is a single transmitter to a single receiver. After televisions became the mainstream mass media in the 20th century, there were plenty of storage media launched to better serve the needs of audiences such as CDs and DVDs. Social media, Web 2.0, and blogs work with the combination of computers and the Internet, and due to the invention and development of smart phones, mobile media have become the new mainstream in the media domain. That is to say, technology is a crucial part of media, and technology also drives the innovation and improvement of media.

As Gitelman (2006) suggests, protocols are "a vast clutter of normative rules and default conditions, which gather and adhere like a nebulous array around a technological nucleus" (p.7). In Gitelman's book, she takes an example of telephones. The protocols of telephony include the behaviours such as picking up the handset, dialing and saying "hello" to the person who answers it (in English speaking countries), as well as the phone bills, wires and cables. To simplify, protocols are how media are embodied in culture. A protocol is what the technology generates socially, economically, and materially while it is employed within a medium: the contents contained, technological and cultural instructions, and social rules. For instance, social media are

not simply a kind of channel in which we publish our status, read others', and communicate with people. They are a series of "protocols," which represent a cluster of rules and behaviours such as an account, one or more friends, contents people share, the ability to operate a device (computers, smartphones), and furthermore, the utility bills and Internet cable bills (or data bills for phones). The lack of any element above will cause the incompleteness of media.

As the platform of media, technology is the fundamental part that supports them. The platform can be a collaboration of more than one type of technology, while protocols of a medium are more complicated since they contain multiple aspects that realize a medium. First of all, not all protocols are physical, such as the ability to engage with technological platforms. To ensure that social media operate properly, in addition to requiring a functional computer (or a tablet/smartphone) as the technology platform, the Internet follows and generates several protocols under different situations: if you are at home, you will need an Internet Service Provider, which needs a legitimate identification with a billing address and bank account or credit card for payment; if you are at school where there is free Internet access, you will have to show proof of permission, which normally is a valid username and password; if you are at a café with free Wi-Fi, sometimes you are required to accept certain terms and conditions. This process contains multiple means of production and relation of production such as hardware factories, software developers, telecommunication companies, banks and even post offices.

According to Gitelman's (2006) argument, protocols change. Some protocols are fully imposed by certain organizations, which formulate the rules as authorities. Some are effectively imposed by giant corporations such as Microsoft and Apple. Under these situations protocols are established based on market needs (such as the adaptation of mouse and QWERTY keyboard). Some other protocols emerge as "complicated engagements among different media" such as

digital genres (p.8). People adapt to the protocols gradually like how we adapted to old media when they were new.

2.2 Protocols

As Henry Jenkins (2008) puts it in his book *Convergence Culture: Where Old and New Media Collide*, any medium should be considered and understood in some way as its basic level as a technology that enables communication (p.13). It is evidently true since we have learned from Gitelman's definition that a medium is the combination of a technological platform and protocols. Additionally, Jenkins' point of view is also the reason why we sometimes confuse media with technology. However, a medium is not as equal as technology after all, since there are the protocols a medium delivers and follows.

Corinne Dalelio (2015) interprets Gitelman's theories of protocols more specifically. She says:

> In fact, these protocols are the combined result of how the medium was designed (the tools, resources and features made available), and how we have used it over time (what users have chosen to employ or not to employ, and the ways in which they do so).

In Dalelio's interpretation, protocols include the creators' intentions and what the intentions require and generate to realize a medium. Furthermore, protocols can be changed variously compared to the original purposes according to the ways they are embedded within culture. As to say, protocols can be affected by both the creators and the users.

Additionally, Dalelio (2015) classified protocols in three types:

- Delivery protocols
- Demand protocols

- Use protocols

There is one more type of protocol, although Dalelio did not include it on her list: design protocols. There are conditions and purposes that the creators add to ensure that the media function as the way they expected, although sometimes the media do not function as expected.

2.2.1 Delivery protocols

Delivery protocols can also be explained as "the characteristics of distribution." They include all the protocols generated when a medium is being delivered to its users. For social media to successfully function, the delivery protocols include all the materials and processes generated because of the access to the Internet, such as the bills from the Internet Service Provider and identifications. The protocols also include access to the equipment (computers and other smart devices), and the ability to operate the equipment.

Delivery protocols can also be changed by culture. Before the digital age, we read printed books. The delivery protocols for printed books sold in stores include the editing process, transportation and payment methods (identification and address will be needed if books are purchased with credit/debit cards). When Amazon and other online bookstores appeared, additional delivery protocols functioned, such as shipping service providers. Now the situation has changed again as we are experiencing e-reading. Some delivery protocols no longer exist because of the uniqueness of digital transmission. In e-reading, printing presses and transportation are replaced by digital presses and digital signals downloaded from providers. For tablet and e-reader users today, delivery protocols for digital books also include a device to read from and the ability to operate devices.

2.2.2 Design protocols

By "design protocols," I mean the reasons why the designer created a medium, including the purposes of designing and the specific cultural background embedded. Design protocols happen before users' participation. A medium is neither neutral nor meaningless because of the engagement of the design protocols. In some circumstances, the current protocols of a medium can be dramatically different from its design protocols.

Marshall McLuhan developed a system in his book *Understanding Media: The Extension of Man* in 1964. In his book, McLuhan disagreed with what General David Sarnoff said: "The products of modern science are not in themselves good or bad; it is the way they are used that determines their value" (p. 11, 1994). McLuhan mocked Sarnoff's perspective because McLuhan felt it was like saying "firearms are in themselves neither good nor bad; it is the way they are used that determines their value" (p.11, 1994). That is to say, whether firearms are used by the police to defend themselves against criminals, or used by militaries to initiate a war, the nature of firearms is to encourage injuries. McLuhan judges Sarnoff for "ignor[ing] the nature of the medium" (p.11, 1994). Although he enlarged the definition of medium, McLuhan's criticism of Sarnoff gives us an inspiration to see every possibility within the culture, and within which technology is embedded.

It is a popular cultural view to believe that technology has two sides. Some may agree with David Sarnoff, that one piece of technology can be helpful and beneficial for oneself or others if it is in good people's hands; under opposite circumstances it can also be dreadful or cause a disaster. To Sarnoff and those who think as he did, technology has no characteristics. This view might seem unreasonable since we generally consider that judgment is something only living creatures have, or more specifically, humans. For those who think technology is neutral,

technology ought to be objective and its attribute is to serve people in the way we choose. However, when we take a look at the circumstances in which people invented some piece of technology, there was always a reason. We are the ones who put potentials and purposes behind every discovery, and we are the ones who get involved with the evolution of technology; therefore, we assign responsibilities to technology and media, no matter whether those responsibilities were designated at the beginning or have evolved through the history of culture. From this perspective, firearms are no long neutral no matter who is using them, because they have the design protocols their creators assigned.

In many cases, part of the delivery protocol is designed so that the creators can ensure that the medium is functioning as the way expected. Social media were invented depending on the technology of the Internet. From this perspective, the Internet is a part of social media's delivery protocols.

Generally, design protocols are the meanings the creators give. During the development of media, design protocols may disappear, or be changed largely by culture and society. Under these circumstances, design protocols no longer hold the significance that the creator expected. Whether design protocols have been changed or not, they are not sufficient to support the implementation of media.

2.2.3 Demand protocols

Demand protocols are what users demand and expect from the medium. For instance, when I am holding a phone, I expect that I can use it to reach someone by pushing a series of numbers (physical or virtual). The implementation of demand protocols depends on delivery protocols. That is, to make the phone call connect with the phone of the person with whom I wish to speak

to, I have to dial a legitimate phone number and the phone must be working. There will also be related fees, bills, identifications, etc.

Demand protocols of a medium differ depending on the person using the medium. When a person is holding a firearm to defend himself, he expects to scare away the predator and protect himself; on the other hand, if a person is using a firearm to commit a crime, he expects that the firearm will allow him to injure whomever is in his way. Because of their opposing perspectives, each of these people demands something different from the same firearm. In McLuhan's theory, the design protocols suggest that the possible uses of firearms are already designated by the creators. Similarly, the design protocol of gunpowder is to destroy, and the design protocol of an electric light is to illuminate. These are the meanings that the creators give, or intend to give, which cannot be changed by demand protocols.

2.2.4 Use protocols

Use protocols are created and can be changed by media users, or what we can say "culture and society." As a terminal of a medium, users play a large part in defining its protocols. Users are at liberty to choose the part of a medium they want to employ, and abandon the part they think is less useful. They are the factor that evaluates the implementation of a medium. In some cases, users completely change the protocols, especially the design protocols of a medium.

In his book *The Whale and the Reactor,* Langdon Winner (2010) asked, "Do artifacts have politics?" He gave a positive answer. Winner had been studying some bridges in Long Island in New York State, and noticed that parkway overpasses were so low that they allowed only small cars to pass under them. These bridges and parkways were built this way by their designer, Robert Moses, the brilliant architect whose social class and racial biases made him an object of

controversy. At the time when the bridges were designed and built, Moses wanted to keep Long Island exclusively accessible to rich people (mostly Caucasians), who were among the only people who owned private cars at that time. So he lowered the overpasses so that only small cars could pass beneath, and blocked the traffic of buses, which mostly poor people (mostly American-Africans) took. Consequently, those bridges were transmitting opposite meanings given by their designer. Although their meanings today may have changed because private cars are more affordable for more people, and the overpasses cannot block anyone who wants to go to Long Island. Winner's theory proves that a medium has design protocols that are established by the creators, but over time its use protocols can be changed by culture and society.

Although the protocols of an artifact or technology may have evolved and sometimes can be dramatically different from the design protocols, they are undoubtedly discovered and designated with meanings that are embedded within culture and society, which use protocols cannot exist or function independently of. Hence, according to Winner (2010), technology can be judged not only for its contributions to productivity and functionalities to users and societies, but also for the ways in which it can embody specific culture.

Applying McLuhan's media theory to Long Island bridges, we could say that generally the existence of bridges enables communication and transportation across each side, which is a part of the design, demand and use protocols of most bridges. However, in a departure from most bridges, Moses' bridges express opposite design protocols by preventing movement, which represents what Robert Moses wanted to advocate through his designs. Users play a big part in changing media protocols. Moses' bridges might have blocked lower classes in past times when only rich people could afford cars. The use protocols of those bridges changed when the

economy developed and cars became affordable for more families. Today those bridges no longer hold the design protocols assigned by Moses.

McLuhan (1994) once put forward the concept of "content" in media theory. He asserted that "the content of any medium is always another medium" (p. 8). As he argued, the content of the telegraph is print, the content of radio is speech, etc. According to McLuhan's theory, media "amplify and accelerate existing processes" (p.8, 1994), which in some way, are old media, or the "content." As Kittler (1996) said, "new media do not make old media obsolete; they assign them other places in the system." Every medium can be the inspiration and foundation of another. However, for media today, especially new media, it is not completely accurate to describe content as only another single medium. They are, as Bolter and Grusin (2000) assert, the refashioning of old media. Current new media are launched on the basis of old ones: the Internet is the foundation of social media and mobile media, and the computer is the foundation of the Internet. According to Bolter and Grusin, remediation is "the representation of one medium in another" (p. 45). That is to say, every new medium inherits part or all of the protocols from its "content." For instance, as a predecessor of the e-reading device, PDAs provided multiple protocols for later generations, including the e-readers and the tablets we are still using today. These protocols include touch screens, built-in dictionaries, and annotations. New e-reading devices do not merely inherit the technology, but also follow some protocols from PDAs which make users more comfortable because users are already familiar with some of the protocols. What new media inherit from their contents could include from the design protocols to demand and use protocols as well.

Therefore, I argue that protocols make media not neutral. They have an attitude and perspective toward specific audiences. Consequently, we must consider how media are embedded within culture and society, and the inheritance of preceding media they draw on.

Radio is an instance that shows how different categories of protocols work and change. Radio is a common medium that many people use today. Before the advent of television and then the Internet, radio was the primary form of communication by which most people kept up with the news. However, radio was not invented as a mass medium for the general public. It was developed to provide a way for ships to communicate with people on land and it relied on telegraphic signals, primarily Morse Code. That is the reason that radio was, at first, a form of one-to-one communication. It started becoming widespread forty years after it was invented (Schneider, n.d.). Radio provides a concept of 'listening to the world' so that people can use their hands and eyes to focus on other things. The number of broadcast programs has exploded and radio now has become a way to provide entertainment instead of merely presenting news. Its content has evolved from speech and storytelling to music, advertisements, and telephonic interaction. Radio provides commuters in motor vehicles with a way to fill silence and alone time. It is hardly distracting, and unlike TV shows or books, broadcast programs are mostly short and noncontinuous so are easy to interrupt and/or drop.

The protocols of radio are evident through its evolution. Its function is no longer what the inventor intended, and the content has changed. Radio no longer holds its design protocols as it has become a broadcast medium instead of a military communication. Therefore, its demand protocols changed as well. As technology is developing today, the delivery protocols may have changed but the theory remains similar. However, radio breaks the pattern of what we were familiar with for obtaining news -- reading. Users do not expect military information and secrets

from radio. What they demand from radio can be music, news, stories, weather, or just a moment to fill the time when they hit the road. The use protocols of radio helped us better adapt to television with features of channel and volume changing. Thus, radio is also the content of other medium.

2.3 Summary

Although mass media did not become widespread until the 17th century, media have a longer history than we have realized. Media are the bridge between us and the world. But we do not learn to use media as a given. We are influenced by what Lisa Gitelman proposes as "protocols." As a guideline, protocols have four categories:

- Design protocols
- Delivery protocols
- Demand protocols
- Use protocols

Most media have all four protocols. Marshall McLuhan argues that the meanings of media are not neutral nor do they depend on users. That is what I call "design protocols." However, the design protocols of media are sometimes changed by culture and society, as seen with the example of radio. Similar to the point that Langdon Winner made about Moses' bridges in Long Island that over time the design protocols have been eliminated by the use protocols. Delivery protocols in a medium are how the society functions to ensure the medium runs successfully, including the bills, transportations, etc. Demand protocols are what users expect from the medium. These expectations can vary among different users, but demand protocols cannot

influence the meaning that the creator designated at the beginning. All four protocols work together to implement the functionalities of media.

Any medium is essentially about communication and interaction. We learn about the world through media, which brings the world right to us. We read news and listen to radios to keep ourselves up to date, we talk to our friends on the other side of the earth, we buy things online that are exclusively sold in stores in another country. Media have changed culture. But the influences are mutual. Culture plays a significant part in the development of technology and media.

Reading is the most common way in which we interact with media, from books to newspapers to online news. We have been experiencing televisions and films that need both visual and audial stimulations to obtain information. As technology keeps changing the world, touching and even smelling may someday be a part of media interaction. Yet reading is still the primary way to communicate through the whole history of media, no matter how the formats vary, from print to digital. Due to the rapid development of the Internet, digital media have become the new mainstream of mass communication. And e-reading has gained more attention.

As a form of medium that has grown rapidly since the Internet came into our daily life, e-reading can be considered one of the most popular channels to communicate with the world. In Chapter 3, I will focus on how e-reading functions as a medium, and how the four categories of protocols are applied in e-reading devices according to the definition I provided in this chapter.

Chapter 3: E-reading

According to Lisa Gitelman's (2006) definition, a *medium* is the combination of a technological platform and its associated protocols that socially realize communication between people. E-reading devices are considered a form of media as they fit Gitelman's definition. These devices were largely developed after the invention of computers and the Internet, and now are mostly focusing on specialized devices such as e-readers and tablets in recent decades. E-reading users are no longer limited to people who voluntarily choose to read on electronic platforms. E-reading has permeated into modern life even for those who insist on traditional reading in the digital age. There are screens all over the place showing slogans or advertisements. In this situation, the option of choosing e-reading or not is no longer in our hands.

The number of e-reading customers increases every day. According to a survey taken by the Pew Internet & American Life Project in 2012, 20% of American adults read e-books (or other digital forms of digital content) in 2011. The percentage increased to 43% when the readers were more than 16 years old (Rainie, Zickuhr, Purcell, Madden, & Brenner, 2012). The number keeps increasing as different types of e-reading devices come to the market and become a part of our lives.

3.1 Evolution of E-reading

The concept of e-books was first mentioned in the 1930s (Bartram, 2014) when Bob Brown, an early 20th-century writer and impresario who organized public entertainments, described his imaginary future reader called "Readies." He wrote, "To continue reading at today's speed, I must have a machine. A simple reading machine which I can carry or move around, attach to any old electric light plug and read hundred-thousand-word novels in ten minutes if I want to" (as

cited in Schuessler, 2010). Brown's conception of an electronic reader was way ahead of his time. About the only things he got wrong are that e-readers are usually battery powered (and have to be plugged in to be charged) and the speed of reading has not changed much.

After Brown's inspiration of electronic reading, there were many attempts and inventions in history. For example, in 1949, a Spanish woman named Angela Ruis Robles invented the first automated reader for student textbooks ("A History of E Book", 2015). However, none of these inventions changed e-reading until 1971, when Michael Hart first made a freely accessible digital document on a computer. He typed in and shared the *Declaration of Independence* on a computer connected to ARPAnet, which later became a part of what we now know as the Internet. Six people accessed Hart's shared file, thus making his file the first e-book in history ("A History of E Book," 2015). Hart launched Project Gutenberg in the same year, thus starting the world's first digital library. By October 3, 2015, Project Gutenberg had released more than fifty thousand e-books (Cook, 2015).

Between the 1970s and 1990s, e-books on CD-ROMs and floppy disks came out. Although books had become digital, users still needed access to a computer or a relatively large screen to read from. A new way of reading emerged in 1998 with the invention of the first e-readers, the Softbook and Rocket eBook Reader. Although the Rocket eBook Reader had a poor capacity of only ten books with an LCD screen, and it took forty-five minutes to set up, these devices ushered in a new era for e-reading experiences and development (see Figure 3.1).

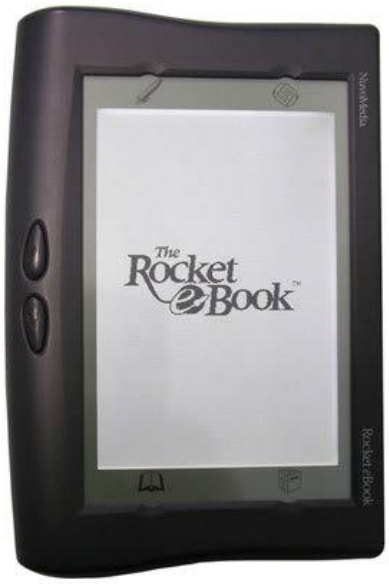

Figure 3.1 The first-generation Rocket eBook Reader (Gabriel, 2015).

Table 3.1 lists the milestones in the evolution of e-readers from the 1970s, when the concept of portable reading began, to the present. Now e-reading is developing faster than ever; more than one new model is launched almost every year. In 2009, Amazon announced that e-books outsold physical books on its website for the first time.

Year	History of E-readers
1970s	Alan Kay first describes the concept of what he calls the "Dynabook"; PARC (Palo Alto Research Center) from Xerox makes the prototype.
1984	Pison releases the Organizer, the first personal information manager (PIM).
1992	Apple coins the term personal digital assistant (PDA) for PIMs, and releases the first PDA, the Newton MessagePad.
1998	The first E-Book readers are introduced: The Softbook and Gemstar's Rocket eBook Reader; eReader.com and eReads.com starts to sell English-language eBooks.
2000	Microsoft releases the Microsoft Reader.
2004	Sony releases the Librié, the first E-Book reader to utilize eInk technology.

2004.12	Google announces cooperation with university libraries to digitize holdings, later known as the Google Books Library Project.
2007	Amazon releases the Kindle e-reader.
2008	Books on Board, first online eBook store, starts selling eBooks for iPhones.
2009.8	Sony links with libraries to enable library cardholders to borrow eBooks.
2009.10	Amazon releases Kindle 2; Barnes & Noble releases Nook; Sony releases Reader Pocket Edition.
2009.11	Blyth Academy in Toronto becomes the first school to supply students with Sony Readers loaded with textbooks.
2010.1	Many new e-readers from Asus, Sony, Plastic Logic, Samsung are introduced at Consumers electronic show in Las Vegas.
2010.4	Apple releases its first tablet iPad with a 9.7-inch touchscreen, and iBook app.
2010.8	Amazon releases the Kindle 3 with free built-in 3G connectivity.
2010.12	Google launches Google eBooks, becoming the world's largest e-book store.
2011	Barnes & Noble releases the Nook Simple Touch e-reader and Nook Tablet; Amazon releases the Kindle Fire and Kindle Touch; Apple releases iPad 2.
2012	Apple opens a textbook section in the iBook bookstore, and releases the iPad 3, iPad 4, and iPad Mini with a 7.9-inch screen; Amazon releases the Kindle PaperWhite with a built-in LED light, and the Kindle Fire HD tablet.
2013	Amazon releases the Kindle Fire HDX tablet; Barnes & Noble releases the Glowlight; Apple releases the iPad Air and iPad Mini 2 with Retina Display.
2014	Amazon releases the Kindle Voyage and a subscription service, Kindle Unlimited, for unlimited access to its e-books; Apple releases the iPad Air 2 and iPad Mini 3.
2015	Amazon releases the Kindle PaperWhite 3; Kobo releases Aura, the world's first waterproof e-reader; Barnes & Noble releases the Glowlight Plus; Apple releases the iPad Mini 4 and iPad Pro with a 12.9-inch screen.
2016.3	Apple releases the iPad Pro with a 9.7-inch screen.

Table 3.1 The timeline of E-readers from the 1970s to now.[2]

[2] Sources from https://liamborner.wordpress.com/2011/02/02/timeline-rise-of-the-e-book/; http://goodereader.com/blog/electronic-readers/a-brief-history-of-ebooks; http://googlepress.blogspot.ca/2004/12/google-checks-out-library-books.html;

Stephen King's book *Riding the Bullet*, published on the Internet in 2000 (Borner, 2011), is largely considered to be the first book initially published in digital version in history. Previous e-books had simply been digitized from physical books. William Gibson published his work *Agrippa (A Book of the Dead)* on self-devouring floppy disks in 1992 (Gibson, 2002). After that the market began to realize that books, newspapers and magazines could be born digital instead of being simply digitalized. This led to the emergence of multiple digital media formats. Current e-books contents are much richer than those in printed books. E-books contain written words and still images, but also a combination of born-digital content such as audio, video (simulations of radio and television), virtual and augmented reality. The e-reading I discuss in this thesis is not merely that which can be read on e-readers, but that which can be read on tablets and apps, which provide the opportunity of interactions with more than simply text and image.

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http://www.publishersweekly.com/pw/by-topic/digital/content-and-e-books/article/45412-google-launches-google-ebooks-formerly-google-editions.html#path/pw/by-topic/digital/content-and-e-books/article/45412-google-launches-google-ebooks-formerly-google-editions.html;
http://www.cnet.com/news/apple-unveils-ibooks-2-for-digital-textbooks-self-pub-app-live-blog/;
http://www.ljinteractive.com/index.php/barnes-and-noble-launches-a-new-nook-the-simple-touch-reader/;
http://arstechnica.com/gadgets/2013/04/kobo-crams-1-5-million-pixels-into-its-6-8-aura-hd-e-reader/;
https://en.wikipedia.org/wiki/E-book;
http://the-digital-reader.com/2015/10/21/nook-glowlight-plus-now-available-waterproof-dust-proof-300ppi-screen-and-only-129/;
http://www.amazon.com/gp/help/customer/display.html?nodeId=201550610;
https://en.wikipedia.org/wiki/IPad#Timeline;
http://www.apple.com/ca/ipad-pro/specs/;
http://www.apple.com/ca/shop/buy-ipad/ipad-mini-2;
http://www.apple.com/ca/ipad-mini-4/specs/;
http://www.apple.com/ca/ipad-air-2/specs/.

3.2 E-reading Properties and Devices

3.2.1 E-reading Properties

By summarizing Schilit et al. (1999), Li (2008) argues that

> electronic reading appliances not only imitate the best quality of paper, but also allow people to exploit extra capabilities, such as distributing and receiving documents on the road, organizing, searching and filtering documents, and providing support for different modes of reading. (p.1)

Li's argument well defines the current e-reading environment. Electronic reading is not limited to digital versions of physical books. On the contrary, the interactions beyond traditional written words are noteworthy. Implementing New Knowledge Environment (INKE) has summarized that the combination of physical and electronic books offers features such as "tangibility", "browsability", "searchability", "referenceability" and "hybridity" ("Features of Books and e-Books," n.d.). Based on its summary, e-books have some features that make them unique and different from physical books:

- **Portability** – A feature that an e-reading device can be as small and light as a booklet and allows up to thousands of e-books and digital contents to be stored.
- **Searchability** – A feature that digital devices automatically scan and search certain contents in the background. Unlike physical books in which the only search (within original contents) is the table of contents and the index in dictionaries, searching in e-books is available through the whole texts and metadata. It is the feature that enhances reading experiences in e-books.

- **Referenceability** – The ability of texts to cross-reference each other in digital contents, and jump into certain pages and points through hyperlinks. The invention of URLs (relative address and absolute address) makes it available for both online texts and integrated applications.
- **Hybridity** - The ability of e-books to use multiple discourses and formats. While texts and still images comprise physical books, the random combination of texts, links, images, gifs, videos, audios, animations and other formats can be frequently seen in e-books and digital contents.
- **Accessibility** – A feature of open access. Compared to physical books, e-books have more access to online bookstores such as Amazon. Digital content downloaded in almost any supported format can be read on certain devices.

Since the use of e-books is becoming more widespread, people are concerned that physical books will disappear in the future. The debates about whether e-books will eventually replace physical books have never stopped especially when Amazon announced that Kindle books had outsold paperbacks in 2010. George Cole (2006) once asked on *the Guardian* "Will the eBook finally replace paper?" He asked a series of questions about the immaturity of the e-book market, such as the lack of interface and formatting standardization. Cole's essay was written before the Kindle and iPad were released, and many people foresaw the promising future of e-books. Cole agrees with Kevin McKiernan, who says that printed books and e-books "will co-exist and we'll see publishers offering combined packages, so customers get the best of both worlds" (McKiernan as cited in Cole, 2006).

Nonetheless, paper is irreplaceable. Sharing is simple with paper, but not with e-books. Many e-book readers have complained that it is difficult to share books with friends due to issues

such as copyrights and format compatibilities. Although e-books are portable and convenient, technology is no substitute for the touch, smell and sound of a physical book. Guthrie (2002) says that books and bookstores will be with us for a very long time, as an e-book is another reading option rather than a replacement.

Similar to other media, e-readings are distinct on various devices. As shown in Table 3.1, the earliest e-reading device that was developed to bring to market was the PIM, later known as a PDA. It was a representative e-reading device that had remarkable influence on subsequent e-readers and smartphones.

3.2.1.1 Personal Digital Assistant

Alan Kay, who came up with the idea of Dynabook (a conceptual prototype of PDAs, tablets and e-readers), argues that the PDA should be "an interactive computer similar to a book with wireless communications abilities and a flat panel display" (Wiggins III, 2004) (See Figure 3.2). Kay describes the Dynabook as a portable and simplified computer with some basic functions that allows users to read and operate on. Unfortunately, Dynabook was never developed for market after Xerox produced a mockup according to Alan Kay's idea (Figure 3.2). The emergence of PDAs after a decade took Dynabooks to a higher level to a tangible and more mobile age.

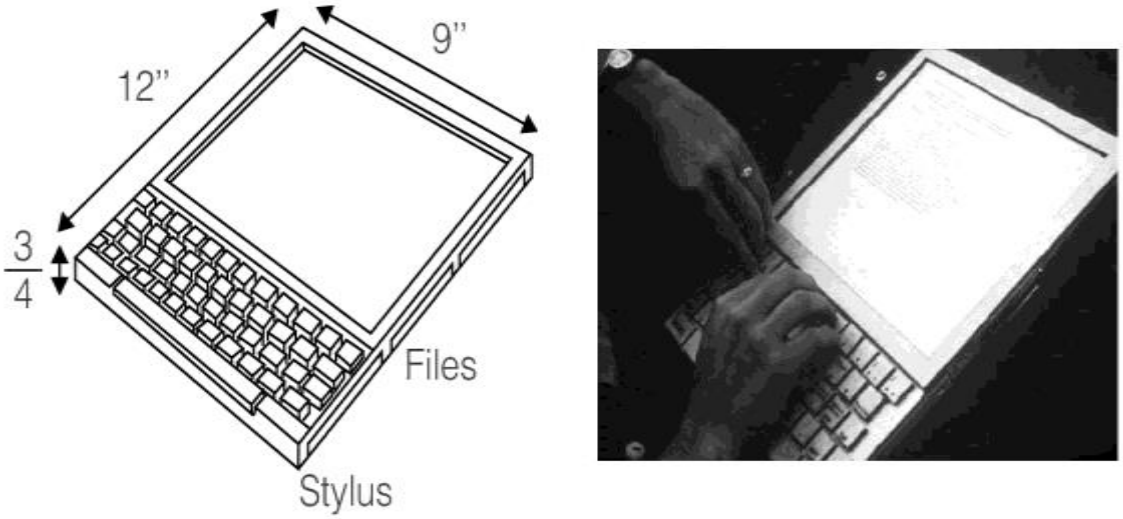

Figure 3.2 A sketch[3] (left) and the prototype[4] (right) of a Dynabook.

The Personal Digital Assistant (hereafter referred to as the PDA), also well known as the handheld computer, was first launched in 1984 by Psion, although the name was invented later in 1992 by Apple (Wiggins III, 2004). It was significantly popular in the 1990s and 2000s as a portable personal information manager. Additionally, it is as an early generation of portable e-reading device before e-readers emerged.

Most PDAs were equipped with an electronic visual display and a stylus to write with or with an attached physical keyboard. The screen was relatively large compared to early cellphone screens. Communication, entertainment and wireless capabilities such as web browsers and media players were standard presets.

[3] Source from http://ioc.xtec.cat/materials/FP/Materials/2252_DAM/DAM_2252_M03B/web/html/WebContent/u4/a1/continguts.html
[4] Source from http://www.tomshardware.com/news/alan-kay-steve-jobs-ipad-iphone,10209.html

Almost all functions in early PDAs were exactly duplicated from computers. For instance, most PDAs had applications such as web browsers, calendars and memos. These applications were implanted from computers and the Internet versions, and improved to be more suitable for reading on small screens. The arrangement of icons for applications on PDAs was also duplicated from the computers. The touchscreens that recognized handwriting and strokes could be considered partly inherited from graphic tablets. In reviews of the Psion Series 5, Sam Evans wrote that "operating the Series 5 is very simple and intuitive, similar to Windows [operation system]." The built-in software was also similar to Microsoft Office for computers.

PDAs followed protocols other than what was written in the instruction manuals. When we are operating a PDA for the first time, we know the keyboard is an input device, and when we press those buttons on a PDA, we expect that they will perform certain functions. When we are holding the attached stylus, we are prepared to write even though we are not clear which part is designed to write on. There are also some protocols about wireless Internet function such as the bills, identities, and terms and conditions which we agree to obey when we set up wireless connections.

PDAs had many different kinds of optional functions and accessories including an expandable Security Digital Card and Multimedia Cards. According to Wiggins III (2004), there were three types of PDA users:

1. People who wanted a compact digital device to keep track of their personal information and replace paper agenda and address books. These users might never take advantage of PDAs' other functions and expansions. They were unlikely early e-reading users.

2. People who always sought the latest technologies and kept up with fashion. These people might be interested in most functions of their PDAs, but were not loyal followers when their devices were out of date.
3. People who Wiggins III (2004) calls the "power user (or enterprise environment user)." They took full advantage of what a PDA could provide and were potential users of subsequent e-readers and tablets.

PDAs were largely discontinued in the late 2000s due to the rise of smartphones. Advanced PDAs had functions that were relatively similar to those of today's smartphones. They inherited some of the protocols from computers and various input devices, and passed them on to today's smartphones. PDA users found it easier to operate smartphones with touch screens and virtual keyboards, although they needed some time to adapt to the featured operation systems.

As the later and advanced generation of e-reading devices, PDAs *remediated* computers and the Dynabook and they passed along specific protocols (applications, inputs, etc.) to their prototype. In this way, PDAs were important transition devices that heavily influenced mobile devices such as the tablets that we are familiar with today.

Another protocol passed on by PDAs is the capability of multiple media formats. PDAs opened the gateway of portable media in the digital environment. As a digital medium, a PDA was more than the communication between writers and readers – like physical books have, but more of the communication and interaction between the readers and the device itself.

3.2.2 E-reading Devices

Table 3.1 lists the protocols of each e-reading device holds, classified into four categories that I have discussed in Chapter 2. Starting with Alan Kay's Dynabook and ending with today's

Kindle series and iPad tablets, the evolution of e-reading devices also shows how e-reading protocols develop.

E-reading devices	Protocols				Comments
	Design protocols	Delivery protocols	Demand protocols	Use protocols	
Dynabook	A personal computer for children at all ages.		A portable computer.	Literacy, ability to operate and type.	Dynabook was designed to be equipped with a near eternal battery. Dynabook was never available on the market.
Psion Organizer II	A personal information manager.	Purchase methods (credit cards, identification, address).	Schedule errands, set alarm, write diaries, connect to printers and computers, calculate, check time, can be used as a timer.	Have an alphabet-ordered keyboard;[5] can be connected to a printer, a computer or a desktop computer modem with RS232 or R5423 port to print and sync; have cursor key to select, an EXE button to confirm; press the letter key corresponding to the first letter of the option; press S key in the menu to save the document.	Psion Organizer I & II resembled calculators in appearance.
Apple Newton MessagePad	A personal digital assistant with smart operation system and infrared and Ethernet connectivity.	Purchase methods (credit cards, identification, address), Ethernet access conditions.	Schedule errands, set alarm, browse the Internet, read documents, send emails, portable reading.	Pressing in the latch to open the lid, have a typewriter and numeric keyboard, tap the screen with the pen to select or write, have handwriting recognition, tap the time to go to clock and set alarms, press the arrow buttons to scroll up and down, have icons similar to Macintosh desktop,	Early MessagePad was equipped with physical keyboards, and no tangible display.

[5] See image at https://upload.wikimedia.org/wikipedia/commons/e/ea/Psion_Organiser_II_-_270404_-_Modified.jpg

				can be connected to certain printers to print, send and receive fax with a Newton-compatible fax modem.	
Rocket eBook Reader	E-reader about the size of a paperback book, comes with LCD screen and a stylus.	Purchase methods (credit cards, identification, address).	read e-books and audio books, portable reading.	Ebooks available to purchase on B&N website; load books from computers via a serial cable; underline, bookmark, annotate with a stylus; literacy; pop-up QWERTY keyboard; page up and down buttons resemble computer arrow keys; rotation like physical books and paper; can be oriented to four directions.	Rocket eBook Reader is equipped with a stylus to write on, a pop-up keyboard, no handwriting recognition.
Microsoft Reader	An application ran on PC and certain mobile devices to read e-books.	Purchase methods (credit cards, identification, address).	Read e-books, sync between devices (optional).	Tap (on tangible devices) or click (a mouse on a computer) to select, print documents via wireless connection with printers, scratch and pinch on the screen to zoom in and out, highlight and annotation partly resemble to physical books.	Microsoft Reader is not an e-reader device, but an application that provides e-reading service and experience.
Sony Librié	E Ink technology - a simulation of printed paper, provides a non-harm environment to users' eyes; low battery-consumption.	Purchase methods (credit cards, identification, address).	Read e-books, a similar reading experience with printed books, portable reading.	Literacy, a physical QWERTY keyboard, a scroll bar borrowed from scroll wheel, page up and down buttons resemble computer arrow keys, ability to load books from computers with a USB cable.	Sony Librié was released only in Japan.

Amazon Kindle (1st generation)	An e-reader that provides wireless connectivity (EVDO) to load e-books, E Ink display.	Amazon account and purchase methods (credit cards, identification, address), shipping methods (deliver companies, address, identification), Amazon account (identification, address).	Read e-books, similar reading experience with printed books, longer battery life compared to former devices and displays, access to more e-books from Amazon online bookstore, portable reading.	Wireless connectivity to the Internet (SIM card, identification and address), scroll bar borrowed from scroll wheel, physical QWERTY keyboard, page up and down buttons resemble computer arrow keys, books and documents can be loaded from computers with a USB cable, online ebooks available in Amazon stores, Amazon accounts and payment methods (credit cards, identification, address).	Popularity is partially dependent on Amazon's large market share.
Barnes & Noble Nook	An e-reader equipped with Android operation system, a combination of 6 -inch E Ink display and 3.5-inch tangible colour control display to provide more visual stimulation, wireless connectivity (3G or WiFi) to load books, built-in games and entertainment.	Purchase methods (credit cards, identification, address), shipping methods if purchase online (deliver companies, address, identification), Barnes & Noble account (identification, address).	Read e-books, a similar reading experience with printed books while a visually operable colour control display, access to more e-books from Barnes & Noble online store, portable reading, entertainment.	Literacy, pop-up QWERTY keyboard, page up and down buttons resemble computer arrow keys, books can be loaded from computers with a USB cable, online ebooks available at Barnes & Noble online store, Barnes & Noble online store accounts and payment methods (credit cards, identification, address), wireless connectivity to the Internet (identification and address for home cable, SIM card for 3G, username and password for public facilities, terms and conditions for free WIFI).	Nook provides two options for users to connect to the Internet with 3G/WiFi or WiFi only, split screen was also an innovation.

Apple iPad	A multitask tablet computer with portability, provides gestures which partly replace physical buttons, equipped with iOS, wireless connectivity, built-in applications and applications available in App Store, sources downloadable from iBook store (iBook app).	Payment methods (credit cards, identification, address), shipping methods if purchased online (deliver companies, address, identification).	Read e-books, download applications, work and entertain, portable reading, access to more books in iBook store, browse the Internet.	Literacy, pop-up QWERTY keyboard, books can be synced with iTunes on computers wirelessly or via cable (optional), built-in gestures (swipe, drag, tap, stretch, etc.) and rotation that resembled as intuitive and convenient as handling printed books and paper, icons resemble those on a Macintosh desktop, wireless connectivity to the Internet (identification and address for home cable, SIM card for 3G, username and password for public facilities, terms and conditions for free WIFI), books available in the iBook store, app store accounts to purchase applications and books.	The iPad is more than an e-reader because it focuses more on the creativity and possibility of millions of applications in the App store, which also provides multiple reading options beyond texts and still images.

Apple iPad Mini	A multitask tablet computer with portability, it supports gestures which partly replace physical buttons, equipped with iOS, wireless connectivity, built-in applications and applications available in App Store, sources downloadable from iBook store (iBook app), a simulation of regular physical books on size (compared to an iPad).	Payment methods (credit cards, identification, address), shipping methods if purchased online (deliver companies, address, identification).	Read e-books with a paperback book-sized device, download applications, work and entertain, portable reading, access to more books in iBook store, browse the Internet.	Literacy, pop-up QWERTY keyboard, books can be synced with iTunes on computers wirelessly or via cable (optional), built-in gestures (swipe, drag, tap, stretch, etc.) and rotation that resembled as intuitive and convenient as handling printed books and paper, icons resemble Macintosh desktop, wireless connectivity to the Internet (identification and address for home cable, SIM card for 3G, username and password for public facilities, terms and conditions for free WIFI), books available in the iBook store, app store accounts can be to purchase applications and books.	The Apple iPad Mini and the Apple iPad are very much alike functionally, only differences are in device size, display and batteries.
Kindle PaperWhite	An e-reader that provides wireless connectivity to load e-books, E Ink display, resemblance to a physical book in weight and size, built-in light and dictionaries, experimental web browser that provides fundamental Internet activities beyond reading.	Payment methods (credit cards, identification, address), shipping methods (deliver companies, address, identification), Amazon account (identification, address).	Read e-books, provides a reading experience similar to that with printed books, a longer battery life compared to early-generation devices and displays, access to more e-books from Amazon online bookstore, portable reading, built-	Literacy; pop-up QWERTY keyboard; swipe to turn over pages; highlight, annotate and define words by long pressing on the screen; books and documents can be loaded from computers with a USB cable; online eBooks available in Amazon stores; Amazon accounts and payment methods (credit cards, identification,	Amazon Kindle series now are assembled with similar hardware and software.

			in light to read in the dark, tangible display.	address); wireless connectivity to the Internet (SIM card, identification and address).	

Table 3.2 Four categories of prototypes of several milestone e-reading devices[6]

As shown in Table 3.1, the first specialized e-reader was launched in 1998. The number and variety of e-reading devices available on the market has grown tremendously in recent decades. However, since the invention of E Ink technology, the development of e-reading devices has gradually moved towards a similar direction. Now e-readers are very much functionally alike. Until recently there are two main branches of e-reading devices on the market: those with a large screen equipped with E Ink technology that are designed primarily for e-books; and multitask tablet computers with built-in and customized reading and entertainment applications.

According to the data integrated by the Author Earnings' website (n.d.), Amazon.com and Apple iBooks took the largest share of the e-book market in 2015. Amazon shared approximately three-quarters of the e-book market in the United States (see Figure 3.3) and ninety-nine percent

[6] Sources from:
https://en.wikipedia.org/wiki/Dynabook;
https://en.wikipedia.org/wiki/Psion_Organiser;
http://archive.psion2.org/org2/mancomm1.htm
http://archive.psion2.org/org2/manlzop1.htm
https://en.wikipedia.org/wiki/MessagePad;
https://en.wikipedia.org/wiki/Newton_OS;
http://www.newted.org/download/manuals/0307258ANEWTONMP.PDF
http://the-digital-reader.com/2011/04/15/a-look-at-bns-first-e-reader/
https://en.wikipedia.org/wiki/Rocket_eBook;
http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1646405;
https://www.slideshare.net/travelinlibrarian/20131019-history-of-e-books-ereaders-lib2013;
https://en.wikipedia.org/wiki/Microsoft_Reader;
https://support.microsoft.com/en-us/help/15044/windows-8-reader-app-faq
http://www.mobilemag.com/2004/03/25/sony-librie-the-first-ever-e-ink-e-book-reader/;
https://www.theregister.co.uk/2004/03/25/sony_launches_true_electronic_book/;
https://en.wikipedia.org/wiki/Barnes_%26_Noble_Nook;
https://en.wikipedia.org/wiki/Barnes_%26_Noble_Nook_1st_Edition;

in the United Kingdom (Kozlowski, 2015), which makes the Kindle series the most common e-readers in the industry. Exclusive accessibility to the Amazon bookstore makes Kindle even more competitive than other e-readers.

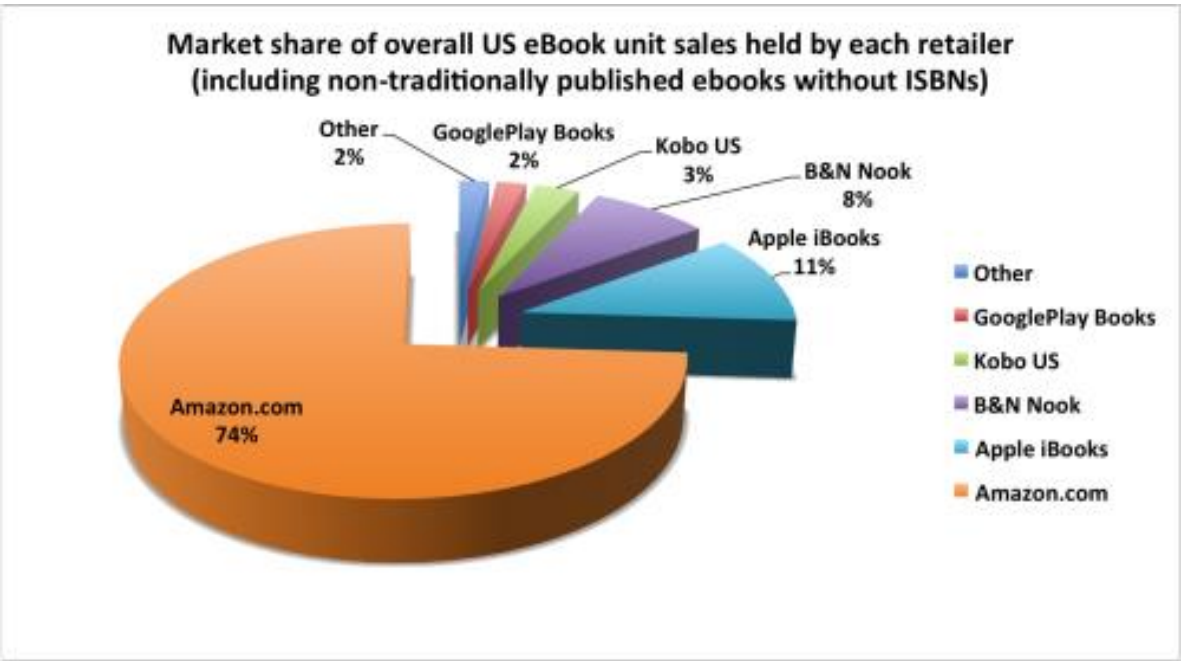

Figure 3.3 Market share of overall US eBook unit sales held by each retailer (Author Earnings, n.d.). This figure shows the market share of US e-book sales in 2015.

The two companies that shared the largest market in e-books, Amazon and Apple, have developed different branches of the e-reading industry. In this section, I will use Amazon Kindle as an example of e-readers, and the Apple iPad as an example of tablets to analyze the protocols of each device.

3.2.2.1 E-readers

Sony invented E Ink technology, which is a paper-simulated display. After Sony introduced the technology in its first e-reader, most other e-reader manufacturers adopted it. E Ink has become the mainstream technology for modern e-readers due to its non-glare properties and low

battery-consumption. E Ink technology is largely responsible for the growth of the e-reader industry, including Kindle. Kindle is a brand of e-reader introduced by Amazon in 2007. Graphic designer Michael Cronan and his wife, Karin Hibma, came up with the name, which means to light a fire. Cronan and Hibma saw "Kindle" as a metaphor for the future of reading (Friedman, 2008).

In the nearly ten years since the first Kindle was released, Amazon has never stopped improving its products. As a result, the first generation of Kindle looks much different from what we are using today. When we look back, the evolution of Kindle is also a history of e-reader development.

As we can see in Figure 3.4, other than the same size of the screen and the E Ink technology, there is no obvious resemblance between the first generation of Kindles released in 2007, and Kindle Voyage released in 2014. Because of the physical keyboard, the Amazon Kindle is bigger and heavier than the Voyage while the latter is almost the same size and weight as a paperback book. The screen has been developed to a higher resolution, with built-in light and tangible display. The storage capacity is much greater.

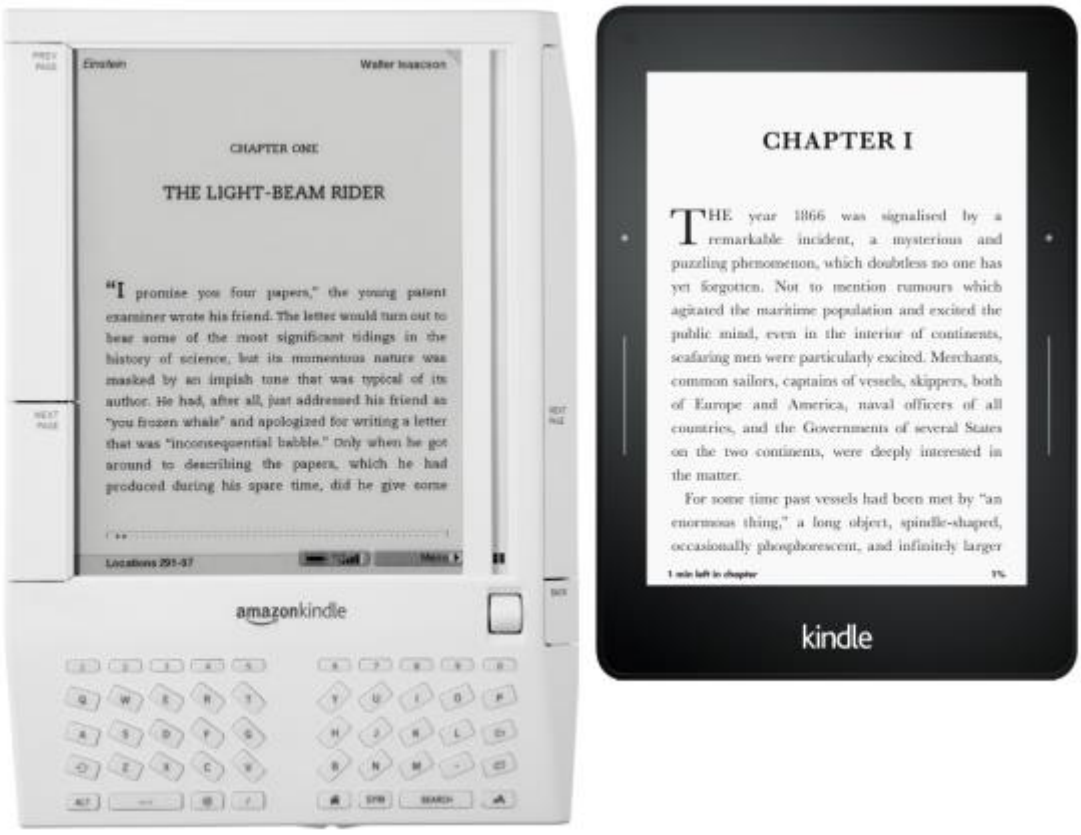

Figure 3.4 The first Kindle (2007) versus the Kindle Voyage (2014) (Atwood, 2014). This figure shows the differences between the first generation of the Kindle and today's Kindle, which indicates how Kindle's appearance changed over the course of seven years.

The formats that Kindles support have not changed much. Kindles have always targeted texts. Using either wireless or USB conductivity, the only contents that can be put into a Kindle are digital books and documents. Apparently, due to the limitation of colour display by E Ink technology which is only able to present black and white, the combination of multimedia is not what Amazon pursues on Kindle e-readers.

The emergence of e-readers improved the convenience of portable reading. However, the actual reading process does not change much as a result of the medium through which the words are transmitted. No matter how much E Ink technology resembles paper, it is not a replacement

for paper. To quote the Kindle slogan, “Reads like a book, and goes beyond a book” (“Kindle Paperwhite e-reader,” n.d.). E-reading is a way to enhance the reading experience, not a substitution for physical books.

According to the Publishers Lunch Deluxe report from “Average Kindle Owners’ Age” posted in the Kindle forum, more than half of reporting Kindle owners are more than fifty years old, and about 70% of owners are over forty. Most say they love Kindle because using it allows them to read comfortably even though their vision is diminishing with age. The adjustable font size in e-books allows readers to zoom in and out, which is a feature function that physical books are not capable of (as cited in Cowen, 2009).

Turning pages on an e-reader is never as intuitive as it is on physical books. But Amazon Kindle designers have come up with a clever way to combat the problem. As we can see in Figure 3.4, there are buttons on the Amazon Kindle that read “PREV PAGE” and “NEXT PAGE.” These buttons flip over virtual pages of a book, as the Amazon Kindle is not equipped with a touchscreen. In addition to the buttons, there is also a scroll bar which functions in a manner similar to that of the scroll wheel in a computer mouse. According to the Amazon Kindle user’s guide (n.d.), when the user scrolls up and down or presses down, the bar can be used to locate specific items. It is not easy for beginners to adjust to e-books since there are no physical pages to turn. Later on when we have been accustomed to touchscreens on smartphones, Kindle addressed the pop-up keyboard instead of the virtual one.

As one of the most popular e-readers, Kindle (e-reader series) has reached a large audience and has enhanced their e-reading experiences. However, it limits the primary reading experiences to books (newspapers and magazines) due to its design and intention. E-reading is far more than just texts. The exploration of the high hybridity of multimedia is what I will examine next.

3.2.2.2 Tablets

Although the Amazon Kindle is equipped with wireless connectivity to online bookstores and some social media websites, E Ink readers are functionally limited to reading activities (texts and still images). Tablets, however, are simulations of handheld computers that are capable of multiple functions such as communication and entertainment (Siegenthaler, Wyss, Schmid, & Wurtz, 2012). They offer broader ways of reading than e-readers.

Figure 3.5 The comparison between the Dynabook (1972) and the iPad (2010).[7] This figure shows the resemblance between 1972 and 2010 versions of e-reading devices.

Figure 3.5 shows the similarity in appearance of the Dynabook (invented in 1972) and the iPad (launched in 2010 with a pop-up virtual keyboard). The resemblance raised some questions (Gruener, 2010) about whether Apple was marketing a product that had been invented nearly forty years ago. However, other than appearance, the two devices have very little in common.

[7] Source from http://www.noticias3d.com/noticia.asp?idnoticia=39067

Modern tablet computers (hereafter referred to as tablets) are conceptualized as mobile computers equipped with touchscreen displays, integrated batteries, cameras, microphones and other technologies. Most support virtual keyboards and multi-touch gestures that replace a computer's keyboard and mouse. The iPad was introduced with a built-in reading app called iBooks. The first generation of iPad has a 9.7-inch tangible LCD screen. While Amazon keeps experimenting with e-reader appearances, Apple seems faithful about its design. Apple designers put more effort into usability and interface design. The appearance of the iPad has not changed dramatically over ten generations. The evolution of technology has been reflected mostly on display resolutions, cameras, batteries and operating system updates.

The built-in reading app, iBook, supports very few formats compared to Kindle. However, what enhances reading experiences on an iPad are the countless applications in the app store. Reading on an iPad goes beyond plain texts. Users can download customized files (texts, images, videos, comics, etc.) to their iPads through supported applications, which makes e-reading on an iPad a complex combination of what Stan Ruecker (2011, TEDx Talks) calls "continuous" and "fragmentary" reading.

3.2.3 E-reading Protocols

The diversity of e-reading devices means that they have respective user protocols. However, considering the same origin they started with, their protocols can be partially generated and inherited (or *remediated*, to use Bolter & Grusin's term) from traditional books and computers. Traditional reading (texts and images) is a process of cognition which does not change through different platforms. On the other hand, early e-reading devices were conceptualized as "portable computers" or "handheld computers." Although they have been evolving through multiple

generations, only the inputs, outputs and interfaces have changed. The essence of the devices stays the same.

Since e-reading devices have protocols from both printed books and computers, they combine traditional and digital communication. The content of printed books is written words, which is what writers use to interact with their readers. And similar to computers, the process of reading an e-book (or other digital content) is an interaction with the device itself. Furthermore, because of the invention of the Internet, along with Web 2.0 and social media, reading is no longer completely private anyway. It is a shared function which allows a tri-directional interaction between writers and readers, and among readers.

Tablets and e-readers share some protocols. While e-readers inherit the buttons from PDAs and computer keyboards to turn over pages, tablets borrow primary features such as touchscreens and virtual keyboards from computer operating systems and operating guidelines. Unlike e-readers, iPads rely on integrated multi-touch gestures, such as rotation and scrolling up and down, that aim to be intuitive and mimic reading behaviours on paper.

I explained in the former chapter that media have protocols. E-reading devices are not an exception. Although people have developed the idea of making reading digital and portable, the original intention has never changed -- making reading simple and convenient.

But perhaps the most important protocol held by e-readers is the way of reading they provide for their users. In his book *Literacy in the New Media Age*, Gunther Kress (2003) classified reading into two categories: linear and non-linear. Linear reading describes the act of reading a printed book with plain text. In this kind of reading, the authors determine the order or the way we read. Non-linear reading describes the act of reading on a computer screen or other

digital device that combines texts with other visual elements; in this form of reading, the reading path is non-sequential.

Kress's theory of a reading path is founded on the classification of physical books and e-books. Because many e-readers are conceptualized as digital simulations of physical books, the categories that support Kress's theory are no longer adequate or accurate. The linearity of a reading path largely depends on readers' preferences rather than the absoluteness of reading devices. Based on Kress's theory of reading, I classify reading into different two categories:

- **Immersive reading**

  Or continuous reading. Immersive reading means users do only one task while they are reading. It requires readers to concentrate on the content for a certain length of time. Immersive reading happens mostly with books (composed with plain text or low complexity of media formats), both physical and digital.

- **Edutainment reading**

  Unlike immersive reading, edutainment reading allows readers to learn and play while they read. There is no need for readers to be immersed in the content, which is mostly fragments composed using multiple media formats such as text, images, videos, and animation. Edutainment reading is not a sequential reading path as the visual elements easily distract the readers from the established order.

Reading patterns largely depend on readers' behaviours and preferences. Therefore, the two categories of reading tend to be conditional. In Kress's (2003) theory, reading on screens and digital devices is non-linear because visual elements such as images distract readers. Although a Kindle is equipped with wireless connectivity to share on social media, Kindle e-books do not have a complex hybridity of media formats. Most e-books on Kindles are the digital version of

physical books, which makes the reading activity immersive and continuous. On the other hand, reading on an iPad is a process of "edutainment reading," during which readers can learn while playing. The multiple media formats mean that iPad users will do more than immersive reading. During an edutainment reading process, readers interact with more than merely words.

3.3 Summary

As a reading method and process, e-reading has many advantages beyond traditional reading: portability, searchability, hybridity, etc. These advantages have ushered in a new era for reading experiences. E-reading devices that we are familiar with today, such as Kindle and iPad, both inherit protocols from media that preceded them, which make them more intuitive even on first use.

The Kindle and iPad are the two examples that I chose to study because they are typical e-reading devices in this age, and the two magnates in the e-reading market. The protocols of a Kindle and an iPad vary primarily because they started with different purposes. A Kindle focuses on reading experiences, while an iPad concentrates on multitasking. From Kress's point of view, reading differs between linear reading (printed materials) and non-linear reading (electronic materials). However, the differences in reading experiences between a Kindle and an iPad prove that Kress's theory is insufficient. Reading is more complicated than just linear and non-linear, which is why I summarize the protocols of reading on Kindles and on iPads: it is all about immersive reading (e-readers) and edutainment reading (tablets).

In the next chapter I will continue my analysis of tablets by analyzing two typical mobile apps – the mobile Perseus, and Watson Walk. Neither are merely about reading texts or images

(as on a Kindle). They are in a blurry zone between reading and playing because they address multiple elements and features such as GPS and augmented reality.

Chapter 4: Case Studies

4.1 Perseus Digital Library

Gregory Crane, the editor-in-chief of the Perseus Digital Library (Perseus project), once asked, "What do you do with a million books?" According to the Athenian sage Solon's estimation of a human being's lifetime, it could take forty lifetimes to read a million books – that is, if we could read a book every day (Crane, 2006). Reading a million books now becomes achievable because of the emergence of digital libraries, which allow "a greater number of users to make more effective use of a wider range of their holdings than was ever feasible in print" (Crane, 2006). The Perseus project works as a digital library that holds hundreds of thousands of documents.

The Perseus Digital Library (Perseus) was built at Tufts University in 1987. Its primary mission is to "make the full record for humanity as intellectually accessible as possible to every human being" (Perseus, n.d., "Research"). It originally provided open access to its collections of the classics from ancient Greece and Rome. Now its collections cover 19th Century America, *the Richmond Times*, the Renaissance, Arabic texts, Germanic texts, etc. (Perseus, 2013, "Browse the Collections"). Besides assembling and digitizing resources, the Perseus Digital Library also provides vocabulary tools to help users overcome language barriers.

As a pioneer of digital libraries, the Perseus Project has gained attention from many research groups, among them the Implementing New Knowledge Environments (hereafter referred to as INKE). INKE has been collaborating with Perseus for several years. It is a seven-year collaborative research group composed of researchers and graduate research assistants all around the world working with organizations and groups to explore the domains of digital humanities.

The Interface Design (ID) team is one of the five branches of INKE. ID focuses on producing and studying experimental prototypes.

Perseus released its first version of digital library on HyperCard in 1992. Four years later, Perseus produced a CD-ROM version. As the latest platform of the Perseus Digital Library (Perseus Hopper), the Internet has been applied within Perseus development over three decades since Perseus first explored the web in 1995. It is looking forward to a mobile version of its collections. The ID team has been collaborating with Perseus to design and develop a mobile optimized tool to cater to the expanding number of mobile users.

As Crane (2006) points out, a collection of a million printed books would not be of much use to one singular reader. However, with the convenience of e-reading, an online digital library makes it available. Users do not have to peruse every page to find useful information with tools such as search and online dictionary functions. Additionally, mobile reading has more advantages over reading on computer screens by taking full use of the exclusive features (touchscreens, gestures, etc.) on smart devices.

It has been a decade since Perseus significantly updated its web interface. Meanwhile, INKE has been seeking to explore new knowledge environments on Perseus since 2012. Inspired by the explosion of mobile device users and educational applications, INKE has reached an agreement with the Perseus project and has begun to draw prototypes of future Perseus that can be used on mobile devices.

4.1.1 Interface vs. protocol

An interface is a primary composition of a medium, especially when the large part of operating an application is depending on it. An interface is also the user end of the send-receive

process in media transmission. In this case, an interface is a part of the technological platform that implements a medium.

Consequently, an interface is also one of the most influential factors that determines the usability of a medium. Although reading on a tablet is never as intuitive as reading a printed book, we are still trying to make e-reading easy to use, especially for beginners. In every step that we take in developing e-reading devices, including the operating system and applications, there are always several protocols inherited from old versions to ensure that people can use them intuitively and transit to the new version seamlessly. For an application that runs on tangible mobile devices, an interface is all we can operate. Therefore, most of the protocols are embedded in the interface. Meanwhile, the interface is also the primary protocol in an application. Under these circumstances, an interface is also a part of protocols. Interfaces and protocols work spirally in the design of a medium.

For instance, for an application run on tablets, swiping up to the top reloads the page. This is the protocol that tablets teach us. For an application that originated as a web version, there will be several features and interfaces implanted from the web that make it easy for users to quickly adapt to the mobile version. Some factors in the interfaces of the two versions will be alike, to a certain degree, to give veteran users a "protocol" as a "quick start."

4.1.2 User Stories and Framework

As INKE started to design the mobile Perseus, three options were on the table based on current formats of mobile applications: native app, mobile web app, and hybrid. Native apps are designed and written to run on a given mobile platform such as iOS or Android, and have full access to the device functionality (Korf & Oksman, 2015), which is the modules of a device such

as the camera, GPS, accelerator, etc. A mobile web app is a cross-platform app format that can switch among different mobile platforms. To access content stored on a server, mobile web apps use a browser with frameworks redesigned for small screens. Mobile web apps have limited access to the device functionalities such as the camera and GPS because they depend largely on the web browser function. A hybrid app is a combination of the former two; it performs as the "web app wrapped inside a native container" (Korf & Oksman, 2015). While native apps provide the most robust performance, and mobile web apps run data from the server and free up the device's storage, hybrid apps combine the two. Hybrid apps take advantage of the best parts of mobile devices while reducing the reliance on memory and storage space. Therefore, the hybrid app was the best for Perseus to start its mobile age.

As a mobile app, it would be necessary for the mobile Perseus to inherit certain primary features of the Perseus Digital Library such as online dictionaries. The hybrid app has some features (catalogs, search engine, signup/login, etc.) that need to be installed on devices, which make the app take larger space than a portal or a web framework. Therefore, some specific features are considered indispensable (e.g., search engine) or optionally downloadable (e.g., archives, pictures) according to user preferences.

In 2013, Perseus received about nine million page views and approximately nine hundred thousand visitors (Google Analysis, 2013a; Romaniuk, Vela, Ilovan, & INKE, 2013). Of those, about 10% accessed the website using mobile devices (Google Analysis, 2013b; Romaniuk et al., 2013). Perseus as an online digital library is targeted to serve all audiences who show an interest in classics. There are two types of goals that can be specifically identified:

- Academic research: scholars and students who use Perseus as a reference tool to study the classics.

- Language learning: users who aim to learn Greek, Latin and other languages through Perseus using its collections and online dictionaries.

As Perseus is exploring a new stage to cater to the needs of the growing number of mobile users, the mobile Perseus is more than merely accessing Perseus on a mobile device. What differentiates the new version from the Perseus Hopper should not be the platforms but the full usage of the modules such as the camera and GPS location on the devices. Therefore, the mobile app caters to more types of users than Perseus Hopper. Tourists who are travelling to the historical places that are related to Perseus collections and eager to interact with the information Perseus is capable of offering can be the additional groups of users besides the two that already exist in Perseus Hopper.

User stories are an essential procedure at the early stage in software development. Developers write down conversations of scenarios about what users need from the software after consultation with the customer or product owner in order to design and realize the desirable functions ("User Stories," n.d.). The better we understand potential users, the more we are able to cater to their needs. INKE conducted user stories with the Perseus group before categorizing the types of users at the beginning stage of designing the mobile Perseus. There are four types of users: student learning, language learning, academic research, and tourist exploration. Among the four types of users, the student and language learning may be in need of some unique features separately, yet they share some too, such as a reference tool. That is why I combine the first two categories into one.

4.1.2.1 Student Learning

The traffic on online Perseus reveals a considerable number of undergraduate students using the site as a reference tool for their assignments. In my summary they are categorized into the same type with language learning tool as the two types of users both take Perseus as a reference tool, which is also the basic function of Perseus.

Figure 4.1 shows the interface of the prototype of the mobile Perseus, with the play *Medea* by Euripides written originally in Greek. Perseus provides a translation version for each page, which is the most useful feature for foreign language speakers. Users can choose to switch between the original text and the English translation. Dictionaries are available for individual words by long pressing them. A "glossary" function is also available for those who need vocabulary tools.

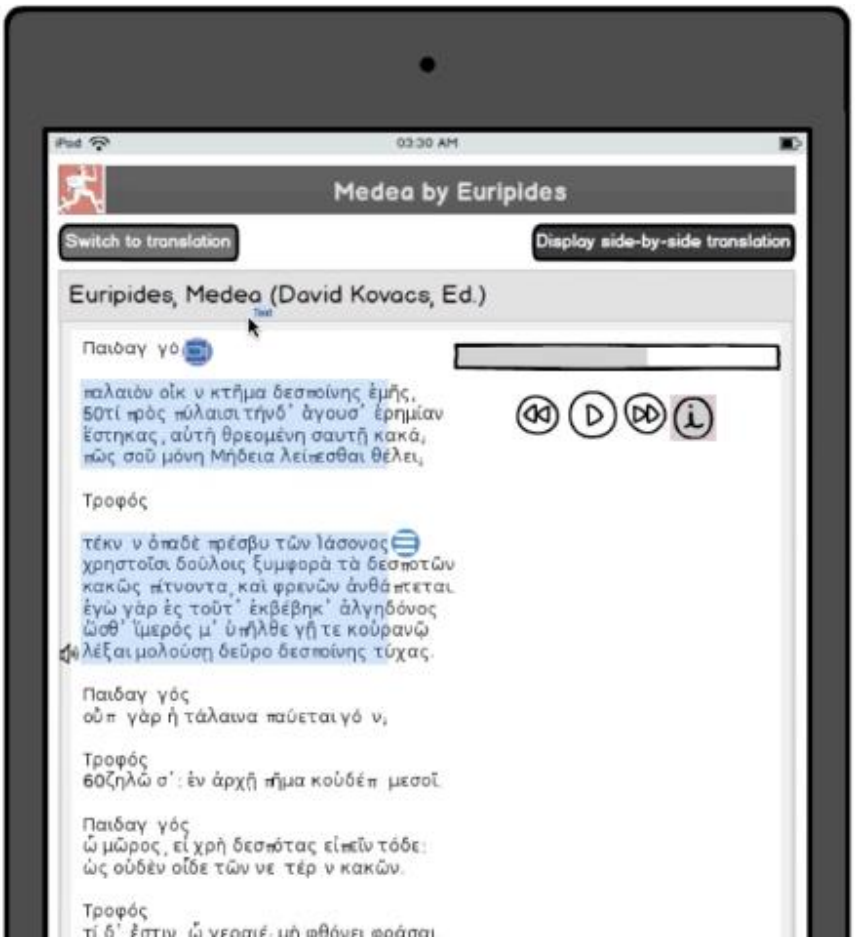

Figure 4.1 Snapshot from the mobile Perseus prototype – the voice-over interface. This snapshot shows how the voice-over feature functions in the app.

4.1.2.1.1 Language Learning

The mobile Perseus has some new features that cater specifically to language learning users. Other than student learning users, who mostly need to understand and reference content, language learning users also need tools to help them learn ancient Greek and Latin.

What is new on the mobile Perseus is the "voice-over" function. Users can choose a paragraph or several sentences in an article, turn on the voice-over function in the main menu, a speaker icon will lead them to an audio player (see Figure 4.1). Unlike dictionaries, the voice-

over is not only for people who need help with pronunciation, it can serve as an audio document for users with disabilities.

Some other features are also mentioned in the user stories. For instance, language learning users would want to practice language with peers, or take quizzes and practice tests to improve their language skills. However, since these are not exclusive features that need to be integrated into the Perseus mobile app, it is possible to take them as follow-up functions during the development in the future.

4.1.2.2 Academic Research

Academic research has always been one of the primary purposes of Perseus. However, for a long time, there was no specific tool for academic research other than references and online searches. Some functions can be designed specifically for academic research.

Annotation has been developed along with the evolution of reading, from simple strikes to manicules (Latin for "little hand") on paper, then to post-its stuck on printed book pages, and finally to annotations and comments functions in PDF and other electronic documents on computers.

Annotation is not a new function for e-reading. Earlier versions of Perseus never included annotation because Perseus is not a personal online digital library. However, for mobile Perseus, it is necessary to store users' personal information since the app will be installed on mobile devices instead of on the Perseus server. For academic research, Perseus is more than a reference tool. As Perseus has set its current goals on personalization, which is "organizing what you see to meet your needs" (Perseus, n.d., "About"), annotation can be a major step in creating a personal library. Therefore, annotating should be an indispensable function on mobile Perseus. In the

prototype of mobile Perseus (Figure 4.2), users can add annotations to certain words or sentences by long pressing the target paragraph, and typing in the frame that appears on the right. An icon will appear beside the annotated paragraph (see Figure 4.2).

Annotation is normally defined as highlighting, striking and adding notes, which is how it functions in the physical universe, on paper. However, with the evolution of the reading medium, annotation can also be a part of e-reading itself. Along with words and drawings, other media formats, such as audios, images, or even videos, can be added.

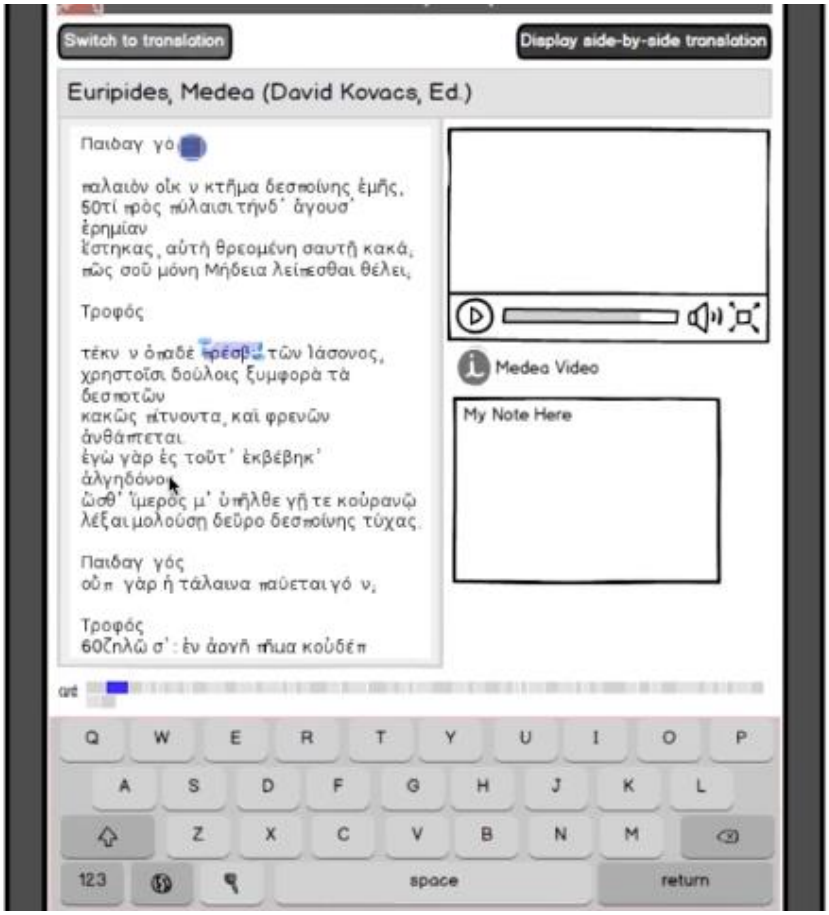

Figure 4.2 Snapshot from the mobile Perseus prototype – annotations. This figure shows how to add multimedia annotations in the app.

One of the main advantages of e-reading is online sharing through social media. On most e-reader platforms today (including webpages and e-books), users can share their reading lists and reviews on their linked social media accounts. For academic research, sharing is more than that. Through the sharing function on Perseus, users can choose to upload their annotations to their accounts and share with specific people when exchanging ideas and experiences. By using digital annotations, people can "build on one another's questions with their own annotations and are exposed to alternative responses that may differ from their own, resulting in their appropriation of new ways to interpret texts" (Castek & Beach, 2013).

4.1.2.3 Tourist Exploration

There is one more user type that INKE has identified for the mobile Perseus other than the Perseus Hopper: tourists – people who are visiting Greece or Italy and feel like engaging with the history, culture and literature using mobile devices. In order to take some common travel conditions into consideration, functions such as offline navigation are necessary for tourists. For tourists, the mobile Perseus is a geolocation app more than a reference tool. As a result, several options have come into INKE's consideration.

4.1.2.3.1 GPS Location

Global Positioning System (GPS) is a navigation system that provides locations with latitude and longitude, and time of the people on the earth under any weather conditions using satellites ("Global Positioning System", n.d.). GPS was developed in the United States in the 1960s and 1970s as a military technology ("What is GPS?", n.d.). It is now popularly used in maps, navigations and location-based search and is built into most smart devices such as smartphones

and tablets. While search engines make targeted reading easier on Perseus than on printed books, geolocation search provides searching variety to mobile Perseus. Users do not need to search certain texts or keywords to find content. All they need is to turn on their device's location service, and the app will automatically deliver surrounding information. Figure 4.3 shows how the Perseus app provides building information using GPS. The app will detect the user's location and search in the database to display the information that fits a certain latitude and longitude. In Figure 4.3, each icon represents a category of nearby buildings in the Perseus database. Detailed information about each building is available by clicking the icons. This feature makes it convenient for tourists to schedule their travel routes.

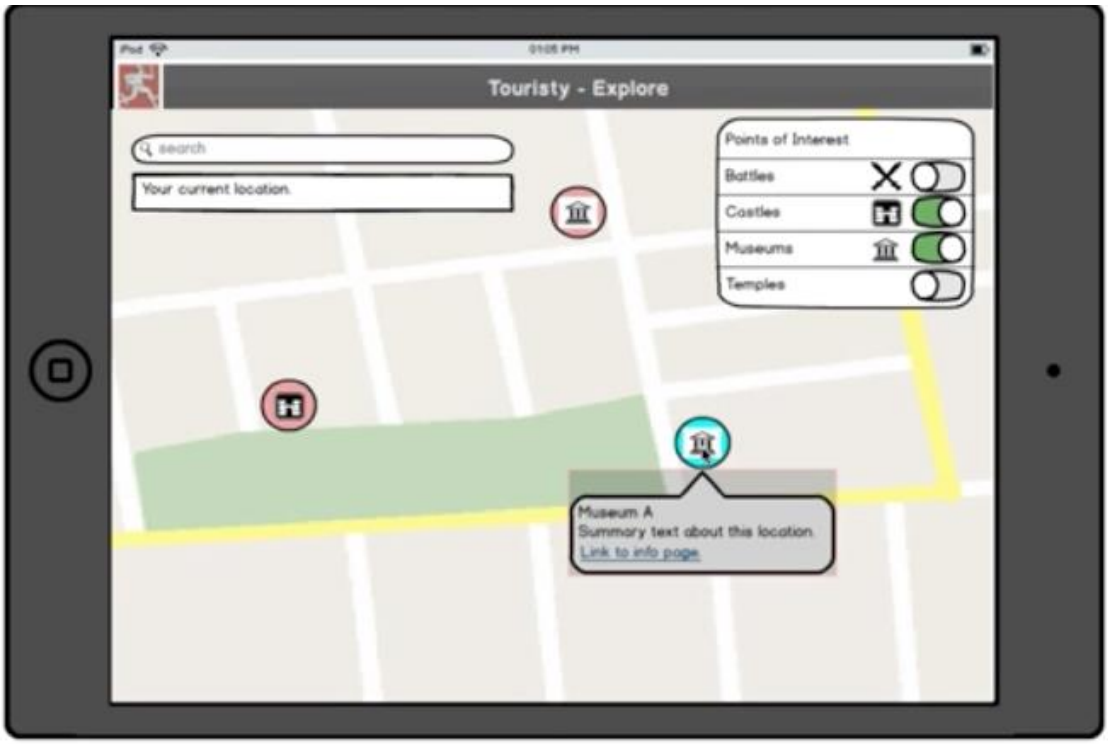

Figure 4.3 Snapshot from the mobile Perseus prototype – touristy interface. This figure shows how historical buildings are displayed on a map using GPS in mobile Perseus.

4.1.2.3.2 Augmented Reality

Augmented Reality is a technology that uses computer-generated layers on top of an existing reality to enhance the interaction between users and the interface (Lindsay, 2015). The general layers in Augmented Reality are texts, images, audios and videos. Augmented Reality is an enhancement of the live world. It is generally implemented with a GPS or a camera on mobile devices, which makes it a distinctive feature in mobile Perseus for tourists.

Augmented Reality has been put into use in many mobile applications: the *Streetmuseum* by the Museum of London is one of the earliest applications that employed Augmented Reality as an appealing feature. One of the most famous functions of *Streetmuseum*[8] is that it uses superimposed pictures combining reality with a historical scenario (see Figure 4.4). As a result, all the historical traces about the scenario can be seen in a single image.

Figure 4.4 Snapshot from the Streetmuseum[9] of a superimposed picture. This figure shows how historical pictures are superimposed with reality with a camera in the app.

[8] See more details at https://itunes.apple.com/us/app/streetmuseum-londinium/id449426452?mt=8
[9] Source from http://www.trendhunter.com/trends/streetmuseum-museum-of-london-app

Augmented Reality combines the past with the present. It can be significant to the mobile Perseus in that it can enable tourists to engage with history, specifically with sites (buildings, parks, etc.) that no longer exist either because they were destroyed during a war or were replaced by modern structures.

In many cases GPS technology is embedded in an augmented reality framework to realize the interaction between users and the software geographically. In some situations, GPS alone can also be employed to enhance reading experiences.

4.1.3 Protocols in the Mobile Perseus

As a mock-up, the mobile Perseus shares many features, such as dictionaries and subcategories, with the Perseus Hopper. To ensure that these features to be implemented, the mobile Perseus that INKE has designed addresses several protocols:

- Protocols from the web Perseus (Perseus Hopper)

  A large number of old users will turn to the mobile version when it comes to market. Therefore, it is the most convenient way that mobile Perseus inherit some protocols from its web version to ensure old users quick adapt to the mobile version. The input methods of the Perseus Hopper are keyboards and mice/trackpads. The input methods of the mobile Perseus are touch screens. However, the two platforms can share invisible protocols. For example, when veteran users want to look up specific archives in the mobile Perseus, they will go directly to the category they want instead of wandering and browsing all the categories in the whole collections, as new users do. Veteran users have the advantage of familiarity, which is a protocol that they learned from the web Perseus.

- Protocols from modules of mobile devices

  Because mobile Perseus shares protocols with mobile devices, users have to know how to operate a mobile device in order to run it proficiently. Applications must follow protocols of modules such as cameras and GPS in order to use those modules. Therefore, it is familiar for mobile users to use gestures on touchscreens and take pictures because they are already familiar with the protocols that they have been following when using their devices.

- Protocols from others

  Although most of the mobile Perseus protocols are from the web Perseus and mobile devices, a small number are borrowed from other. For instance, the web Perseus does not have an annotation function since it is not a customized personal digital library. Therefore, the annotation protocol is not available on either the web Perseus or mobile devices. It can be borrowed from other reading applications such as a PDF reader, which also borrows protocols from non-e-reading habits when we take notes on paper while reading. Meanwhile, annotating on the mobile Perseus still follows the protocols as operating a mobile device.

  Many protocols in the mobile Perseus, such as icons, were developed around the same time and for use on the Internet and mobile applications. Icons are a significant part of an interface. In web browsers, buttons for “home,” and for “previous” and “next” pages appear as part of the address bar in the tool bar. Now we are all familiar with the functionalities of icons and buttons in web browsing. In a mobile application, it is well known that an arrow on the upper left means “back to the

previous page." These elements in interfaces have evolved through time to a degree that users recognize them without thinking. They are protocols.

4.2 Watson Walk

Watson Walk is a mobile app for iOS and Android, designed and created by the Editing Modernism in Canada (EMiC) research group at the University of Alberta. It focuses on Canadian modernist writer Sheila Watson's life in Paris during the mid-1950s. Watson Walk is a combination of both reading—Sheila Watson's literature works during the time—and touring—via a geolocation city guide. Users can follow Watson's steps in Paris with the app while enjoying her writing (manuscripts, letters, and journals, etc.).

EMiC at the University of Alberta (EMiC UA) is a part of the EMiC research group, which is primarily devoted to producing edited texts by modernist Canadian authors (Editing Modernism in Canada, n.d., "About Us"). Figure 4.5 shows four primary snapshots of the Watson Walk app running on Android devices.

Figure 4.5 Watson Walk app on Android (EMiC UA, 2012).[10]

[10] Source from http://emic.ualberta.ca/?p=636

GPS is a primary feature that supports the entire framework of the app. As a semi-touring application on mobile devices, static information is not sufficient for users. With the live longitude and latitude information that GPS provides, users can get more detailed information about the points of interest (POIs).

Figure 4.6 is a snapshot of how Watson Walk combines historical maps of Paris with live maps by superimposing the former on the latter. It also provides a comparison of how the city was transformed during the years from the 1950s. The historical map was not accurate at the southeast quadrant; therefore the two maps overlap only partially (Quamen, H, personal communication, April 12, 2017). With the POIs pinned on the maps, users can choose several of them to plan personalized tours to follow Watson's steps. By clicking the POIs, users can learn which of Watson's works relate to which POIs.

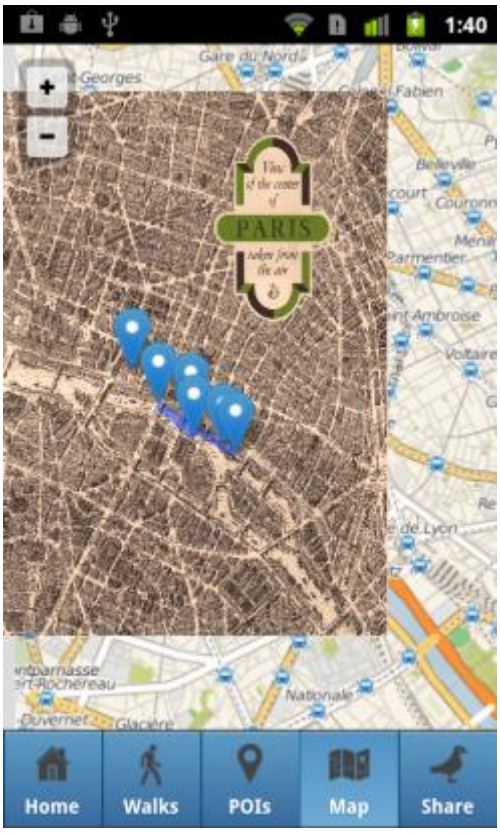

Figure 4.6 Snapshot from the Watson Walk—a historical map with POIs overlaid on a live map.

Watson Walk is a mobile app that combines geolocation and literature reading as a tour guide around Sheila Watson's life in 1950s Paris. Unlike traditional reading apps, Watson Walk provides an environment that allows users to personalize their touring routes and enjoy reading while walking. Technically, Watson Walk is not categorized as an e-reading app since reading is only one of the app's many functions. However, it shares the edutainment protocols with other reading apps because it offers readers the experience of "reading while playing."

4.3 Case Analyses

As both reading and touristy mobile applications, the mobile Perseus and Watson Walk share certain protocols in addition to those that take full advantage of modules from mobile devices. While Watson Walk focuses on tourism, the mobile Perseus aims to inherit most of the featured affordances from the web version. It is also the divergence between the design protocols of the two apps.

Table 3.2 shows that the delivery protocols of e-reading devices have not changed much in recent years since online purchasing has become an economic pattern. Therefore, the delivery protocols of modern e-reading devices are mostly centered with online accounts, payment methods and materials generated by them. Delivery protocols are tightly related to culture as a part of protocols within media.

Sometimes the demand protocols are mostly the same as the design protocols, which indicates that the design meets users' expectations. Users of the mobile Perseus would expect the application to be mostly a reference and a study tool with a tour function about ancient buildings as a bonus, while Watson Walk users would not expect to discover anything other than Sheila Watson and Paris. Demand protocols largely depend on the product's manuals and descriptions,

the judgment from the appearances, and the promotions such as the advertisement.

Robert Moses's bridge on Long Island indicates that design protocols can be changed. For example, radio and GPS were both invented for military use, but more widespread use changed their protocols. Use protocols can be partly understood as "thoughts" or "knowledge. These are invisible but function as unwritten rules that users should obey. Therefore, to employ some of the conventional protocols and to avoid confusion in use protocols is significant to increase the usability of a medium. For example, double clicking the mouse on a desktop computer is required to open a file, while only a single tap is required to perform the same function on tablets. This is a conflict between different protocols of one action. For the mobile Perseus, it is unavoidable to decide which protocols to choose from the web version or mobile modules to carry forward. Table 4.1 lists the use protocols of the web Perseus, the mobile Perseus and Watson Walk.

Features	Protocols		
	Web Perseus	Mobile Perseus	Watson Walk
Voice-over	N/A	Turn on the voice-over function under the main menu; texts available for voice-over are highlighted, click the speaker-shaped button on the side to start; play/pause, back and forward buttons resemble from video/audio players available by tapping on the screen.	N/A
Dictionary/Vocabulary tool	Mouse over and click to select the word; English translations (for foreign language collections) available for reference with mouse click	Long press and hold on the screen to select the word, click "define" to get definition; English translations (for foreign language collections) available for reference by tapping the icons.	Entries generated automatically by locating certain distance within points of interests(POIs).
Annotation	N/A	Long press and hold on the screen to select one or more words, click "Add note" and type annotations in the text bar shown on the side; any	Generated automatically by the system indicates the POIs users

		texts with annotations will be shown with a mark on the side.	have been to, available for users in the "map" category.[11]
Customized tour	N/A	N/A	Two complete routes built in the application with POIs in order as Watson did, directions available for users to follow (only for original routes), routes can be customized with several POIs for users' preferences.[12]
Search by image	N/A	In the touristy-capture interface, take the picture of a POI using the camera on the device, search result generated and loaded automatically by the picture.	N/A
Data obtain	Need Internet access while opening webpages, documents available for download to read offline.	No need for Internet access if data and documents are downloaded as a pack beforehand.	No need for Internet access if data and documents are downloaded as a pack beforehand.
Maps	No contemporary maps available, ancient maps can be reached within texts and entries.	In the touristy-explore interface, map loaded automatically with POIs shown by categories.	Tap the "map" section on the screen at the bottom of the interface; three maps available to choose: live map (need Internet access), contemporary map amd historical map (1950s); swipe left and right to check maps; live maps can be overlapped with contemporary map or historical map via Internet connection.[13]
POIs	N/A	Tap the icon of a POI on the screen and click the "link to info page" at the bottom of the pop-up frame.	Tap the POIs section on the screen at the bottom of the interface.
Augmented Reality	N/A	N/A (under further development)	In the "map" view, tap the layer icon on the side of the screen, then choose the maps.
Gestures	N/A	Tap, rotate, scroll up and down, zoom in and out, tangible operating embedded within the gestures of the mobile devices.	Tap, rotate, scroll up and down, zoom in and out, tangible operating embedded within the gestures of the mobile devices.
Keyboard	physical keyboard (mostly QWERTY) linked to the computer	Virtual pop-up keyboard.	Virtual pop-up keyboard.
GPS	N/A	Generated automatically in map interface after allowing	Generated automatically in map interface after allowing the app

[11] Quamen, H, personal communication, April 12, 2017.

[12] Quamen, H, personal communication, April 12, 2017.

[13] Quamen, H, personal communication, April 12, 2017.

		the app to access the camera on the device.	to access the camera on the device.
Share on social media	N/A	Link with social media accounts to share annotations and locations (under further development).	Set linked social media accounts in the "share" section.

Table 4.1 Comparisons of use protocols from the web Perseus (Perseus Hopper), the mobile Perseus and Watson Walk.

Because Watson Walk was started as a mobile application, there were no features it could borrow as the mobile Perseus had borrowed from the Perseus Hopper. However, the EMiC UA did refer some protocols from other similar mobile applications such as the JoyceWays[14] and Anne's Amsterdam[15] (Quamen, H, personal communication, April 13, 2017). The development of Watson Walk paid most of the attention to the GPS and map features of mobile modules. This makes Watson Walk attractive to tourists who are familiar with protocols of mobile devices, and eager to follow Sheila Watson's footprints in Paris, with mediated reality tools to enhance the "reading" experiences at the same time.

Meanwhile, the mobile Perseus is not brand new on some level. It attracts some loyal users from the web Perseus because the mobile version inherits most of the featured affordances they need. Additionally, what is new to the veteran users are the GPS and augmented reality feature, which could draw the attention of people who are on a trip at the Perseus POIs and are looking forward to "read" them historically and literally. Unlike Watson Walk, the touristy feature in the mobile Perseus functions as a digital "travelling brochure." Watson Walk is more centered with Sheila Watson instead of a touristy Paris.

Some of the use protocols of the mobile Perseus and Watson Walk are generated not only from the modules of mobile devices, but from market demands, or trends. Cameras on

[14] See https://itunes.apple.com/us/app/joyceways/id534524278?mt=8

[15] See https://itunes.apple.com/us/app/annes-amsterdam/id520476666?mt=8

cellphones were only used to take photos before mediated reality became popular. Therefore, it could be confused for users when the first application used a camera to implement Augmented Reality because there was no protocol to follow. For example, SnapDragonAR[16] software, built a few years ago, can play 2D videos on a piece of paper through a camera using Augmented Reality technology. When AR was not familiar to most people, SnapDragonAR was hard to play with at the beginning since no one would raise a piece of paper in front of a camera. Many people did not know cameras could implement Augmented Reality just as easy as taking photos. Now when we see a superimposed photo or a pinned POI with information on a live picture from a map, we know what it is going on. This is how protocols work within culture.

As a reference app, Perseus focuses most on reading, with several features, such as annotations and online dictionaries that are common in e-reading apps. As a touristy app, Perseus focuses on how users interact with actual historical buildings that are represented in its collections.

Both as a half-reading, half-playing app, Watson Walk shares some similarities with mobile Perseus but generally stands on the opposite end of the continuum. Unlike mobile Perseus, Watson Walk is not a reading app per se. Its purpose is to follow Sheila Watson's steps in Paris to relive what she experienced. Reading is an important yet not primary part of the app.

[16] See http://www.futurestories.ca/snapdragonar/

4.4 Summary

In this chapter I introduced the prototype of mobile Perseus that INKE participated in designing, and the comparison between the mobile Perseus and the Watson Walk app that EMiC launched. The web Perseus has been focusing on classics and modern literature. The Perseus app should not be merely a mobile version of the web Perseus. The key to a successful mobile Perseus is to keep the essence of the web Perseus, and make innovative progress. A significant step in the design process is to make decisions about what to keep and what to innovate. Unlike the prototype of the mobile Perseus, Watson Walk focuses mostly on touring instead of traditional reading. The protocols that Watson Walk addresses are centered on the GPS and locating feature of mobile devices. The similarities between the two applications are that they both follow some of the protocols from the mobile devices they run on, and some existing protocols from society and industry. Protocols can be an invisible guidance that participates in the formation of both applications.

Protocols function as a form of guidance from the perspective of designers and developers, and as a subconscious "manual" for users who are experiencing new media. That can be the reason why many mobile devices no longer provide detailed instructions. Users have already learned the similar "manual" from other devices.

When reading today is not limited to traditional reading with printed books and newspapers, or e-books with static texts, we are expecting more interactions between us and the reading objects (books, authors, devices, etc.). This can be the next stage of e-reading, which is what Bozkurt and Bozkaya (2015) call "interactive e-books" (see in 5.2).

Chapter 5: Conclusion

5.1 *The Fantastic Flying Books of Mr. Morris Lessmore*

Let us go back to the example I offered in the introduction: *The Fantastic Flying Books of Mr. Morris Lessmore*. Although there are not many words in children's books, they are still a part of the reading process. Reading the book through the app has different categories of protocols:

- Design protocols

Whether it is the same reason that the Moonbot Studios developed the short film and the printed book, the iPad app is designed to enhance reading experiences of the story, and to give readers a vivid environment to "put yourself in Morris's shoes" (Moonbot Studios, n.d., "The iPad App").

- Delivery protocols

The delivery protocols of the printed book *The Fantastic Flying Books of Mr. Morris Lessmore* are the same as those of most physical books, while the mobile application on tablets certainly update conventional delivery protocols to implement the interaction among users, the physical book and the application. To ensure that the app *The Fantastic Flying Books of Mr. Morris Lessmore* runs successfully, a smart device with the app installed is needed. Additionally, a valid account in iTunes, a payment method (e.g., a credit card, which requires identification, money, etc.) are also necessities to implement the application as a part of delivery protocols.

- Demand protocols

Demand protocols can be different for various types of users. Children require a pleasant time reading the application and the book, playing and entertaining themselves with the visual

elements; the demand protocols for parents are a new reading experience for their children so that the children can re-read a book that they enjoy, and a method in which their children can fall in love with reading; for other adult users, delivery protocols may be the performance of augmented reality, the interaction between themselves and the application.

- Use protocols

The use protocols for reading applications on tablets always share some similarities such as the gestures and tangible interfaces which all the applications on mobile devices have to follow so that readers can use the devices as intuitively as possible. For example, in the *IMAG-N-O-TRON*, touching and rotating the screen is to interact with the figures and items in the picture, allowing the app to use the camera so that it can get access to the whole story. There are some scenarios, like playing the piano, in which readers are considered to have basic knowledge about pianos because you need to put fingers on the keyboard and press to make a sound.

The book *The Fantastic Flying Books of Mr. Morris Lessmore* is considered to be developed as a children's book, which target in children and parents. However, the *IMAG-N-O-TRON* app is no longer focused on attracting only children as primary users. Both children and adults are potential users. As a result, the user group of the app changes the use protocols of the original book because it is necessary to hold a book if users would like to play with the application.

The *IMAG-N-O-TRON* app is more focused on playing than on reading. As summarized in Chapter 4, the protocol of e-reading on tablets is edutainment reading, which involves more than interactions with words and screens.

5.2 The Future of E-reading

Bozkurt and Bozkaya (2015) argue that the future trend of the e-reading industry is interactive e-books. They give a definition of it on the basis of Mike Matas's (2011) talk of "A Next-generation Digital Book" on TED (Technology, Entertainment and Design):

> Interactive e-books are essentially digital book formats in which the user, the digital book, and the environment can interact reciprocally at a high level; digital book elements can communicate and interact among themselves and [the] environment as well as users, and many communication channels are put in use at one and the same time. (p. 60)

Compared to conventional books, the innovations of an interactive e-book are shown as the four types that Bozkurt and Bozkaya (2015) summarize (see Figure 5.1):

- Interaction among the digital book elements: the "interconnectedness of interactive e-book elements" (p. 61). It is the interactions happening among elements contained in an e-book.
- Interaction between environments: interactions happen between the digital environment and what is described as the "real and virtual environment" in Figure 4.3, such as accelerometer, GPS, sleep monitor, light sensor, fingerprint reader that can output by taking certain input data and processing in digital environments.
- Interaction between digital book and user: most of this type of interaction happens when readers interact physically with electronic reading devices by using gestures and eye movement tracking.
- Interaction with other users/online communities: interactions among users in e-reading are mostly through the Internet, which is different from the way that

readers interact when reading a physical book. Readers using e-readers can search relevant webpages and communities within an interactive e-book and participate in discussions.

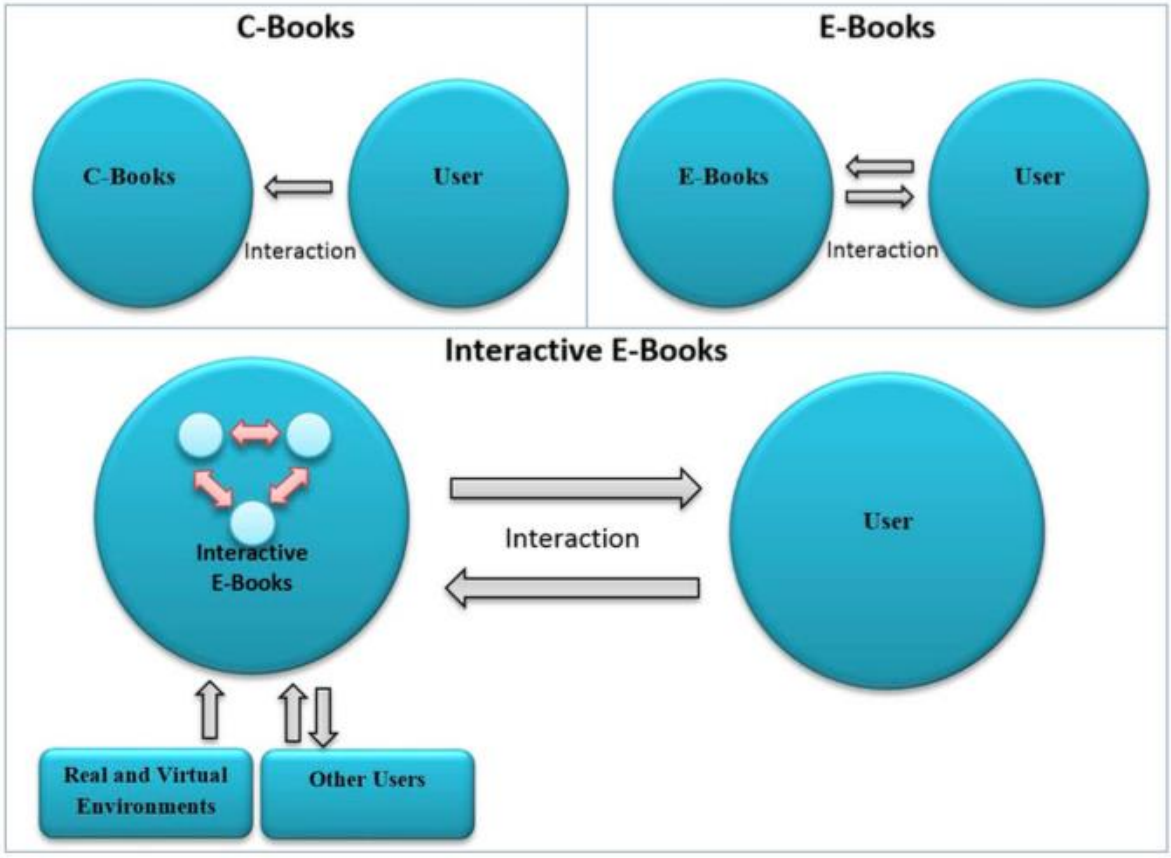

Figure 5.1 Comparisons of different types of interactions of C-Books (conventional books), E-books (electronic books) and interactive e-books (Bozkurt & Bozkaya, 2015, p. 61).

Although e-books on some e-readers allow certain interactions that Bozkurt and Bozkaya mention, their protocols suggest that e-books on e-readers, especially digital versions of physical books, scarcely have many perspectives towards abundant interactions as tablets.

David Geleruter (2009) once criticized Marshall McLuhan by commenting that "the medium is not the message; the meaning and music of the words is what matters." He concluded that "the

tools are neutral." He tried to convince his readers that media are only tools and the value of media depends on how we decide to use these tools. However, Gitelman's and Winner's theories both prove that McLuhan's theory still makes sense today, that the medium is the message.

The evolution of e-reading proves media protocols well. The original intention of e-reading has never changed over the nearly eighty years of development: to enhance the reading experience and make reading more convenient. Current e-reading devices have developed into different branches that hold different protocols. From PDAs to today's e-readers and tablets, protocols function from the beginning of the design process to the choices of users. E-readers such as the Kindle focus on immersive reading by imitating the way as reading physical books, while iPads and tablets enhance the reading experience with edutainment and interactions.

As the two main branches of e-reading trends, e-readers and tablets well prove that how much difference protocols can cause and effect. Using the mobile Perseus and the Watson Walk as examples, it is obvious to notice that e-reading can be the combination of reading and playing, or what I call "edutainment reading." The main difference between edutainment reading and traditional electronic reading is the interactions which, according to Bozkurt and Bozkaya, will be the trend of reading in the future.

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